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TECHNOLOGICAL TRANSFER IN LARGE-SCALE AGRICULTURAL PROJECTS: THE ROLE OF PRIVATE ENTERPRISE

SARAH POTTS VOLL

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TECHNOLOGICAL TRANSFER IN LARGE-SCALE AGRICULTURAL PROJECTS: THE ROLE OF PRIVATE ENTERPRISE

by

SARAH POTTS VOLL

B.A., Goucher College, 1964
A.M., Harvard University, Graduate School of Arts and Sciences, 1966

A THESIS

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Thesis director, Allen Thompson, Asst. Prof. of Economics

Robert Barlow, Prof. of Economics & Administration

Edmund Jansen, Assoc. Prof. of Resource Economics

John Korbel, Prof. of Economics & Administration

Douglas Wheeler, Prof. of History

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It only remains to admit that the responsibility for any errors and omissions is mine alone.
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ABSTRACT

TECHNOLOGICAL TRANSFER IN LARGE-SCALE AGRICULTURAL PROJECTS: THE ROLE OF PRIVATE ENTERPRISE

by

SARAH POTTS VOLL

One of the most serious contemporary global problems is the discrepancy between the supply and demand for food products. It is generally recognized that the immediate solution is the export of foodstuffs from the industrialized countries to less developed countries, and the ultimate solution is the modernization of Third World agriculturalists and control of Third World population growth. However, the specter of local food shortages and the promise of favorable prices for agricultural products have persuaded many leaders of the Third World to seek middle range methods of increasing agricultural production. One such method is the commissioning of western private agribusiness to organize and manage agricultural projects. These projects are established in limited areas for the production of designated crops and are often conceived independently from broader programs of rural development. However, there is a marked lack of consistency in the degree to which these projects have been able to reach the production goals set by their sponsors. The earliest project, the Gezira Scheme in the Sudan, has been considered an outstanding success by most
of its participants and observers, while later projects have foundered on a series of unsuspected reefs.

Focusing on Africa and the Middle East, this study has analyzed the structure and experience of the Gezira Scheme, fifteen projects of the colonial era and five projects of the era of independence. Based on these case studies, it is possible to designate eleven specific factors which must be considered if an agricultural project involving a western corporation is to be successful.

1. The choice of project site must be based on sound agricultural considerations: western technology cannot compensate economically for a poor choice of site.

2. High value food and industrial crops, especially those which require some processing and are intended for the international market, are more appropriate than subsistence crops.

3. The government must exercise extreme care in its choice of company, preferably selecting a company which has both experience in the cultivation of the desired crop and a background in Third World agriculture.

4. Preliminary surveys, feasibility studies and a pilot project are an essential prerequisite.

5. The government must realize that once the company is chosen, the project's production flexibility will be limited to crops in which the company has some expertise.

6. The project must be located near sufficient supplies of labor. The development of unpopulated areas is better accomplished through government-managed settlement schemes.
7. The company must expect to train host nationals for the skilled, supervisory and management levels of its labor force.

8. The project must avoid alienating large numbers of people from their land.

9. Planners must assure that the physical capital is appropriate in cost and design to the productive capacity and physical conditions of the project.

10. Project sponsors must incorporate incentives for efficient management into the project design.

11. Projects operate best when they are part of a regional development plan: the host government must appreciate that contracting a foreign company is not a substitute for the construction of local infrastructure, the provision of social services or the organization of rural extension work.

Given these considerations, the best model for the contemporary generation of agricultural projects is the nucleus estate/outgrower structure. The company operates the estate whose core is the processing and research facilities. Cultivators from surrounding farms are then encouraged and assisted by the government and company to augment their production for sale to the estate.

The study concludes that properly organized, experienced companies can contribute to the increase of agricultural productivity in the Third World. However, contracting western companies is not a solution for the very short run, and is not appropriate for all sites or crops.
CHAPTER I

INTRODUCTION

One of the most critical economic problems facing the world today is the disparity between the rising demand for food and the limited supply. While this gap can be partially filled by increased production in the developed world, it is clear that agricultural production must be greatly increased in the less developed nations as well. ¹ The food shortage itself results from the rate of population growth exceeding the increase in agricultural production in the developing world: even if the developed countries could produce enough for global needs, it is unlikely that the poorer nations will be able to afford to import increasing amounts of foodstuffs over the long run.

Interest in, and the approaches to, modernizing agriculture in the developing world has changed considerably over the past two decades. In the 1950's, most Third World countries with development plans emphasized rapid industrialization as the most promising path for economic growth. When considered at all, the agricultural sector was viewed primarily as a source of surplus labor which could be siphoned off to be employed in industry with no significant loss of agricultural production. Development of the rural sector itself was generally neglected.

¹Leroy L. Blakeslee, Earl O. Heady and Charles F. Framingham, World Food Production, Demand and Trade (Ames, Iowa: Iowa State University Press, 1973) project supply and demand for food in the years 1985 and 2000, both globally and regionally.
By the early 1960's, the emphasis on industrialization had given way to concepts of balanced growth and emphasis on interlocking domestic markets. The agricultural sector was seen as a producer of raw materials to be processed and a consumer of the finished and capital goods produced by the industrial sector. The development of the rural sector was then viewed primarily in terms of output with "rising statistics of farm production. . .the prime indication of rural progress."\(^2\)

The 1970's has now produced another shift in approach, partly based on the goals set for the U. N. Second Development Decade, partly reflecting evidence from the Green Revolution that an increase in production is not synonymous with a rise in general welfare, and partly stemming from the realization that increasing agricultural production is more complex than was originally supposed.

This larger view. . .equates rural development with the far-reaching transformation of social and economic structures, institutions, relationships and processes in any rural area. It conceives the goals of rural development not simply as agricultural and economic growth in the narrow sense but as balanced social and economic development, with emphasis on the equitable distribution as well as the creation of benefits.\(^3\)

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\(^3\)Ibid.
In the midst of this new emphasis on equity and social development, the rise in commodity prices in 1974 and 1975 has presented the developing countries with both an opportunity and a problem: production of agricultural commodities for export has become profitable for the LDC's and their import prohibitive. Recognizing that rural development plans as currently conceived are unlikely to produce any sudden spurt of output, many nations are looking for alternative ways of investing in agricultural production apart from their on-going rural development plans. A possibility which has appealed to several countries is the wholesale application of the techniques of western agri-business in a limited area. These countries have established experimental projects and invited western companies to provide the technological and managerial expertise. The host countries, and the companies they employ, implicitly assume that no real problem will be posed by the transfer of the technology itself: a company which can organize a successful agricultural enterprise in its own country is expected to be able to transfer the entire technological package and duplicate the enterprise, and its success, in other parts of the world. The only real question considered is the willingness of the host country to trade off equity and social progress for agricultural production.

The recent failure of a number of such projects, and the success of others, suggests that this approach too is more complex than its participants had supposed. The success of the technological transfer is not assured, and therefore in some instances, the trade-off between equity and output may
not exist; and where the experiment fails, the host country must bear financial, social and political costs it can ill afford. This study will examine a series of agricultural projects involving private or quasi-private western enterprises in an attempt to identify the key elements of a successful project and the crucial areas where problems are likely to occur. The projects are drawn from Africa and the Middle East and span a period of over fifty years. The variety of locale, era and degree of success should make it possible to distinguish those elements which are unique to a specific scheme from those which represent more generally applicable principles.

Chapter II reviews the literature on multinational enterprises, technological transfer and agricultural development. In general, the vast literature on multinationals ignores the area of agricultural enterprises in the developing world. Few studies deal with the developing world, and those consider either the macro-economic effects of MNE's, or industry rather than agriculture. The studies on technological transfer seldom deal with both western companies and agriculture. Studies considering western companies in the developing world generally focus on the issues of management and factor proportions in industry. Studies on technological transfer in agriculture now focus on the possibilities of intermediate and/or domestically produced technology in rural development rather than the packaged technology provided by a foreign firm. Finally, the literature on rural development now concerns problems of income distribution, institution building, employment and social progress rather than output or large-scale projects. Thus
little of the literature in the relevant areas deals directly with the attempt of private firms to transfer a package of advanced technology to agricultural projects in the developing countries.

Chapter III outlines the issues raised in any agricultural project and the specific forms they will take when a private foreign company is involved. It highlights the problems which are likely to occur and the consequences of the alternative solutions. The following three chapters then apply the schema developed in Chapter III to the individual projects.

The projects themselves logically fall into three groups. Chapter IV discusses the Gezira Scheme in the Republic of the Sudan. Inaugurated in 1925, this project involved an extensive irrigation network, the highly successful production of long-staple cotton, food and fodder, and a then unique tenurial arrangement and tripartite partnership between the tenants, the Sudan Government and a private company, the Sudan Plantations Syndicate. The oldest, largest and most successful of the projects, the Gezira Scheme and the solutions it evolved served as a prototype for many of the projects which followed.

Chapter V deals with other colonial projects of the 1920's through 1950's. Large-scale projects in the colonies were inhibited by lack of finances and most agricultural work was devoted to study of diseases and crops, the preliminary training of staff, and the establishment of extension work and inspection systems. Interest in large-scale projects stemmed from two sources. Domestically, administrators, especially in Africa, were concerned about the stability of agricultural
production and several projects were proposed (although few actually implemented) to increase production in order to avoid the perennial threat of famine. In addition, the late 1930's and early 1940's was the heyday of alarm concerning soil exhaustion in Africa: the increasing population pressure had led to overgrazing, overcropping and shorter bush fallows, and hence to lower soil fertility and increased erosion. Large schemes were seen as a method of shifting populations to less densely inhabited land and modernizing and controlling agricultural methods. Where agricultural departments lacked the manpower and expertise, foreign firms were invited to develop these projects on behalf of the government. A second source of interest in large-scale production was the postwar metropolitan desire to increase the production of primary goods within its own currency bloc. This interest, coupled with a vision of turning jungle into productive agriculture and a naive faith in the capabilities of western machinery, aroused enthusiasm for a large number of schemes, most of which were soon discredited. By the last years of colonial rule, most administrators had concluded that large-scale agricultural projects were not viable in themselves, and had realized that maintenance of soil fertility was not an impossible task, even under conditions of increasing populations. Attention turned to piecemeal

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4 Robert Chambers, *Settlement Schemes in Tropical Africa* (New York: Frederick A. Praeger, 1969), pp. 19-29. A third source of large-scale projects was the postwar group or cooperative farming movement. These, however, did not involve foreign private companies.
programs of extension work, marketing and stabilization boards, the elimination of disease and promotion of cash crops.

Chapter VI focuses on the generation of projects that arose after independence. While a number of countries embarked on large scale agricultural projects after independence, few national leaders wished to establish or perpetuate foreign-owned plantations. As independence has become more secure, however, and agricultural production potentially more profitable, a number of leaders are reconsidering their aversion to the idea of foreign companies engaging in agriculture. However, the framework has changed from that of the colonial era, and the problems raised and solutions offered must change as well.

The final chapter summarizes the discussion and attempts to pinpoint the crucial elements of a successful project. It examines under what circumstances an agricultural project involving foreign private companies can increase a nation's agricultural output in the 1970's and what the developing nation must be willing to sacrifice to secure this output. It then returns to the original question of whether private western companies can provide a short term or partial solution to the problem of filling the gap between the global supply of food and the demand.
CHAPTER I

THE SURROUNDING THEORY

The subject of the transfer of agricultural technology to the developing world by western-based corporations does not lie wholly within any single area of economic analysis. Rather it draws on the literature of three separate and distinct fields: the nature and role of multinational corporations, the costs, benefits and methodology of technological transfer, and the problems of agricultural development in the Third World. The focus of each of these fields is on other questions and problems, and therefore their analyses deal only peripherally with the issue of technological transfer in agriculture by multinational corporations. Nevertheless, the literature of each area provides some insights into this phenomenon, particularly where the fields overlap. This occurs occasionally between the field of technological transfer on the one hand and multinational corporations or agricultural development on the other, but less frequently between agricultural development and multinational corporations. These areas of overlap however are small relative to the range of each field as a whole, and therefore in the following discussion, the literature of each field will be summarized separately.

MULTINATIONAL CORPORATIONS

Analyses of the nature and role of multinational corporations have evolved from the efforts of economists to
answer three sets of questions. The theoretical economists are generally attempting to place the phenomena of multinational corporations within the framework of already established theory and ask the question of why the multinational corporations exist at all. Economists located in the business schools take the existence of multinationals as a given and address rather the question of how MNC's operate overseas. Finally, analytical economics, while interested in why and how the multinational corporations operate, are chiefly concerned with the question of 'with what result?'

In the traditional theory of international trade, the doctrine of comparative costs states that a nation will tend to export those commodities whose domestic production costs, relative to the costs of other commodities, are lower than when the goods are produced by its trading partners. The Heckscher-Ohlin model further relates these comparative costs of production to factor prices and factor endowments to derive general predictions about the commodities which countries will characteristically export. Hedged by numerous assumptions, the model essentially asserts that a country is most likely to export those commodities which use intensively the factors of production found locally in relative abundance.

Several of these assumptions, the international immobility of factors, the absence of trade barriers or transport costs and the existence of a universally identical technology for example, must be discarded when the theory is used to describe the location of production and direction of trade in the real world. Trade theorists' interest in multinational corporations
is directed toward the basis on which these corporations make the decision to produce domestically and export their commodities, or alternatively, to establish plants abroad to supply the overseas market and perhaps eventually the domestic market as well. Most recently, exploration in this area has been analyzed with reference to the product cycle theory of international trade. This theory\(^1\) has evolved from the realization based on empirical evidence that factor endowments and prices do not in themselves constitute a satisfactory explanation for the composition of a nation's trade.\(^2\) It relates the location of production to the age of the product, distinguishing between the early stages when production requires skilled workers and rapid feedback from the markets, and the mature phases when production is standardized and the techniques of mass production with semi-skilled workers become appropriate.

The product cycle theory accounts for the pattern of production and trade for a fairly narrow range of commodities in international trade: new product lines and overseas assembly plants in manufacturing. More comprehensive approaches to the phenomena of the multinational corporations have evolved from both the concepts of international production found in


\(^2\)W. W. Leontieff, "Factor Proportions and the Structure of American Trade," Review of Economics and Statistics, XXXVIII (November, 1956), pp. 386-407. Leontieff found that the United States, a capital rich country, tended to import capital intensive goods and export labor intensive goods. This finding has been called 'Leontieff's paradox'.
location theory and the Marxist-Leninist theory of imperialism. These approaches discuss multinational corporations and international investment within the framework of theories of international production, which being specialized presupposes trade, rather than analyzing them as part of a revised trade theory.

The initial thrust of location theory was to consider distance one of the costs of production. The location of a plant would be determined by the differential between establishing the plant near the raw materials and transporting the finished goods to market, and locating the plant near the market and transporting the raw materials to the plant. Variations on location theory include factors other than transport costs, in particular differences in the costs and availability of various types of labor. One refinement divides production into three levels: level I plans strategy at the home office, level II coordinates production in different parts of the world, and level III manages the day to day activity. The location of each level depends on the resources available in various regions. Level III facilities can be located all over the globe in response to markets, manpower and raw materials. Level II, which requires white collar workers, communication and information, will be placed in urban areas; while level I, which requires proximity to capital markets, media and government, will be concentrated in a handful of very

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large cities. From this stratification of production and location is derived a 'law of uneven development' which posits that the structure of income and consumption parallels the production levels of status and authority. Another refinement draws on portfolio theory and bases foreign versus domestic investment decisions on differentials of return and risk between countries.

For the adherents of Marxist-Leninism, the multinational corporations fit into the concept of imperialism, the monopoly stage of capitalism in which the economy is typically dominated by large firms and cartels rather than smaller competitive firms. These giant corporations have moved their operations abroad in the search for markets and raw materials to counter their declining profit margins. Bank capital is combined with industrial capital to create the basis of a financial oligopoly, and the export of capital becomes as important as the export of goods. The drive for colonial empires of the late nineteenth century is seen as the political corollary to the division of the world by corporations into protected markets. Once the social and economic institutions were shaped to support a dependent relationship between the colony and the home country, it was possible for the economic relationship to endure even after the political association had been dissolved. For the Marxist-Leninist, then, the era of the multinational corporation is that of post-colonial imperialism, with its laws of

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motion deriving from a set of not unreasonable assumptions concerning the nature of the corporations and the world economy.

Several empirical studies have surveyed the multinationally producing corporations and have distinguished two sets of typical characteristics. In both, firms investing abroad are larger, more profitable, more oriented toward advertising and research and more diversified. The main determinant within an industry for overseas investment is size: larger firms are more likely to invest overseas than smaller, and in industries where the average firm size is large, few medium sized invest overseas.5

Beyond these characteristics multinational firms can be divided into two types. "Oligopoly with product differentiation normally prevails where corporations make 'horizontal' investments to produce abroad the same lines of goods they produce in the home market."6 These corporations are primarily concerned with securing or maintaining their market share and establish a complex local organization to sell and service their product. Once this apparatus is established, the marginal costs of the next step, building productive facilities, is greatly diminished.7


The other type of multinationally producing corporations invest abroad because of a supply oriented strategy rather than because of marketing strategies. The products of these corporations require a raw material or other input which is necessarily produced abroad, and the companies invest abroad in order to insure their supply. This type of investment declined with the rise of nationalism in Latin America, Africa and Asia and the subsequent takeovers of mines, oil fields and plantations. Industries continue to invest however, finding the additional risk acceptable as long as profits are high and hoping to retain a buyer relationship even after they lose ownership rights.

The effort to fit the multinational corporation phenomena into a single body of theory has thus far been unsuccessful. Rather, different areas of theory provide explanations for different facets of MNC behavior. International trade theory explains in the context of factor prices why a corporation would wish to produce different products in different parts of the world. The product cycle theory accounts for shifts in production locale over time, with new products initially being produced where they are invented, but with the production locale shifting later in response to relative factor prices. Location theory provides insight into differential production costs, portfolio theory into differential risks. Marxist-Leninism places multinational corporations within a long range historical context. The theory of oligopoly supplies an explanation for multinational production in terms of control of markets and supplies rather than production costs, and
distinguishes between the horizontally integrated oligopoly and the vertically integrated ones.

Most of the theoretical analysis of multinational corporations can be applied to some extent to their involvement in Third World agriculture. Traditional trade theory notes the obvious connection between tropical crops and Third World abundance of the climatic conditions necessary for their cultivation. Newer approaches in trade theory, like the product theory, are less relevant to the spread of agricultural technology. The product theory assumes that the product is new, and in agriculture, while production techniques may change, the product itself is constant. Location theory does describe the growth of primary products in the Third World, its 'Level III'. To the extent then that the Third World contribution is limited to the production of primary products, it becomes subject to the 'law of uneven development'. However, location theory, focused on phases of international production, does not perceive that the MNC, in substituting modern agricultural technology for traditional subsistence techniques, may be making a positive contribution to Third World development. Finally, MNC investments in agriculture, like mining, have been traditionally explained in terms of the supply oriented, vertically integrated oligopolies described in the theory of oligopoly. Current examples of MNC involvement in overseas agriculture indicate that the oligopolies have been able to substitute the establishment of a buyer relationship for outright control of production. Thus several firms are engaged in the guise of technical and managerial consultants rather
than investors; so far, no body of theory has dealt directly with this phenomenon.

Most of the literature emanating from the business schools takes the existence of the multinational corporations for granted. These studies are generally concerned with the problems of how a company should operate overseas, rather than whether, and focus on the individual aspects of effective management.

A major issue discussed in this literature is the question of the organization of multinational corporations. Corporations usually start overseas operations by exporting, and then establish distribution centers and eventually production centers abroad. Initially overseas operations are handled by an international division, but by the time a company becomes truly 'multinational', i.e. is transacting enough business abroad that its financial status depends on operations in more than one country, it is no longer efficient to have all non-domestic operations handled by a single autonomous division. Corporations may then either establish a product centered organization, with area managers within each product line; or divide overseas operations into geographic areas with a rationalization of production among them. A third possibility is a 'grid structure' which entails division managers reporting

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to both product and area supervisors, rather than reporting through a single chain of command.\textsuperscript{9}

A second aspect of the organizational issue is the degree of centralization in the corporation. The crucial element in this area seems to be the extent of influence of the foreign culture especially on the corporation's ability to make sound judgments. One study\textsuperscript{10} analyzing corporation blunders (defined as a foreseeable problem whose solution was either poorly prepared or entirely overlooked) found that marketing errors were more likely to occur with products sold to final consumers than with intermediate products, especially in greatly different cultures (like Asia). Blunders were much more likely to occur in the functional areas of marketing and management than in the legal, production or finance areas. Another consideration is that centrally organized corporations may reject profitable opportunities because management's ignorance of the overseas environment increases the real and perceived risk of new operations.\textsuperscript{11} Increased decentralization and effective use of local nationals reduces the risk, especially in marketing and management; the center would remain


responsible for coordination of the diverse operations, corporate finances, research and development and long range planning.\textsuperscript{12}

Many of the points involved in decentralization are raised again in the issue of joint ventures, and the success of the joint venture will in part depend on the type of internal organization the corporation has adopted. Joint ventures take a variety of forms but the term usually signifies a partnership between a foreign firm and a host government or a firm with local connections. The ownership shares of the foreign firm and local group vary, and the venture may or may not include a 'fade-out' provision, under which foreign participation is limited in advance to a specified number of years. Occasionally the joint venture is formed at the instigation of the foreign firm, either to share the risk of an overseas operation or to capitalize on the knowledge of local personnel. An example of the latter is the joint ventures formed with the United African Group of Unilever which combines the technical expertise of the newcomer with the long years of experience in Africa of UAG.\textsuperscript{13} More often, however, joint ventures are formed on the insistence of a host government which believes that local participation, either private or governmental, will give some measure of local control. The host government may also hope that a joint venture will lead

\textsuperscript{12}\textit{Ibid.}, p. 39.

to some transfer of managerial skills and a greater proportion of the returns remaining within the country.

Nearly one-third of all joint ventures are eventually dissolved, not all amicably. In general, corporations that are diversified and whose management is decentralized have a high tolerance for joint ventures "and the sort of decentralized decision-making they imply."\textsuperscript{14} Vertically integrated corporations with monopolistic control of raw materials but with diversity in the end use markets can also tolerate joint ventures, especially for the market opportunities they provide for the raw materials. However, corporations that concentrate on a single product line or on serving a particular customer group usually have a centralized management with decision making only at the senior level. These corporations, in the interests of standardization, cutting costs and rationalization of markets and production, eventually dissolve their joint ventures, often at the point when they are reorganizing internal management to a more centrally controlled regional or regional-functional structure.

In addition to the general organizational issues, a number of studies focus on specific problems of management, both of the local unit and the corporation as a whole. One of the local problems is the management of an overseas labor force. One observer cautions that "in a situation where labor

appears cheap and profits easy there is a strong tendency to underestimate the importance of good management." He found serious deficiencies in employee selection, training, first line supervision and wage administration. These faults were not corrected until competitive pricing or higher wage rates provided a greater incentive for higher productivity which was then achieved by "tighter and more experienced supervision, improved work organization and higher output standards." Another research project found a remarkable similarity of goals across nationalities and occupations and concluded that most problems of dealing with people of different cultures arose from management's assumptions of stereotyped differences which did not in fact exist. A third study, focusing more specifically on industrial relations in the United Kingdom noted problems of economic conflicts, different traditions, the MNC's more intense labor utilization and distance between the decision making body and the local situation. Nevertheless, the foreign firms seemed less strike-prone, with their industrial

16Ibid., p. 295.
relations procedures particularly adept at avoiding the small unexpected strike.

Another problem area which is both local and global is that of marketing. The differing market characteristics, industry conditions, marketing institutions and local restrictions make marketing a primarily local concern. There are however great benefits of standardization: cost savings in product design and packaging, consistency with consumers, improved planning and control, exploitation of good ideas in advertising and avoidance of transshipping due to price differences.¹⁹ Because of these benefits there is a tendency to coordinate markets which are either interconnected or similar. The coordination is usually on the basis of geographical proximity, level of economic development, or language or currency blocs. A more sophisticated approach²⁰ is the designation of groups of countries based on the 'clustering' of characteristics relevant to marketing aggregate production and transportation, affluence, purchasing power of money, international trade, economic advancement, higher education/political heterogeneity and health and education.

Finally, three areas, finance, research and development, and corporate planning, are generally considered the


responsibility of the center and should be managed on a global scale.

Methods of financing affiliates vary according to the circumstances and most of those recommended to the MNC are precisely the sort about which host countries have serious reservations. Loan repayment is easier to repatriate than equity/dividends and often saves on taxes. A small initial investment followed by a period of no returns but eventually high dividends guards against excessive risk. Local borrowing prevents loss from devaluation and, if the host capital market is controlled to encourage investment, may be achieved at lower interest rates. Host countries are generally sufficiently valuable in their objections that mutual financing among sister subsidiaries is not much used. On withdrawing funds from abroad, dividends are usually subject to tax considerations while royalties and management fees have the advantage that they do not have to be shared with a partner in a joint venture. Similarly, transfer pricing can be varied to shift the tax burden.21 Another financial concern is currency depreciation because on paper at least, it decreases the value of assets held overseas. Recommendations vary between elaborate hedging policies22 and the acceptance of devaluation as an adjustment for the increase in asset value due to local inflation.23


Another function which is almost entirely centralized is that of research and development. While foreign facilities may help in some specialized areas, or work on product modification for their local market, most research is conducted in the multinational's home country. The problems for the multinationals are twofold. First they must assure that the research benefits reach the subsidiaries, which requires good lines of communication throughout the corporation. Second, the multinational must assign research costs to the proper department. Usually, overseas branches are charged directly when the work was done at their request; the costs of more general research are recouped either by royalties or through the increased profitability of the subsidiaries.

The last major functional area, also managed at the center, is corporate planning. Most companies have a separate planning staff and complex system of communication to keep abreast of changes in the company's environment: government planning, national interests, markets, the rate of technological developments. Common mistakes in planning include the excessively detailed development of long-range strategic plans, the use of regional plans that do not allow for country differences and the lack of stress on local politics. The major benefit of corporate planning is not the formulation of a rigid plan, but the creation of a flexible tool which allows


the corporation to be prepared for change and to grasp opportunities as they arise.\(^\text{26}\)

Very little\(^\text{27}\) of the business-oriented literature contains much of interest to the consideration of MNC involvement in Third World agricultural projects. Most of these studies are clearly directed toward the involvement of U.S.-based multinational corporations in Western Europe, and nearly all have limited the scope of the study to manufacturing enterprises. Most are written from a global perspective; few are interested in the management of the overseas operation itself. Some of the recommendations would be misleading if they were applied to agriculture. While the manufacturing labor force may be much the same throughout the world, the agricultural labor force is likely to be considerably more culturally bound. Also, while in manufacturing research and development can be effectively centralized, agricultural technology is notoriously location-specific and any successful agricultural project will undoubtedly have to include a fairly extensive research center to deal with its local problems. One area of analysis relevant to Third World agriculture however


\(^{27}\)An exception is Simon Williams, "Private Enterprise in World Agriculture," Harvard Business Review, XLIII (Nov/Dec. 1965), pp. 95-105, which urges U.S. firms to invest in overseas agricultural projects. Since he hedges his advice with a number of unpalatable restrictions (acceptance of lower returns and higher risks, withdrawal after 20 years, avoidance of land ownership and generally willingness "to yield the glory and accept the blame", p. 102), the overall impression conveyed by the article is negative.
is the consideration of joint ventures: currently, few MNC's are allowed to operate agricultural projects independently and the 'fade-out joint venture' bears a striking resemblance to the older idea of a jointly managed concession area. Corporate planning, with its emphasis on an awareness of the political and social environment and flexibility in the face of change, is another relevant functional area. In most Third World countries, there are few more politically vulnerable issues than the control and development of the land, and any MNC involved in the management of Third World agriculture will have to be both sensitive and adaptable.

The third body of literature on multinational corporations attempts to measure their impact on the international economic and political system, on their home countries and on their host countries. These studies try to weigh the benefits of the multinationals against the costs and discuss appropriate measures of control which could be taken either by individual countries or by the international community at large.

The underlying assumption at the global level is that multinational corporations are beyond the control of any single country. Their transnational mobility enables them to remove themselves from any environment they find suddenly uncongenial. Several writers have suggested that at minimum there should be a global chartering of multinational corporations. One study has outlined an international forum, a sort of GATT for

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international investment, under whose auspices multinational agreements could be negotiated. Other writers stress the need for regional agreements like the Andean Pact which would discourage MNC's from attempting to play one country against another; or the need for transnational labor union solidarity which would create a countervailing power to international business. Other suggestions include establishing codes of behavior for MNC's, the renunciation by home countries of manipulating MNC's to further their own national interests, harmonization of national policies in areas like taxation, the establishment of information centers on MNC's, and the creation of alternative sources of technological innovation. The wheels of international cooperation move slowly, however, and little has been done to implement these ideas.

The impact of multinational corporations has been felt by both the countries of their origin, the 'home countries', and by the countries of their expansion, the 'host countries'. The home countries have been primarily concerned with the effect of overseas investment on domestic employment, incomes, taxes and balance of payments. Studies of both U.S. and U.K. based firms


30United Nations. Department of Economic and Social Affairs, Multinational Corporations in World Development, ST/EGA/190 (1973), Part IV.

have pointed out that overseas production is not a direct substitute for domestic production and export. Often an overseas market can only be served by overseas production and at least the home country receives some benefits from the export of inputs or from repatriated profits and fees. The practice of establishing overseas assembly plants in cheap labor countries reflects a loss of home country jobs; however, the loss of employment in this one stage of production has probably preserved jobs in other stages (component manufacturing, marketing, etc.). The alternatives are importing the entire product from a foreign competitor or producing the good non-competitively behind protective tariffs. The tax question is much debated, but in general deliberate avoidance of taxes is not common: the organization of the multinationals is too complex for it to be run as a single unit, and the savings from manipulation are small compared to the profits that can be made by capitalizing on the MNC's strengths. Finally, the multinational corporation eventually recoups its investment and repatriates the income, although the period of recoulement differs according to the geographical area of investment.  

Host countries have even greater reservations, political and economic, about multinational investment. While most objections are based on some kernel of fact they are also nourished by a xenophobic resentment of the outsider's success and influence. In developing countries this surfaces in the  

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dependency doctrine prevalent in Latin America which maintains that true development can only occur through structural change and domestically mobilized resources. According to this doctrine, foreign private investment merely perpetuates social and economic backwardness by helping to maintain the traditional system.

In developed countries, primarily Europe and Canada, the success of the U.S. based multinational corporations is viewed as an indication of the failure and even collapse of host country economic institutions. Seen positively, U.S. corporations with their talent for accepting and mastering change, are the only firms which have acted on the logic of the Common Market to deal with Europe as a single unit. More negatively, U.S. firms have used their vast power to attain a pre-eminent position in the economy of their hosts. Thus one study of U.S. firms in Canada purports to sketch "Canada's slide into a position of economic, political and cultural dependence on the United States and seeks to explain the process whereby national entrepreneurship and political unity have been eroded to a point beyond which lies the disintegration of the nation state."34

While the anti-multinational rhetoric may overstate the case, the political and economic power of the multinationals and the impact on the host country is very real. By and large


the era of overt interference of foreign business into the political affairs of its host has passed, although the example of ITT in Chile and the Lockheed Corporation's bribes in Japan and the Netherlands indicate that such maneuvers are not unknown. MNC's may attempt to influence their home governments or international lending agencies to act in their behalf, but they rarely achieve any significant success, especially since big business seldom speaks with one voice.

The political impact of multinational corporations on their host countries usually centers on the more amorphous problem of control. Developed countries manage their economics through a collection of finely tuned macro- and micro-economic policies. The flexibility of the MNC enables it to evade the consequences of some of these policies and thereby lessens their effectiveness. For example, a country concerned with inflation may attempt to control demand by raising interest rates. Domestic firms, discouraged from borrowing, may either postpone planned expansion or lower dividends in order to finance expansion through retained earnings. In either case, the effect of raising the interest rates has been to lower demand. The multinational subsidiary can simply borrow from the parent company. In less developed countries the same problem of control is posed in a slightly different way. There politicians worry that major decisions affecting the economy of the host country are made outside the country by foreigners whose loyalties lay with a multinational corporation rather than with the nation state. This is not particularly a problem where the MNC organization is decentralized and subsidiaries
act like national companies. Where the company organization is centralized, however, and company officers base their decisions on a global strategy, the interests of any one country in the Third World will have a fairly low priority. Nationalist politicians fear that having achieved political independence, they may become the victims of economic colonialism, or neo-colonialism.

One solution to the problem of control is the proposal to break up the 'package' offered by the multinationals and contract for each component separately. It is quite possible for a developing country to obtain financing, plant construction, managerial expertise, licensed technology and marketing outlets, each from a separate source. However, this separate contracting, while politically satisfying, is not necessarily cheaper, requires high level management skill in the bureaucracy and loses the benefits of the synergetic relationship of the package as put together by the multinational. More important than the separate components offered by the foreign investor is the "unique mix of money, people and experience which has enabled him to succeed in his own country."\(^{35}\) The company's accumulated experience, its history of trial and error, success and failure, is itself a valuable asset. Further, separate contracts do not necessarily lessen the degree of dependence: "knowledge still has been imported; and because of imperfections in diffusion of knowledge and technology, on the one hand, and

lack of local capabilities on the other, the key components of dependence - at least at the firm level - still remain."  

There are undeniable economic advantages of multinational corporative investment. The MNC aids in capital formation, either by providing its own investment funds or by soliciting local capital. It creates viable enterprises by combining factors of production missing in the local economy (technology, management skills and a marketing framework) with those which are locally abundant. The MNC is more easily directed into less popular locations than are local entrepreneurs who cluster around the capital, and thus the foreigner can be an aid to regional development. Also, contrary to the predilection of foreign governments and international agencies for large showcase schemes, private enterprise is willing to invest in small productive projects. Foreign investment can stimulate inefficient industries, both among its competitors and its local suppliers, by providing an example of business organization and planning and a source of competition. Backed by the resources of the multinational corporation, the subsidiary can assume risks which local firms cannot. Finally, the multinational firm can supply substantial training for all levels of the host's labor force.

There is however, serious concern about the economic impact of investment by multinational corporations, and many of these reservations flow directly from the supposed benefits.

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One of the chief dangers of MNC investment is that it restricts the ability of the host to choose its own path of development. In the past, private foreign firms were almost solely interested in projects which entailed some prospect of exports, and the availability of investment funds for these activities and no other shaped the direction of economic growth. Multinational corporations have been accused of creating a system of international and internal dualism.\textsuperscript{37} Modern science and technology as formulated by the multinational has been dominated by the needs of the developed countries and a growing gap is perceived between the highly sophisticated capital intensive technology which benefits the developed countries and the simpler labor intensive technology appropriate to the countries of the Third World. Internally, the MNC specialization in export and especially extractive industries has created an enclave of modern capital-intensive industry in predominantly traditional economies. There have been few linkages between the enclave and the surrounding economy and therefore the benefits of increased efficiency, management and training seldom spread to local enterprises. Some of these reservations have been dispelled as multinational corporations have moved into new fields. While still export oriented, MNC's are increasingly taking advantage of inexpensive labor costs in less developed countries to shift labor intensive processes and production

states to the Third World. In addition, western technology is being applied to fields like tropical agriculture which are of special interest to the developing countries. Host government insistence on technical training and local content has increased the linkages between the foreign subsidiaries and local industries. However, the problem of inappropriate technologies with its consequences for the use of scarce capital and for unemployment remains and is likely to persist.

Another area of concern is the relation of local enterprises to the foreign subsidiaries. The introduction of competition into a previously protected market presumably promotes greater efficiency, better allocation of resources and price reductions. Local firms which are unable to adjust, however, are likely to disappear and in the long run the market may be less competitive than before the entry of the multinational. This is particularly true if the entry was effected by the takeover of inefficient locally owned firms. One multinational subsidiary may dominate the entire local market with only the forces of foreign competition left to sustain the economy at its now higher level of efficiency.

The most sensitive problem of multinational investment centers on the dual question of the division of the profits and the host country balance of payments. To the extent that overseas investment is a sort of zero sum game, the reassurances offered to the home country that in the long run such investment

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is to its benefit are a matter of concern for the host country. Some writers view multinational investment as an instrument for the 'de-capitalization' of the less developed countries. They subtract from the original investment the repatriation of earnings, royalties, fees and interest, and cite the often negative remainder as evidence that MNC's eventually withdraw more capital than they initially invested. In addition to this simple arithmetic they can produce indications that the intra-firm transfer prices are juggled, exports underpriced and imported inputs overpriced, to transfer additional funds out of the local subsidiary. Finally they observe that often the source of the financing of the initial investment is the local capital market: investment by multinational corporations does not necessarily entail an inflow of capital from abroad at all. Critics of this approach charge that its adherents achieve their results by making invalid comparisons. They claim that it is misleading to compare investment inflows with the outflows of returns because such comparisons ignore the productive features of the investment. The output of the subsidiary is bound to have import-substitution and export implications and these impacts have to be included in any balance of payments analysis. The host country profits from foreign investment through taxes levied on its profits, output and wage earners, through an increase in the nation's productive base and through wages paid out to local employees. As nations achieve parity with the multinationals, they become quite capable of extracting their share of the rewards of foreign investment: the experiences of the oil industry and the less
complex manufacturing enterprises are good examples. The problem of transfer pricing stems from a firm's attempt to maximize global profits in a world of differential taxes, tariffs and subsidies, multiple exchange rates and quantitative restrictions. It is limited by the subsidiary's ability to defend itself against the depredations of company officers at the center, coordination and standardization of investment-related policies among host countries, and by the effectiveness of the host's customs and tax officials. This effectiveness could probably be increased by the exchange of information on the value of internationally traded goods and perhaps by international assistance to help developing countries decipher MNC accounts.

There is not a great deal the multinational corporations can do about the suspicion they engender among peoples and governments. Writers advise rather generally that corporations should study how to become 'good corporate citizens.' Economically this is interpreted to mean that their subsidiaries must contribute to the net national value added, benefit the balance of payments, add to the public revenue and promote growth generating effects. Basically the "long-run security of market position and business assets rests on management's ability to think in similar terms and to so structure overseas enterprises


as to identify them with the national interests of the host societies."\(^{41}\) Local subsidiaries must nurture within the firm an interest and concern for the development problems of their host and encourage its members to take disinterested initiatives toward their solution: in short, must adopt in each country the old Scottish adage, "Stands Scotland, Stands my house."\(^{42}\)

Studies of the impact of multinational corporations seldom specifically relate to agriculture. Most are clearly concerned with manufacturing or mining, with one study stating bluntly, "broadly speaking, the era of foreign investment in agriculture has ended."\(^{43}\) Nevertheless, there are three areas of some significance. One area is the concern over the division of the rewards and the balance of payments effects of investment in agriculture. What is true in general ought to be valid for the specific case: the investment benefits the host country as long as the investment itself is productive. Investment in agriculture will have substantial export and import substitution effects, although there may be some danger that overproduction may result in price reductions and possibly a


worsening of the terms of trade. A second area is the concern over the encouragement of dualism in the agricultural sector. The agricultural project established by (or for) the multinational corporation will undoubtedly use imported technology and equipment, foreign managers and technical specialists, and wage labor. Linkages to the surrounding traditional agriculture are possible; technology may be transferred by the laborers or through example or instruction. Such linkages do not occur spontaneously however; rather they have to be deliberately forged, probably through a complex coordination of project managers and government extension workers. The third, and possibly most important, subject of interest involves the political reservation about multinational investment. In no sector are sensitivities more apparent than in agriculture where foreign control of the land offends even the most modern nationalist. Again, there is little a corporation can do except be aware that this is a sensitive area and attempt to acquire a local coloring to obscure the outward manifestations of its own foreign-ness. Meanwhile, the trend towards greater internationalization, with multinational corporations becoming less parochial and host countries more technocratic, may eventually defuse the issue.

Few of the studies on multinational corporations deal with agriculture in the Third World. Overseas investments in the last two decades have flowed primarily towards the developed countries, almost entirely in manufacturing; and most of the literature on multinationals reflect those trends. Some observations are apt, such as the discussions of the practicality
of joint ventures, Third World political sensitivities and economic benefits and pitfalls. Most unfortunately are irrelevant, and a few are actually misleading.

TECHNOLOGICAL TRANSFER

The involvement of western based multinational corporations in the agricultural development of the Third World almost by definition includes some element of technological transfer. Host countries in fact engage the corporation precisely so that this transfer can be facilitated. The record of such transfer in industry as well as agriculture has not been one of unqualified success, and critics have voiced their skepticism in four main areas: the suitability of the technology itself for developing countries, the channels through which the technology can be transferred, the cost of the technology and the capacity of the developing country to absorb it.

Questions on the suitability of Western technology have been asked both within a broad, almost philosophical, context, and in a more narrow technical one. In the broadest sense, the entire construct of western technology has been declared unsuitable for the milieu of the developing, especially Asian, world. Asia according to this view has been able to forge the "proper linkage with the broader aspect of man's creativity and his spirit of modernism through his own volitions."

While "a nation's technical progress though narrow, specialized,

repetitive operations may show good results for a limited period. . . in the long run, it is bound to recoil and sow the seeds of individual and social disintegration." Western technology, by definition, is inappropriate.

Most writers are not quite this absolute in their condemnation, and many find the ethical question irrelevant or at least uninteresting. A distinction has been noted between those who take a 'Gestalt position', that technology must be adapted to fit the cultural and social milieu, and those who take the 'transfer position' that the proper concern is with the operational problems and adaptation should be left to take care of itself: presumably the burden of adaptation is borne by society, not technology. Adherents of the 'Gestalt position' have outlined criteria on which to judge the suitability of a given technology. It must constitute a technical improvement over existing methods; it must be conducive to social progress by benefiting the mass of people and thus avoid perpetuating or solidifying an oppressive social and economic order; and it must stimulate economic progress by making optimal use of resources. The choice of technology involves not only the method of production but includes the

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45 Ibid., p. 35.
46 Daniel L. Spencer and Alexander Woronick, eds. The Transfer of Technology to Developing Countries (New York: Praeger, 1967).
the selection of the product itself, in type, quality and scale. Further, the choice must be viewed dynamically, and the decision may vary over time as the national characteristics change with development.

Considerable debate has surrounded the criterion of optimal use of resources and has taken the form of a controversy over factor proportions. Western technology has developed in response to the factor proportions of the U.S. and Europe and is consequently biased toward capital using and labor and material saving techniques. These proportions seldom match the factor proportions which exist in the labor abundant host countries. The mismatch of transferred technologies and LDC factor proportions was first viewed as a concern for the profitability of a technique given LDC factor prices. Later cognizance was taken of the differential impact the choice of technology would have in the context of optimal growth paths: given different propensities to consume and invest among the owners of factors, planners should choose the capital intensity of the technology in such a way that the returns to the factor owners match the desired pattern of consumption and investment.

More recently, concern has revolved around the high rates of urban unemployment in the developing countries. Industry has not absorbed labor fast enough, partly because of the increase

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in labor efficiency, but more because of its adoption of capital intensive processes.

To the extent that western based firms move overseas in order to cut production costs, they are responding to factor proportion and factor price differentials between their home and host countries. While they move production location in order to obtain a better match between their technology and the factor price structure, once abroad they are generally reluctant to adapt the technology to achieve even greater savings. Multinational corporations drawn overseas by the attraction of market rather than cost advantages, have even less incentive to adapt their technology, especially where they have been able to establish a monopoly position. From the company's vantage point, the implications of substituting labor for machines goes beyond simple factor price considerations because different degrees of mechanization imply different labor force structures.

A higher level of mechanization requires a smaller but more highly trained workforce than does a lower level of mechanization, and the level of mechanization influences the structure of the administrative and management cadre as well. Increased mechanization reduces operational problems to the management of machines rather than of people, and where the pressures of competition are slight, the managerial advantages of mechanization outweigh the cost advantages of a more precise response to local factor prices. In addition, the more capital

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intensive process allows managers to react more quickly to demand fluctuations since it is easier to shut down and start up machinery than it is to fire and hire a large work force. Also, the machine often produces a better quality, more uniform product, although many times the uniformity and quality are not appreciated by the consumer. Finally, the engineer who supervises plant construction may be swayed by a sort of aesthetic attraction of the sophisticated capital intensive machinery of the West, and his choice of machinery may have little to do with relative factor proportions and prices.\footnote{Louis T. Wells, Jr., "Economic Man and Engineering Man: Choice of Technology in a Low Wage Country," Public Policy, XXI (Summer, 1973), pp. 319-342.}

An interesting sidelight to the factor proportions controversy is the finding that measured by the total returns to factors the multinational corporations are no more capital intensive than their local counterparts. The MNC's use more capital per worker but since they also pay higher wages per worker the capital/labor ratios are about the same as those of local firms.\footnote{Robert Hal Mason, The Transfer of Technology and the Factor Proportion Problem: The Philippines and Mexico. UNITAR Research Report No. 10. (New York: United Nations, June 1971).} Western based firms do not employ significantly more equipment per factory worker than does the local company; the excess capital investment is primarily in buildings and inventories. The foreign and locally owned plants do employ different types of equipment however, and the labor force required by the western based firms is composed primarily of
executive, technical and semi- or unskilled workers while local firms use more skilled workers and professionals.\textsuperscript{53} Thus the multinational corporations are not a "distinctly separate contribution to the problem"\textsuperscript{54} of excess capital intensity; local firms are equally culpable.

Most of the studies on factor proportions are focused on manufacturing. However, one discovery that is applicable to agriculture has resulted from a study of the relation between mechanization and scale. In manufacturing, where labor is cheap and capital expensive, the lowest mechanized methods are optimal as long as markets are small. As markets enlarge, higher mechanization becomes optimal even where relative factor prices favor labor. In LDC agriculture, however, at no level of scale does the cost advantage shift towards mechanization. "Even including... all types of social overhead costs and making a correction for the lower working capacity of manual workers in tropical areas, the most simple labour-intensive method leads to lowest total costs of production regardless of the production volume desired."\textsuperscript{55} Thus multinational corporations who are introducing agricultural technology will have more incentive to adapt that technology to conform to local factor proportions than do firms engaged in manufacturing.


\textsuperscript{54}Mason, Transfer of Technology, p. 6.

\textsuperscript{55}Boon, Economic Choice, p. 169.
Advisors have offered a number of possible solutions to the problem of disparate factor proportions. The most comprehensive proposal is that LDC's should reject the technology of the West and develop their own intermediate technology. The research cost is undoubtedly high, however, and most intermediate technology currently in use is adapted from more capital intensive methods. Japan has been particularly successful at adapting technology to match the Third World's labor abundant economies but few other countries possess Japan's large technically trained scientific community. A more effective use of scarce scientific talent is probably seeking out and selecting among already available technologies and reserving the development of original intermediate technology "for important special opportunities and peculiar bottlenecks." In agriculture, many of the intermediate methods thus far advanced produce less at a higher cost than do the known and tested capital intensive methods. In an era of shortages of both food and investment capital, experimentation with intermediate methods for the sake of job creation does not seem to be worth the cost or the risk.

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Developing countries can pursue a policy line that would encourage firms to generate labor intensive technologies even where the governments themselves lack the research facilities. They can establish a competitive climate which would apply cost cutting pressures to firms. They can assure that the factor prices are not distorted by minimum wage laws and capital subsidies. They can subsidize the development of intermediate technology and adaptive research. Finally, they can attempt to attract those industries which are inherently labor intensive.59 These policies are considerably more feasible than a program for the development of an independent intermediate technology.

Countries which employ foreign firms to operate large scale agricultural projects have generally already decided to ignore the issue of factor proportions. Instead they have opted for western technology and management, accepting its capital intensity, for the sake of short term rapid growth in production. For them, job creation is a worthy social goal and intermediate technology a reasonable long term means; but they are both irrelevant to the context of the priorities of these particular projects.

There are a number of routes through which developing countries can acquire advanced technology should they decide that such technology is best suited to their needs. Which route will be chosen by the host country will depend on the

character of the technology and the degree of control desired by the host. Some technology, especially in agriculture, is available from governments and international aid agencies, but most must be obtained from private sources.

The LDC retains the highest degree of local control when it acquires foreign staff on an individual basis, a method most appropriate when the technology is in the public domain. A similar but more structured approach is the employment of a consulting firm. Such firms are able to assemble an assortment of skills and techniques and recombine them to create an instrument for resolving local problems. With their global experience, they are also specialists in the process of development itself and are able to advise on the feasibility of different approaches in varying circumstances. The temporary nature of their employment is however a source of intrinsic flaws.

Because they are without continuing long-range responsibility, their work is likely to be quick and shallow. Because they depend upon the favor of a technically sophisticated clientele, they are liable to mingle science with promotion, in unequal proportions. Because their assignments are temporary, the value of the experiences they have accumulated in the particular circumstance of given assignments is liable to be continuously dissipated and lost.60

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Where the technology is part of manufacturing and production, the involvement of a foreign manufacturer in some capacity becomes necessary because its acquisition generally entails some restrictions imposed by patent rights and trademarks. Technology embodied in equipment can simply be purchased with the machinery or, most comprehensively, through a turnkey contract in which the host country purchases not only the machinery but the entire factory. To be effective, the firm or salesmen must guarantee a continuing relationship, including training, service and spare parts. Where the technology involves an entire process, the appropriate methods of transfer are through either direct investment by the foreign patent holder or through a licensing agreement between the foreigner and the local government or company. While the host may prefer the greater control afforded by licensing agreements, the ultimate decision rests on the preferences of the foreign firm. Where the technology has resulted from substantial expenditures on research and development and has given the corporation a wide lead over its competitors, the firm is generally reluctant to agree to licensing arrangements. If the firm has sufficient resources, and especially if it has a global strategy in which licensed firms could disrupt already established markets, it will usually opt for direct investment so that the firm rather than the host country can control production and marketing.
A variation of particular importance for agricultural projects are management contracts. These contracts are appealing to host countries because they provide a high degree of local control and are of limited duration. They may be acceptable to the firm primarily as the only conditions under which they will be allowed to engage in politically sensitive sectors. In addition to the negotiated fees, the firm can acquire outlets for domestic production, foreign sources of supply, tie-ins with existing operations, contracts for subsidiaries (for the construction of the turn-key plant for example), and a stronger market position. All of these benefits provide the basis for a lasting framework for cooperation between the host country and the foreign firm and thus make the management contract a more viable form of technological transfer than either consultancy or licensing arrangements, and in politically sensitive areas, than even direct investment.

The cost of the technological transfer has produced fairly acrimonious controversy. The cost of technology is determined by negotiation rather than by any competitive pressures on factor returns, and the multinational corporation's monopoly position gives it an initial advantage. As the technology is transferred, the advantage shifts to the host country and the original agreement may be re-negotiated amid bitter feelings and angry words. Companies complain that their hosts do not appreciate the developmental costs, and therefore

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the value of the technology they are acquiring. One LDC advocate replies that given the dubious suitability of western technology for the developing countries, multinational corporations should transfer it at their own cost. In any case, the cost to the LDC's of obtaining technology from private corporations, or while higher than government foreign aid or export credit, is not higher than that paid by developed countries or of the alternative methods of assembling the technological package.

The final issue discussed in the literature on technological transfer concerns the capability of the receiving country to absorb the technology. The concept of 'absorptive capacity' was first used in the context of foreign aid grants and was defined as the "capacity of a country to employ financial capital in a manner which will result in an increment to the net national product." The concept has been extended to include the ability to use new technology productively. In either case the 'absorptive capacity' imposes a limit on the effective use of a single factor injected from outside.

There are two overlapping stages in the process of absorbing foreign technology. The first stage includes the

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selection, if necessary the adaptation, and the initial utilization of the technology. The second stage involves the spread of the technology throughout the economy. The two stages may overlap. Competitors may begin to imitate some technologies before they are fully operative in the initial firm; however, the diffusion process does not ordinarily begin until the technology has achieved some measure of success in its first location.

The capacity of a nation to complete the first stage of adoption successfully depends on the extent to which it already possesses factors complementary to the new foreign technology. The first requirement is the existence of an organized scientific and technical community within the developing country. The nation must be able to create an institution capable of planning a program for the development and acquisition of needed technologies, of surveying available technologies and selecting the most appropriate; of recognizing where the technology must be adapted to conform to the domestic physical and ecological, social and economic context and making those adaptations; and where necessary and where resources permit, of engaging in long-term basic research for the development of new technologies. In addition to staffing government development organizations, the scientific community also performs a somewhat more nebulous task of promoting scientific education

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65M. Taghi Farvar and John P. Milton, eds., The Careless Technology (Garden City, New York: Natural History Press, 1972) is full of examples where the introduction of inappropriate technology has disturbed "the complex relationship between ecological, cultural and economic factors," p. 672.
and understanding throughout the country. Very little is known of the relationships between basic science education and development in an LDC, but it is generally presumed that the discipline of scientific thinking is one of the fundamentals of the development process.

Once an appropriate technology exists, to become productive, it must be combined with skilled labor and management. These factors can be imported with the technology, but if they are, the net contribution of the technology to the country's output will be less than if the technology had been able to work with previously idle workers or workers transferred from less productive employment.66 The technology can be made operational by a technically competent staff; it will flourish "only when it is maintained and nourished by an environment offering it a range of services which are essential to its continued operation."67 These services entail not only the mechanical skills of repair and maintenance, but the whole gamut of managerial talent for locating spare parts, sub-contracting specialized processing, enhancing the efficiency and reliability of suppliers, coordinating stages and lines of production, and constructing domestic and foreign marketing networks.

After the new technology has been established in one location, the process can either be stunted, in which case the

66 Mikesell, p. 371.

innovation merely fosters the growth of economic dualism, or it can be adopted by other productive units in the economy. An extensive literature on diffusion discusses the process by which an innovation is communicated through certain channels over time among the members of a social system. It emphasizes that the speed of adoption depends primarily on attributes of the innovation, such as its long run profitability or utility, the transition frictions or pressures for change versus the costs and dangers of the status quo, the uncertainty of the superiority of the innovation and ease of overcoming that uncertainty, the complexity of the innovation, and the compatibility of the new technology with the existing social, economic and political context. This context, with its structure of mores, beliefs and attitudes is not immutable however even in traditional societies: if the benefits of the innovation are sufficiently great and obvious, people will gradually reshape their attitudes to accommodate their changing interests. Thus friction between the innovation and the traditional context does not prohibit change, but it does slow the rate of adoption. One of the more frustrating findings, particularly for new agricultural technology, is that the most important factor in spreading innovations is personal contact between the 'change agent' and the recipient: in Eastern Nigeria for example the agricultural extension worker typically has 18,000 clients scattered over 38 square miles, and the idea of direct

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68 Everett Rogers, Communication of Innovation (New York: The Free Press, 1971) is a summary of 1500 studies on diffusion of innovations.
personal contact with each seems unlikely. Concentrated effort at the traditional centers of communication and reliance on the centuries old network to spread new ideas seems more effective than any attempt to reach everyone.

The transfer of agricultural technology raises problems which are different in degree rather than in kind from the problems of industrial technology. Agricultural technology tends to be extremely specific to the country and the sub-area, and it is therefore less likely that a technology developed in a temperate climate will be suited for the tropics. A higher proportion of agricultural technology needs to be developed and tested on site than industrial, which implies a greater need for local research facilities and for pilot projects in agriculture. The traditional factors which erect barriers to the diffusion process are stronger in agriculture than in industry because agriculture is generally more intimately connected to the indigenous culture. There is a greater variation in the physical and biological factors from one area to the next and therefore a greater variation in the profitability of any innovation in agriculture. Since the pace of the adoption of new techniques is substantially determined by the economic incentives they provide, the additional uncertainty in agriculture is as much an impediment to change as the social and cultural barriers.

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A prime advantage of hiring a western corporation to manage and provide the technology for an agricultural project is that the whole question of absorptive capacity becomes much less important. After the planning organization decides on the nature of the project itself, it must be able to select a capable firm, but the process of choosing and adopting an appropriate technology is left to the company. Typically the company also initially supplies technicians and managers, assumes responsibility for training local counterparts and establishes a research center within the project. The corporation may also build the facilities, import the necessary capital equipment, choose and provide inputs like fertilizer, seed, insecticides and pesticides, locate and encourage local suppliers, and arrange for processing, shipping and markets. The role of the government is reduced to supplying the land for the project and convincing local inhabitants to participate in or at least refrain from actually sabotaging the scheme (sometimes a not insignificant task). Further, any gains obtained from the diffusion of the new technology throughout the agricultural sector are considered something of a bonus: ordinarily the cost/benefit ratios are calculated only for the project itself. Thus the barriers to diffusion may exist but are irrelevant since in these projects the government is willing to foster dualism in the agricultural sector for the sake of a profitable, albeit narrowly based, productive unit. The fundamental assumption for this type of project is that a foreign corporation is capable of providing the necessary services, an assumption thus far not proven.
In general, once a country has decided to hire a foreign corporation to manage an agricultural project, most of the issues raised in the literature on technological transfer become irrelevant. The company has been contracted to apply the technology it already possesses, and will adapt it only to the extent required by profitability and the local ecology. Problems of employment and equity will be solved through other programs. Problems of absorptive capacity are restricted to the project itself with the corporation being both the donor and the recipient of the technology. Difficulties remain, but they tend not to be the ones which dominate the literature on technological transfer.

AGRICULTURAL DEVELOPMENT

Most development economists have not been particularly interested in the transformation of the agricultural sector per se. Economic development is primarily a macro-economic study and interest in any single sector is limited. Further, industrialization was tagged as the key to economic progress, and interest in agriculture at least initially centered on the role of the entire agricultural sector in accelerating industrial growth.

An early formulation of this type of analysis is the two sector approach originally stated by W. Arthur Lewis and developed by John Fei and Gustav Ranis. These scholars

differentiated between two sectors, one traditional/family farm/ agricultural where each laborer receives a return equal to the average product of labor, and the other a wage sector where each laborer receives a return equal to the marginal product of labor. Further they assumed that the agricultural sector contained a considerable amount of 'surplus labor', unemployed or underemployed labor whose marginal product equalled or was less than zero. They then hypothesized that it ought to be possible to reallocate this labor to more productive jobs in industry without either lowering agricultural output or raising industrial wages. A variation on the surplus labor theme is the speculation that for any level of agricultural prices, the traditional agricultural sector establishes an equilibrium between individual effort and output. This line of analysis assumes the existence of surplus agricultural labor, but emphasizes that the surplus takes the form of underemployment and that it can be productively utilized to increase agricultural output if the proper incentives are offered. The two sector concept has also been used to analyze the relationship between traditional and commercial farms within the agricultural sector. Like industry, the commercial farm may not be able to attract workers unless it offers wages which match the wages of labor the worker can collect on the family farm. The commercial farms may therefore employ fewer workers

and be more highly capitalized than would be the case if wages equalled the marginal product of labor. The idea that the agricultural sector can be raided to supply a labor force for a growing industrial sector without loss of agricultural production is an attractive one. Unfortunately, studies of the traditional agricultural sector have revealed that there is no labor surplus that can be removed without affecting output. Nor does there seem to be a great deal of seasonal labor.72

Other studies of the role of agriculture focus less specifically on labor and more generally on the complex intersectoral relations of resources and production. These studies recognize both that manufacturing cannot progress without some agricultural surplus, and that an agricultural surplus will result only from the investment of additional resources in agriculture. New techniques which increase the returns to agriculture provide an incentive for a flow of public and private resources into agriculture: capital, research, extension education, facilities for supplying new seed and fertilizer, credit and marketing structures. A technologically dynamic agricultural sector can then earn foreign exchange, increase the food supply, contribute to capital formation especially for overhead, and release labor and raise demand for the industrial sector.73


For those economists who focus on the agricultural sector itself, the nature of the traditional society they wish to transform, its institutions and attitudes, is crucial in terms of both the success and the equity of any strategy of development. It is no longer accepted that traditional societies are isolated and stagnant and that traditional farmers irrationally reject innovation because of their ignorant conservatism. Rather within the framework of the existing technology, the ecological determinants and the institutional structures, peasants are rational resource allocators who act on the logic of resource costs and price incentives in the same manner as western agro-businessmen. A major difference between the Third World peasant and the Western farmer stems from the contrast in institutional environment. The social security of the peasant is based on his place as a member of his tribe or village and he must spend much of his 'leisure' time strengthening his ties to the community. Second, since there is little public insurance against famine, the most important task for any farmer is assuring that his family and village have enough to eat. Third, the limited availability of consumer goods in rural markets inhibits any desire to earn additional income. The result of these factors is that Third World peasants tend to place a high value on leisure and on risk aversion. The latter becomes particularly important for any strategy which involves substituting cash export crops for food crops or a new untried technology for the possibly less productive but reliable traditional techniques. The peasants often have grounds for their suspicions since the
traditional methods frequently recognize local ecological features that an imported technology may ignore. Finally, the association of government primarily with taxation and the failure of past government projects has led many farmers to harbor considerable reservations about any new program emanating from government sources.

While limited by this somewhat conservative value system, peasants quite clearly respond to economic incentives. They accept new crops, substituting one cash crop for another or introducing new crops where labor requirements permit, and adjusting the quantity and quality of a given crop in response to changes in the price structure. They are less likely to switch readily from food to cash crops and may adopt new technology only after its benefits have been thoroughly demonstrated. In general "as far as one can tell presently the rate of acceptance of a new agricultural factor by farmers in a poor community is best explained by the profitability of adopting and using the factor. The profitability depends on the price and the yield."74 Finally the value system itself is not necessarily stable. Changes in the institutional framework could alter attitudes toward risk, leisure and government leadership,75 and the adoption of new technology itself will


75 See Polly Hill, Rural Hausa: A Village and a Setting (Cambridge: Cambridge University Press, 1972) and John W. Mellor, The Economics of Agricultural (Ithaca, N.Y.: Cornell University Press, 1966), who unlike T. W. Schulz believe that the traditional value system is changeable.
alter traditional norms and values. The processes of innovation and change are not without trauma: but change does occur even in traditional societies where the economic benefits are sufficiently great.

The institutional framework also influences the equity of any agricultural innovation. When a society already suffers from substantial inequalities in the distribution of landholdings, income and social power, the introduction of technological innovations is likely to increase the inter-personal and inter-regional disparities. Poorer farmers by definition must be more cautious in adopting new ideas: to a wealthy farmer, a crop failure implies a loss of profits, for a subsistence farmer it may presage the loss of his livelihood or even starvation. Moreover, the wealthier farmers have greater access to the factors complementary to the new technology. For example, the most significant technological innovations have been in the area of cereals grown on irrigated land, and therefore the first beneficiaries have been those who have access to irrigation water and fertilizer. Finally, where the extension/education system is rudimentary, larger farmers will probably be contacted first simply because they are better educated and more likely to recognize the benefits of any new idea.

Strategies for agricultural development differ on what is desirable, what is effective and what is possible. Ultimately, all proposals aim for a progressive agricultural sector within a dynamic economy, but they disagree on the intermediate goals and methodology.
A fundamental issue is whether development planning should be directed towards the modernization of the rural society, with an emphasis on employment and equity, or towards the contribution the agricultural sector can make to economic growth, with an emphasis on production. The preoccupation with the employment and equity effects of agricultural planning stem from the realization that the urban unemployment rate in some countries reaches as high as 25%, and that the technological advances of the last decade have increased the welfare disparities in rural areas rather than benefitting all levels equally. Obviously there is a connection between the two: rural development schemes which do not improve the lot of the rural masses or provide employment for the educated rural youth foster migration to the cities and contribute to the growth of an unemployed and sometimes unruly urban mass.

The issues of equity, output and employment would be easily resolved if it were possible simply to develop a modern agricultural sub-sector and absorb the farm families that have been by-passed into industry and commercial farming. Occasionally in fact it is possible: in Nigeria, the Oil Palm Rehabilitation Scheme achieved success by appealing to and creating a rural middle class who bought up and replanted formerly tribal land while creating and supporting a landless peasantry. More often, "the facts of demography, employment

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and poverty really exclude any policy which is not directly designed to improve the production and incomes of the vast majority of the farming population." Given a 2-3% growth rate in rural population and labor force with rural families composing 70-80% of the total population, it is unlikely that rural workers would be absorbed as quickly as they were released from traditional farming. The example of Japan is frequently cited as a demonstration that a smooth transition from traditional to commercial agriculture is possible. By concentrating on increasing the productivity of small farmers through the introduction of technological advances, Japan's planners were then able to increase rural savings and taxation and siphon off resources in the form of capital and labor to develop the industrial sector. Japan however made major investments in irrigation works before introducing the new techniques: today's developing countries may first have to allocate a large share of their available capital to agriculture before they can expect agriculture to contribute a substantial resource surplus for investment in industry.

While it may be difficult to improve rural welfare while increasing production, equally it may be impossible to achieve either objective singly. Production cannot be increased


without an improvement in the incentives, usually an increase in agricultural prices and/or an increase in the amount of resources dedicated to the agricultural sector, resources like credit, transport, marketing facilities, administrative and organizational skills, research, capital improvements, and health and education services. On the other hand, few countries can afford to improve rural welfare if that improvement does not also increase production. Specific policies may be chosen because they increase rural equity and welfare, but in the long run, the agricultural sector must be able to pay its way. "For a basically poor although rapidly growing country... equity is not a substitute for growth."  

Another disputed issue in the strategy of agricultural planning is whether agricultural development has been retarded by the lack of a single or a few crucial elements whose supply will relieve a key bottleneck; or whether growth in the agricultural sector demands the investment of a whole series of interlocking complementary resources. The three most commonly cited bottlenecks are technology, specifically adapted to the local circumstances, a more effective system of education and extension, and an adequate transportation network.

The emphasis on technology stems from the assumption that the traditional farmer is a rational economic planner. Since little progress can be expected from shifting existing resources within the present technology, increased output

depends on the availability of modern high pay-off inputs, especially high yield seed varieties. To be of greatest benefit, the technology should focus on food-feed crops, soil and water management, and livestock, rather than the traditional export crops. Researchers should avoid aggravating social and economic inequalities by developing varieties which can be grown on rainfed rather than irrigated land, emphasizing those techniques which can be used by small farmers and do not have great economies of scale, and taking a cautious attitude towards mechanization. Finally, research must be modified to suit local circumstances. This is especially important in agriculture and probably requires that developing countries build an indigenous research capability and establish research stations throughout the country. It must be able to coordinate separate specialized technical aid projects into a national research system and adapt imported or centrally developed technology to the environment of each district. The second cited bottleneck, extension/education, is based on the recognition that the farming practices of most peasants do not incorporate the most sophisticated already developed technology. Much of the theoretical work in this area as it applies to development has been done by sociologists and anthropologists involved in information and communication theory and their studies are


cited in both the literature on technological transfer and on agricultural development. Modernization is viewed as a communication process: new ideas spread from a, usually urban, center to the peasant subculture through literacy campaigns, mass media, change agents and villagers' trips to cities. An analysis of the relationship between rural leadership and the acceptance of new ideas concludes that leaders reflect the values, innovative or conservative, of their community. This finding casts doubt on the suggestion that mass media may be an important tool to reach beyond non-innovative opinion leaders to influence people directly. The classic patterns of spatial diffusion seem to be operative in agriculture with an initially rapid outward spread of low intensity adoption, followed by new diffusion 'nodes' at scattered location and with the process concluding as the peaks spread out to produce saturated areas.

The approach has been criticized on several counts. Its description of the peasant subculture is not specific enough to provide a guide for the change agent who is trying

82 C. P. Marsh and A. Lee Coleman, "Farmers' Practice-Adoption Rates in Relation to the Adoption Rates of 'Leaders'", Rural Sociology, XIX (June 1954), pp. 180-181.


formulate messages which will influence peasant behavior. Secondly, the traditional diffusion approach with its emphasis on the impact of communication and the socio-cultural resistance to innovation, neglects the ecological constraints to the adoption of new ideas. Given the location-specific nature of agricultural technology, beyond a very limited area the adaptation of technology to the local environment is probably more important than the spread of a given technology. Lastly, much of agricultural extension work has failed not because the information network was ineffective, but because the information which was being communicated was inadequate. Extension work has not emphasized those areas of greatest interest to the farmers, especially profitable low risk innovations in food and feed crops, livestock breeding, fertilizers, and plant disease, weed and pest control. Profitability probably has more to do with the acceptance of new ideas than does the analysis of leadership roles and spatial diffusion from development nodes.

A third bottleneck cited, transportation, is particularly relevant to the development of virgin lands. In a study of twenty-four agricultural projects in Latin America, it was found that the most economically successful project was the


one in which the government provided the least in the way of social and economic investment. The government provided only a transportation network and the area was developed through spontaneous settlement.\(^87\)

Economic development through specific solutions to perceived bottlenecks has been largely abandoned in favor of a package approach: "What does it take then to get agriculture moving and to keep it moving in the direction of higher and higher levels of productivity? The answer. . . . is 'almost everything.'"\(^88\) Among the essentials are new farm technology, with the education and research to produce it; incentives in the form of appropriate product and input price policies, and credit and marketing facilities; and local availability of farm supplies and equipment. Provision of any one of the essentials without the complementary factors may be simply a waste of resources. For example, one of the lessons of the Green Revolution is that failure to invest in irrigation, fertilizer and pest and disease control can obviate the investment in research on crop varieties. Similarly, investment in large scale irrigation projects does not justify the capital and farmer re-training costs if new high yield technology is


not also available. Where the initial stages in agricultural development are successful, second generation problems may appear as increased production overloads existing transport systems, mills and storage facilities.

Administrators in developing countries have found that plans to offer all the elements essential to the increase of agricultural productivity throughout the entire rural sector places a formidable burden on its bureaucratic staff. It is therefore tempting to invest the package of new inputs into narrow geographical areas, settlement schemes, agricultural projects or plantations, and even to assign responsibility for coordination and management to a non-governmental organization. In a sense, the planners can start afresh with an agricultural scheme. They can avoid the difficulties of introducing new technologies into already existing farm units; decisions can be made at the level of scheme management, involving only minimally district or central agencies and individual peasants; programs of separate departments for health, education, marketing, credit, research, etc. can be integrated one with another and tailored to the local environment. For complicated export crops like tea, cane sugar, bananas, coffee,


it is easier to maintain standards and to dovetail agricultural production and processing. Lastly the scale requirements of investments in capital improvements, machinery and institutions means that the plantation or project approach has an advantage over rural development schemes in that it is possible to subdivide land in a project among tenants, yet retain the scale necessary for efficiency. The approach has the initial disadvantage that it directly benefits only a small constituency in a limited area, but most planners hope that the techniques introduced on a project will somehow be communicated to the surrounding areas, either by example or deliberate outgrower schemes. ⁹¹

The most serious objection to plantation schemes is that they foment economic dualism in the rural sector. They tend to overconcentrate on export crops, leaving food-producing regions "badly undersupplied with infrastructure, deprived of government services, desperately short of capital for development and technologically pre-feudal." ⁹² To some extent the large-scale projects are locked into export crops because given their overhead expenses they seem to be economically viable only when they are producing the high value industrial and horticultural

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crops.\textsuperscript{93} Plantations tend to be viewed as entities somehow apart from the rest of the economy, but in fact they compete with peasant farms and rural development programs for productive land, skilled labor, capital, and research facilities.\textsuperscript{94} Where plantations are owned by foreigners, they are subject to the same criticism that is directed towards other MNC enterprises: company-wide rather than local profit maximization, a high component of imported inputs, benefits of productivity increases accruing to consumers in developed countries, capital exported in dividends, fees and royalties, and production rigidities in response to relative price changes. In addition, they are accused of purchasing and then under-utilizing large parcels of land.

The other major criticism of project agriculture is that despite its heavy investment and restricted scope, the projects are often no more successful than the wider rural development schemes. Even here there are problems of poor planning, inappropriate technology, uncooperative labor and uninspired management, and bad luck. Failure often results when agricultural schemes are initiated for reasons that have little to do with increases of output and productivity.

Resettlement schemes are intended to provide homes and employment


for people displaced by dam projects or by overpopulation or
at times are intended to act as an effective countermeasure to
the spread of nationalist insurgency. The emphasis is
primarily on social welfare (or defense) and only secondarily
on the possible economic benefits. The difficulty is that few
developing countries can afford to subsidize large scale
agricultural projects for very long, especially since the
social benefits are restricted to a limited number of settlers.
A better approach, suggested by a student of settlement schemes
in Africa, is that managers of large agricultural projects
should concentrate on increasing the economic benefits of the
project and allow the settlers to transform those benefits
into social gains. A

The third major issue in discussions of agricultural
development is the controversy over whether development can
be achieved by increasing and improving the productive inputs,
or whether true development can only occur as part of a major
structural transformation. The less radical proponents speak
of institution building; the more radical of land reform and
reorientation of political and economic power. The idea of
structural change is particularly important to those who think
that technical change is endogenous, dependent on factor prices

95Brendan F. Jundanian, "Resettlement Programs," Comparative Politics (July 1974), 519-540, discusses the
defensive resettlement projects in Mozambique.

96Robert Chambers, Settlement Schemes in Tropical Africa: A Study of Organizations and Development (London:
and felt public needs, and who are concerned about the welfare/equity effects of technological change. 97

Those who stress institution building begin with the need to involve the peasants, arousing their interest in the process of building institutions which reflect their personal and social aspirations. 98 The new institutions could then incorporate already existing local social and cultural units. The new institutions gain acceptance by concentrating first on increasing productivity and then move into activities which directly improve social welfare. Important in any system is achieving a rational local to national institutional structure. At the national level, rural development is most effective when the functions are grouped into only a few ministries, and those ministers are then responsible for formulating a national policy framework, and setting and enforcing minimum standards of performance. The district or provincial level should provide financial resources above what can be mobilized locally and technical expertise, and be responsible for directing, advising and coordinating local institutions within the nationally designated guidelines. Local organizations should be most directly responsible for local affairs and most responsive to local problems and aspirations.


The actual rural development structure is usually a far cry from the ideal. In the judgment of one author, "the inadequacies of government administration in the operation of new economic institutions is probably the greatest single cause of the poor economic performance and the slow pace of development in the less developed countries." It is all very well to advise that government initially should have a large innovative, educational and managerial role which will diminish as other institutions develop to assume the responsibilities. However, effective governmental structures are themselves a product of the developmental process. It is only rarely that the bureaucracy of a developing country is capable of a high level of innovation, coordination and leadership. It may be necessary for government to confine itself to a limited number of tasks, such as investment in infrastructure and the creation of a price/incentive structure, and hope that market forces will be strong enough to induce increases in productivity.

A more radical view envisions rural development as part of an extensive institutional change, usually with land reform providing the engine for a major shift in economic and therefore political power. Such agrarian reform entails at least the re-distribution of land ownership and changes in the forms of land tenure and agricultural employment. Proponents of structural reform point out that plans advocating improved

100 See Hunter, "Agricultural Administration. . . ."
technology and productivity followed by the improvement of peasant welfare are proposing an unlikely sequence. Once agriculture becomes a profitable enterprise, large scale landowners will have increased their economic and political influence, and only the most progressive will then willingly distribute land and profits to the peasant masses. In reality, land reform has often been disappointing. Somehow governments capable of mobilizing the political will to initiate land redistribution seem to lack the organizational capabilities needed to supply the essential services that would make the program a success.\textsuperscript{101} Programs which merely create a mass of subsistence farmers destroy the agricultural surplus necessary for economic development without substantially improving welfare in rural areas.

Much of the literature on agricultural and rural development is in some way relevant to the problems of Western based multinational corporations involved in agricultural projects in the Third World. There are a number of studies on the success and failure of agricultural development through large scale projects; several mention the possibilities of foreign investment although most of these consider such involvement an unfortunate vestige of a colonial past. Some issues, like institution building, communication/information systems and equity become less important once a multinational corporation is involved: part of the reason the multinational

was contracted was to circumvent the problems of inadequate institutions and poorly operating extension services. In the balance between equity and output, the government has designated output as the more important. However, many of the general problems of agricultural development are also issues for the multinational corporation, especially questions of technology, mechanization, incentives to increase peasant involvement and productivity, and the organization of education and research. The multinational corporation may take a different approach to problems in these areas than would a government official, and most of the literature does in fact assume public rather than private initiatives. The basic studies however contain much of interest, and underline the fundamental issues which must be faced by anyone attempting to increase the productivity of the agricultural sector in developing countries. The ability of the multinational corporations to deal with these issues will in large measure determine the effectiveness of their involvement in Third World agriculture.

Few of the studies in the three fields of multinational investment, technological transfer and agricultural development deal directly with the involvement of Western based multinational corporations in Third World agricultural projects. A number of studies discuss one aspect or another of this phenomena and many analyses provide insights into the opportunities and problems which are likely to arise. But in all three fields, the area of multinational corporative investment in LDC
agriculture is often ignored or neglected. Attempting to apply the perspective of most of the studies in the existing fields leaves this area somehow slightly out of focus.
CHAPTER III

LARGE SCALE AGRICULTURAL PROJECTS --
ISSUES, PROBLEMS AND SOLUTIONS

There are no magic formulae whose application will guarantee a successful agricultural project. Certainly none is suggested by the existing literature. Agricultural projects do however exhibit certain commonalities. It is possible to outline the typical issues which arise in an agricultural project and note the forms which these issues are likely to take when a foreign corporation is involved. The projects are confronted with similar problems and the projects' administrators generally choose from approximately the same set of possible solutions. These issues, problems and solutions can be discussed within the framework of the traditional micro-economic model in which production is achieved through the combination of land, labor and capital. A major difficulty faced by most Western based corporations is the finding that these inputs, as they exist in the Third World, are disconcertingly different from the same inputs as they are found at home.

LAND

To the classical economist, land, as a category of inputs, encompasses any unprocessed raw material. Its market value was seen to depend primarily on its scarcity. David Ricardo, for example, distinguishes between those goods whose value depends on the amount of labor required to produce them
but which "may be multiplied, not in one country alone, but in many, almost without any assignable limit, if we are disposed to bestow the labour necessary to obtain them;"¹ and those goods, like land, which are not reproducible, i.e., "no labour can increase the quantity of such goods, and therefore their value cannot be lowered by increased supply."² What was obvious to Ricardo, though sometimes forgotten by twentieth century businessmen, is that the quality of land, "the original and indestructible powers of the soil,"³ varies from one parcel to another, and the value of any given acreage, both as an input and in the market, depends on its ability to support the production of the desired crop. Western businessmen have an unfortunate tendency to view all overseas land as essentially equal in value, reflecting in part the attitude of one Middle Eastern economist that 'with enough water and enough fertilizer, you can grow crops on a piece of linoleum.'

In most cases, the choice of the land, or site, of an agricultural project is made by the host government. The government decides what crops it wishes produced, usually on the basis of import/export considerations and general notions on the suitability of the local climate, and chooses an appropriate location. Once the crop and location are fixed, the

²Ricardo, p. 6. (Chapter I, Section 1, para. 4).
³Ricardo, p. 33. (Chapter II, para. 3).
government then looks for a company which has had experience growing the chosen crop, hopefully under similar circumstances. Unfortunately, the choice of the project site may not be directly related to its suitability for producing the chosen crop, or even for its agricultural potentialities in general. The project's general location may have been picked because it fit into a general plan for regional development, or even for the establishment of a defense perimeter against insurgency. The specific location may simply have been the acreage which seemed the most easily acquired within the region, or the most accessible. The government may or may not have considered such vital factors as the existence, capacity and efficiency of ports, airstrips, roads and railroads during the different seasons, and the capacity and accessibility of markets, mills and storage facilities. Additionally, it may or may not have adequate information on the availability and variability of water, either rainfall or for irrigation, or the ease or difficulty of clearing and preparing the land for cultivation.

Many of the defects of the choice of location can be remedied as the project progresses. Transportation networks, processing plants and storage facilities can be built. Land can be cleared, soil can be treated, additional sources of water can be tapped. Crop varieties can be adapted and in an extreme case, the choice of crop itself can be altered. The question is not whether a given parcel of land can be made to produce something, but rather whether it is economic to do so. Where the land is marginal and requires a substantial capital
investment to make it productive, it is likely that the project's return will never be capable of covering its costs.

The problems which can arise through oversights in the choice of the land point to the desirability of beginning any project slowly and preferably with several years of pilot projects. A gradual start allows time for preliminary surveys to be completed, especially of soil and water. Pilot projects make possible the development of crop varieties which grow well at the site and are resistant to local weeds, pests and disease. They also have the advantage that should the scheme prove unfeasible, the resource commitment, and therefore the loss, will be relatively small. This slow start is frustrating to many administrators who would prefer to push on and solve problems as they arise. While they recognize the value of scientific experiments, they also realize that experimentation is expensive, particularly when it is not conducted as part of an already operating, profit making project.\(^4\) This impatient attitude is especially prevalent when a foreign corporation is involved: a major reason for contracting foreigners is to speed the pace of development, and besides, the company, not the government, is responsible for overcoming the problems as they become apparent. The alternative view emphasizes the importance of basic information as the only way to avoid planning a project on ever increasingly unreliable assumptions, with ill-founded primary assumptions of agricultural feasibility.

\(^4\)See for example, Wingate to Stack, 19 April 1913; School of Oriental Studies at the University of Durham, England, Box 108/15.
serving as the basis for estimates of capital and operating costs which in turn determine the estimates of markets and profitability. This view recognizes the argument that fear of failure could paralyze all agricultural development in Africa and some projects whose sponsors have courageously forged ahead despite initial ignorance have achieved success. It counters, however,

To this let it be answered that success never has crowned irresponsible ventures in agriculture even in good ecological setting and, admitting the flair of a gifted few to turn everything to advantage, it is rare to find the Midas-touch in agriculture in the repertoire of politicians, administrators and public servants be they local or international.  

The choice of the project’s location is one of the areas in which problems occur because the responsibility for planning the project has been divided between the host government and the company. The government selects the site, for reasons not necessarily based on its agricultural potentialities, and relies on the company to solve any problem which might arise. The company, hired to grow a specific crop in a specific location, may assume that any doubts as to the basic agricultural feasibility of the project have already been resolved. Both may be well into the scheme before either does the preliminary surveys

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which should have been completed well before substantial resources had been committed.

Aside from the physical qualities of the site, questions also arise in relation to the area's population. There is a tendency to view any project acreage as essentially empty land and planners are sometimes misled by the seasonal or sporadic nature of the settlement. Actually there are few unclaimed tracts of land in any country and the project planners in some way have to take into account the already existing population. There are obvious advantages to choosing a site which is sparsely populated. The removal of a large population from a site is a potential source of political and social problems both before and during the operation of the project because it upsets the traditional social and economic systems. In its early stages, the project will not be able to establish viable social institutions to replace the ones it has destroyed, and, if the original population is large enough, it may not even be able to provide job opportunities for all those who want to stay in the area. Thus one of the first effects of the project is the creation of an unemployed and footloose rural populace which can either migrate to the urban areas or remain in the area to cause trouble for the project.

Unless the country as a whole is sparsely populated however, there may also be disadvantages in choosing a site remarkable for its small population. A small population, in relation to general population densities, should raise doubts concerning the value of the site. There may be special problems of disease, inadequate water supplies or soil infertility known
but inarticulated by the local inhabitants, but unknown to
the central government or the foreign company. This situation
is especially likely to arise where preliminary studies are
incomplete and where the area, because of its small population,
has not been thoroughly studied by governmental agricultural
departments.

The issue of the ownership of the land chosen for the
project involves many of the arguments raised by those concerned
with the equity effects of agricultural innovations. Adminis-
tratively, the easiest course is some form of expropriation.
Compensation is usually given to those who can prove they held
titles in the area, although this becomes difficult where legal
ownership rights are not well defined. Ownership rights can
then be transferred to either the company or the national
government. In either case, the mandated switch from local to
outside ownership of land may leave behind a legacy of resent-
ment, but the latter at least may avoid charges of imperialism
or colonialism. If the project cannot provide work for all the
people it has displaced, expropriation may create a class of
unemployed landless peasants. Where compensation is adequate
and the population is sparse, the displaced farmers can purchase
other land nearby. Where these two conditions are not met,
however, the money received by the peasants for their land may
be quickly spent on more temporary consumption goods. Finally,
expropriation may affect the development of similar land still
in private hands. Where compensation is minimal and land sales
mandatory, fear of expropriation substantially decreases the
the incentives for capital investment in privately held land.
The increased output achieved through a major project would then be partially offset by lack of development in other areas.

The alternative to expropriation is to leave the land in the hands of the original owners. This solution avoids problems of alienating peasants from their land and creating disincentives for agricultural development by the private sector. It does complicate the administrative structure, which has to deal both with the project as a unit and with the individual family plots as sub-units. If the new technology is less labor intensive than the traditional methods, leaving the land in private hands will not solve the problem of adequate employment for the entire population: it may merely substitute widespread underemployment for more limited unemployment. Finally, the long run benefits of the new technology will accrue in part to the landowners. If the area exhibits great differences in the economic and social status of the inhabitants, the project will probably reinforce the disparities as profits are absorbed by the landholding class. In general, however, the entire question of equity is ignored by those planning large scale projects, and the arrangements for land ownership are commonly made to suit efficient management rather than social justice.

LABOR

Agricultural projects face potential problems in both the quantity and the quality of their labor force. The labor situation depends in part on the choice of the site of the project, and a choice which eases agronomic or political
problems may complicate the recruitment of an adequate labor force.

Classically, labor was more than one of three inputs: it was the basic measure of value for most commodities. "The value," wrote Adam Smith, "of any commodity, therefore, to the person who possesses it. . . is equal to the quantity of labour which it enables him to purchase or command. Labour, therefore, is the real measure of the exchangeable value of all commodities." The classical economists did not assume that labor was homogenous:

In speaking, however, of labour, as being the foundation of all value, and the relative quantity of labour as almost exclusively determining the relative value of commodities, I must not be supposed to be inattentive to the different qualities of labour. . . . The estimation in which different qualities of labour are held. . . . depends much on the comparative skill of the labourer and the intensity of the labour performed.

While more recent economists tend to view labor as an homogenous input measured in manhours, both the host countries and the companies recognize the crucial differences in skill and training. The host country hires the foreign company for

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7 Ricardo, pp. 11-12. (Chapter I, Section 2, para. 1.)
its managerial and technical skills and specifies the training of its own nationals in the contract. The companies are fully cognizant of their responsibilities for training technical and managerial personnel; they may be less aware of the difficulty of recruiting and training semi-skilled workers.

If the chosen site is sparsely populated, the original acquisition of the land may have been accomplished fairly easily and the company will probably be able to avoid disruptions by dispossessed landless unemployed peasants. However, if the displaced farmers are able to buy land nearby, it may be difficult for the company to recruit them to work on the project. The productivity of the scheme will have to be sufficiently higher than the productivity of the traditional methods of the surrounding farms to permit management to establish a fairly generous pay scale for its unskilled and semi-skilled workers. This situation is more negative than the possibilities envisioned by the 'dual economy' analysts who feared that a commercial farm would have to match the return to the average productivity of labor of the family farm rather than its own, lesser, marginal productivity. In the circumstances of a sparsely populated area, the commercially run project would have to match the average return plus pay a bonus to compensate farmers for their loss of independence if the managers expect to be able to utilize local labor.

There are two alternatives to paying extraordinarily high wages to basically unskilled local labor. The first is to import labor from more crowded areas of the country. The costs of transport and settlement would over the long run be
offset by the lower wage rates; also, drawing from a larger labor pool, it might be possible to attract more qualified workers than are available locally. The major problem is the possibility of conflict between the newcomers and the local inhabitants. While local inhabitants may choose not to participate in the scheme, nevertheless they may resent the restrictions the project imposes on their traditional way of life. The scheme, for example, will undoubtedly limit local access to its own water supplies, and require close supervision of privately owned livestock. It also withdraws a large parcel of land from the traditional practices of fallow bush cultivation, where a farmer cultivates a plot for several years and then moves on as the soil becomes exhausted. Friction is especially likely if the project has been placed on traditionally tribal lands, as the project, planned by the state and run by foreigners for the ostensible benefit of outsiders, can acquire a definite aura of alien intrusion and disruption of native rights.

The other possible solution is the adoption of a labor saving, capital intensive technology. Heavy mechanization, including tractors for clearing and equipment for harvesting will reduce the size of the necessary labor force. Mechanization however changes the structure of the work force, substituting personnel capable of operating the newly introduced machinery for traditional farmers performing familiar operations.  

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8See Chapter II, p. 41 for a discussion of the relationship between the structure of the labor force and mechanization.
especially if the educational system is rudimentary, which is
not unlikely in a sparsely populated area. Project managers
would then have to train local labor themselves or recruit
mechanically capable workers from outside the region. On the
other hand, a small mechanically skilled and probably fairly
well educated labor force is easier to manage, especially for
a foreign firm: the higher level of education usually implies
language and literacy skills and western oriented work attitudes.

Mechanization can be expensive and where carelessly
applied may overburden the project's potential return with a
heavy capital charge. Where a well trained and experienced
staff is not available and the mechanics have no real concept
of preventative and corrective maintenance, at any one time
25-30% of the machinery may be idle because of breakage and
slowness of repairs. Even where the staff is adequate, there
may still be problems of obtaining the necessary spare parts.9
The highly trained labor force required by successful mechaniza-
tion is expensive in a developing country because of its
relative scarcity, and the project will either have to pay
fairly high wages to attract the technical personnel it requires,
or establish its own training programs and then pay wages high
enough to keep the personnel it has trained.

A variation on the alternatives of imported settlers
and high mechanization is the adoption of a fairly high degree
of mechanization supplemented by migrant labor for those

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9V. D. Wickizer, "Some Aspects of Agricultural
Development in the Tropics," Tropical Agriculture, XXXVII,
3 (July 1960), pp. 163-176.
seasons when the work is especially heavy. Migrant labor has been a frequent solution for African plantation agriculture and has the advantage of providing labor at peak periods without requiring the support of a large community throughout the year. Plantation owners however have always complained of the general incompetence of migrant labor at even the simplest tasks. Most migrants are target income workers, view the work as a temporary expedient rather than a way of life and seldom work for more than two seasons. Also, traditionally migrants have crossed national borders to find work and the numbers of migrant workers have declined with the rise of nationalism and economic development at home.

Thus while the selection of a densely populated area as a project site involves the social and economic problems of a redundant rural populace, the alternative, the choice of a thinly populated area, implies problems of recruiting an adequate labor force. Further, the possible solutions to the labor shortages can create social, economic and political problems of their own.

In addition to considerations of appropriate skills, there may also be problems of attitude and life style. The primary requirement made by an agricultural project of its employees is the willingness to subject themselves to a high degree of regimentation. Project managers, attempting to conserve valuable water and land resources, adhere to a rigid

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timetable in clearing and cultivating land, and planting, tending and harvesting their succession of crops, a timetable quite alien to the traditions of the area. The discipline such a schedule requires is irritating to the formerly independent, often semi-pastoral, farmer, who has been accustomed to managing his own affairs, however badly. The transition from independent farmer to employee is a difficult one, and one that not every peasant is willing or able to make.

The interwoven problems of quantity and quality of labor suggest further problems of the relationship between the government and the corporation. If the desired skills and attitudes are not apparent among the indigenous inhabitants, the project managers can either import more suitable outsiders at the risk of enraging neighboring farmers and creating political problems for the local government, or attempt to nurture the desired characteristics in the local people. While it is possible to develop both a sense of discipline and a mastery of new machinery and techniques, the teaching phase may postpone the profitability of the project. A foreign company, while it expects to train top level managers and technicians, may not be equipped to teach basic skills to local inhabitants. Few of its own managers and technicians have either an understanding of the local culture or a facility in the native language, and most would see the re-orientation of the skills and life-styles of the local inhabitants as a function rather of rural extension agents. Thus, for example, the managers are prepared to explain the intricacies of the irrigation system to an English speaking secondary school
graduate, but may not expect to have to instill in an illiterate non-English speaking farmer an awareness of the importance of oil to the operation of machinery. The host government on the other hand may envision the project as an alternative to the development of its extension/education network rather than complementary to it. It hired the company to speed the developmental process and relieve the government agencies of the responsibility for the project. It would therefore view with considerable disfavor the prospect of delays in the success of the project especially coupled with continuing governmental responsibility for the training of the labor force. To some extent, the need for education/extension work to make a project successful is an issue for any project where the policy makers thought they were choosing between two mutually exclusive paths of agricultural development, project versus rural education. It is especially a problem where a foreign corporation is involved however, because the corporation is being paid to manage the project without further governmental assistance.

A related issue is the responsibility of the project, moral and financial, for establishing social services for the project's labor force. Services like schools, clinics, local government and police are often charged to large scale projects because of the neatness of the project as a unit and the desirability of coordination between the social and economic institutions. They place a considerable burden on the project's financial and managerial resources however, and at least some scholars believe that the inhabitants benefit more where the
project managers concentrate on output and return than where they attempt to provide a great number of services designed to improve general welfare.¹¹ This is particularly true where the managers are foreigners, since their capacity to build viable institutions is limited by their ignorance of the local culture.

CAPITAL

There are two types of capital in production theory. Capital as an input signifies goods produced by the economy which make possible more productive but time consuming indirect methods of production. 'Input' capital can be divided into fixed capital, machinery and buildings, and working or variable capital, a fund which underwrites the costs of inputs and wages for the period when production has begun but the output has not yet been sold. In the very long run, the concepts of fixed and working capital merge, as the production period exceeds the life span of the capital goods and all capital can be thought of as variable. Capital is formed when more resources are diverted from current consumption than is required for maintaining and replacing existing capital goods. Those who are willing to forgo the current consumption and provide the necessary resources expect to receive some compensation for postponing their consumption, some return on the resources they have provided. These resources then are the second form of capital, financial or investment capital. Both these forms of capital,

¹¹See Chapter II, p. 71.
capital goods and investment capital, raise issues relevant to large scale agricultural projects.

The issues raised by capital goods revolve around the suitability of the machinery and the technology which it embodies for the local agricultural environment, and the desirable capital intensity of the project. Machinery developed for temperate zone agriculture is not necessarily appropriate for tropical agriculture and must be either very carefully chosen or be adapted to the local circumstances. For example, experience has shown that the disc plow and harrow are the only types that will ride over rock without breaking and cut through African roots and brush without jamming. The most appropriate tractors in Africa are the 25-40 horsepower models: below 20 h.p. cannot stand up to the bush road, the African driver and the 'cultivated' field, while models above 40 h.p. are not as suitable for the light jobs and are not sufficiently maneuverable.\(^\text{12}\) In addition, heavy implements, especially when used for clearing, can damage the surface soil and leave large patches of infertile subsoil exposed.\(^\text{13}\) Major systems of capital goods also have to be adapted or carefully chosen; for instance, in a tropical climate, irrigation by overhead sprinkler systems common in temperate climates loses much more water through evaporation than do underground systems. A

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drawback to the availability of sophisticated machinery is that it encourages planners to embark on uneconomic projects. With Western machinery it is possible to clear brush, remove roots and level African acreage, but it is an expensive undertaking and it is doubtful that the marginal land thus made available can ever produce a return high enough to cover the initial costs.

Other forms of capital expenditure also have to be adapted to the local circumstances. Agricultural research into seed varieties, fertilizers, pesticides and herbicides ought ideally to be done on the site. Foreign companies who are accustomed to centralize their research will find agricultural technology too location-specific for the results of research to be easily transferred from a central research laboratory to an overseas project. Thus governments should hire foreign based companies not for their store of technology which they have developed elsewhere, but rather for their ability to develop technology successfully in the context of the local project.

In addition to the question of the suitability of specific pieces of capital equipment and technology, there is also the issue of the desirable capital/labor intensities, that is, the appropriateness of a technology given the level of capital goods in relation to labor and output it implies. Capital intensity, or the level of mechanization, has implications for labor management and project costs, but its most direct effect is on project employment and therefore is of greatest concern in those countries troubled by widespread
unemployment. While large scale agricultural projects are generally not devised as a major tool of job creation, neither should project managers view local unemployment as merely a government concern and responsibility, irrelevant to the operation of the project. The project's ability to provide employment opportunities will influence local attitudes towards the project and a high level of employment can help diffuse resentment stemming from displacement of local farmers. Managers will not want to adopt traditional labor intensive methods, but can take care to emphasize those forms of mechanization which are complementary to labor rather than a substitute for it. Thus, where labor is plentiful, the project can use tractors and plows for clearing, cultivation, planting, etc. in order to facilitate multicropping, but then rely on local labor for the harvesting of the various crops. The project should also expect to train local labor to operate any processing plants it establishes.

While capital as a physical good raises questions of suitability and capital/labor ratios, investment capital involves issues of management incentives, profit shares and control. Investment capital is available for agricultural projects from three sources: the foreign corporation, the national government and international lending agencies.

When a major part of the project financing is provided by the foreign corporation, the capital is both a token of good faith and a strong incentive for good management. Especially where the company has both formulated the pre-project feasibility studies and receives the contract for construction and management,
the commitment of the firm's own resources to the project sustains confidence in the original report. Without that commitment, there is always the suspicion that the feasibility of the project was exaggerated in order for the company to obtain a lucrative management contract. Company investment also stimulates management concern for efficiency and profit and loss. Where the corporation's economic incentives are limited to fixed fees plus long term advantages like outlets for home production, foreign supply sources, etc., management may not be quite as concerned with the return to capital as they would be were the company's own money involved. Government oversight would probably be handled fairly perfunctorily through some sort of board recruited from the civil service whose experience and attitudes militate "against too detailed questioning or understanding of management" and whose sanctions "have very little to do with corporate 'efficiency' or profit making." Thus where the corporation is not financially committed to the project, there may be "no sanctions which operate against management of enterprises which are not, in commercial terms, successful."  

A capital investment however implies a return to the capital, and if the project is successful, the corporation will

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14 See Chapter II, p. 48.


16 Packard, p. 168.
take a large share of the profits, eventually repatriating them to the home country. Both the profit and the repatriation will touch sensitive chords, since they make the project vulnerable to accusations of 'decapitalization' and exploitation. More fundamentally, capital investment implies ownership rights over the development of land, which most nationals feel are incompatible with their goals of political and economic independence.

Another source of outside funding is international aid giving agencies or countries. Capital from these sources is usually in the form of low interest loans with generous terms for repayment. Since the funds are in the form of a loan, rather than an equity investment, repayment will be unrelated to the profitability of the project. This is an advantage when the project is a success, but presents problems where the project fails and repayments have to be made from general funds. Another problem is that foreign aid donors tend to be biased in favor of large showcase projects which in turn biases development plans toward more grandiose schemes than are necessarily optimal. Public agencies, governmental or international, also tend to have some reservations about private enterprise and are therefore less than enthusiastic about the idea of corporative management of the project. Finally, foreign agencies may attempt to include conditions beyond the narrowly financial ones, such as general anti-inflation controls, or foreign exchange or fiscal reforms which may be unpalatable to the host government. Thus while foreign aid may be the least expensive source of funding, it is not necessarily the most attractive.
The host country retains the greatest degree of local control, of course, when it supplies the capital for the project itself. The choice is obvious when the benefit/cost ratio of the project is at least as high as that of any alternative. Where it is not, there is a very real question of the most optimal allocation of scarce government development funds. Given the political difficulties associated with obtaining funds from other sources, the complex of economic, political and social factors may favor host government financing of most agricultural projects. The primary danger of government financing is that it provides few strong incentives for financially efficient management. Government oversight may be fairly limited, and if anything, biased in the direction of subsidizing an unprofitable project for the sake of advances in social welfare, savings in foreign exchange, enhancement of national prestige or strengthening local politicians.

Unsuccessful large scale agricultural projects are an expensive way of achieving any of these objectives and generally it seems to be more nationally beneficial to manage the project along economic lines and use the profits from the scheme to underwrite more strictly social or political activities.\(^{17}\)

The ability to find solutions to the many problems which will arise during a large scale agricultural project will in large part depend on the nature of the agreement between the host country and the corporation. The agreement can vary along a continuum from an outright concession for a privately

\(^{17}\)See Chapter II, p. 71.
owned plantation to a management contract for a government sponsored and supported project, with each form specifying different apportionments of profit and responsibility. The primary danger in any contract is that when responsibility is divided between the government and the company, neither party takes prompt action when a problem develops, so that every minor difficulty becomes a crisis. Further, a division of responsibility encourages each party to act irresponsibly, relying on the other to resolve any problem it may create. None of the problems which are likely to occur arises in a vacuum, and any solution is likely to give rise to problems in other areas. There may be a tendency for the company and the government to decide issues in its 'own' area with little regard for the consequences which that decision may have for the other's area of responsibility.

The assignment of responsibilities may be based on incorrect assumptions about the capabilities of both the corporation and the host government. The government hires the company to be responsible for the economic success of the project. It assumes that the company will be able to translate the success it has achieved elsewhere into the ingredients necessary to achieve success in this particular project, that it will be able to transfer and adapt relevant technology, manage the domestic labor force, choose an effective level of capital intensity, train a national technical and supervisory staff, and in fact, accomplish all of the difficult and interlocking tasks necessary for a successful project. The company, on the other hand, assumes that the government can fulfill its
responsibilities under the contract. It assumes that the government has made the preliminary studies which justify its choice of site, can fulfill its commitments on infrastructure, achieve bureaucratic coordination at the national level and guarantee cooperation between national and local governments. Both sets of assumptions are usually over-optimistic, and while individual failings are not necessarily disastrous for the project, they will certainly cause complications and delays.

One fact emerges from the overview of the issues, problems and solutions of a large scale agricultural project: the potential profit of the project must be unusually high to provide incentives necessary to make the project a success. The government initially chose development by large scale project rather than by rural education in the expectation that the former would produce a high level of output, profit and revenue. The preparation of undeveloped land is extremely expensive, and whatever its intrinsic value, its previous owners have to be generously compensated if the project is to avoid local resentment and unrest. Labor costs are also high. Peasant farmers will not participate in a project involving new techniques unless they can be assured that they will receive an adequate return. This return will have to be substantially higher than the income received from traditional farming to offset the greater perceived risk of the new techniques. In addition, it may be necessary to increase the financial incentives to compensate for the inconvenience of a radical change in lifestyle. Training programs for unskilled labor are costly, but the alternative, operating complex machinery with inadequately
trained labor, is prohibitive. Trained labor is also expensive. Domestic technicians are highly paid because of their scarcity while foreign technicians demand bonuses for tolerating the inconveniences of living in a developing country. Finally, the company too expects a high return on any capital it has invested. The real and perceived risks of investing in the agriculture of a developing country are high, and the company would be reluctant to commit its own financial resources if it did not foresee substantial profits from that investment. Corporations also place a high value on their technology and management techniques, and the fees stipulated in management contracts reflect that value. Thus the potential return from the project must be inordinately high for the project to be able to offer each factor of production sufficient incentives to contribute to the project's success.

In the twentieth century, managers of agricultural projects in Africa and the Middle East have examined the problem areas outlined above and have attempted to develop appropriate solutions for their particular projects. Some managers, and projects, have been more successful than others and the following chapters examine a number of schemes in an attempt to discover the crucial ingredients of that success.
CHAPTER IV

THE GEZIRA SCHEME

Unquestionably, the most renowned agricultural project in twentieth century Africa and Middle East has been the Gezira Scheme in the Republic of the Sudan. Formally inaugurated in 1925, it has been the backbone of the Sudanese economy and the mainstay of Government finances for half a century. Fundamentally, the Scheme owes its success to the ability of its administrators to deal with the issues outlined in Chapter III. The solutions evolved in the Gezira Scheme sometimes were produced by careful thought and pre-planning, but more often were developed by trial and error during the life of the Scheme, and occasionally they resulted simply from unpremeditated good fortune.

The primary purpose of the Gezira Scheme was unequivocally the creation of a source of a high level of output, revenue and foreign exchange. In the early twentieth century the Sudan was technically ruled by the British and Egyptian Governments whose armies had jointly defeated the Sudanese Khalifa* at the battle of Omdurman in 1898. The British, in de facto control of much of Egyptian policy through its High Commissioner in Cairo, were also the senior partner in the Sudan, and the attitudes of British administrators directed

*See glossary at the end of Chapter IV for definitions of selected Arabic terms.
the course of political, economic and social development in
the Sudan. Lord Kitchener, Sudan Governor General 1898-99,
explained that the purposes of his administration was "to
acquire the confidence of the people, to develop their resources,
and to raise them to a higher level."\(^1\) Governor General Sir
Reginald Wingate defined the policies of British administration
more explicitly:

The task which the Sudan Government has set
itself to perform is primarily to confer the
benefits of civilization on the inhabitants by
rendering secure, as far as is possible, their
persons and their property; by improving communica-
tions across those wide stretches of desert or
wilderness. . .; by adding to the fertility of
the naturally rich soil by means of artificial
irrigation. . .; and finally by providing - in
addition to the great Nile waterway and railway
which bind the Sudan to Egypt - a good port and
harbour on the Red Sea within easy access of the

\(^1\) Reports by His Majesty's Agent and Consul-General on
the Finances, Administration and Condition of Egypt and the
Sudan, 1899 (Cmd. 95), p. 55. A general report on conditions
in the Sudan was submitted annually to London where it was
printed as a Command Paper. From 1898 to 1913 it was submitted
by the Agent and Consul-General, from 1914 to 1920 it was
submitted by the High Commissioner of Egypt and after 1921 it
was sent directly from the Sudan by the Governor General.
These reports will hereafter be cited as Sudan Annual Report
(SAR) with the appropriate year and Command number. A longer
set of confidential reports was also submitted containing the
reports of the Governor-General, the Administrative Departments
and the Provincial Governors. These reports will hereafter be
cited as "Reports" with the appropriate date.
interior, whereby the inhabitants may be more economically furnished with their requirements from abroad, and may find outside markets for their natural products.\(^2\)

The difficulty with this program of development was finding sources of financing. The unrest generated by the heavy taxation imposed during the 65 years of Egyptian rule of the Sudan had culminated in a nationalist/religious revolt in 1885 under the Sudanese Mahdi, and this response convinced Lord Cromer, Consul General in Egypt, that successful administration in the Sudan must be based on low taxation. Further, he did not anticipate that either private enterprise or the British Government would be willing to embark on a massive public works program in the Sudan. The Egyptian Government made substantial contributions to the Sudan between 1900 and 1912 in the form of budget subsidies and capital improvement loans, especially for the military transport systems. But it was clear to British administrators in both Egypt and the Sudan that Egyptian bounty could not be relied upon indefinitely, and some alternate source of investment capital and budgetary revenue must be found. Lacking any known form of mineral wealth, the most

\(^2\)Governor-General's Memorandum for 1907 to Sir E. Corst, H.M.'s Consul General in Egypt, p. 1, quoted in Arthur Gaitskell, Gezira: A Story of Development in the Sudan (London: Faber and Faber, 1959), p. 34. Gaitskell was a field executive in the Gezira Scheme beginning in 1923 and worked his way up to General Manager from 1945 to 1950. His book is the standard reference for the Gezira Scheme.
obvious possibility seemed to be the development of irrigated agriculture and the export of cash crops.

**LAND**

Physical Characteristics of the Site

While the Sudan with an area of 967,500 square miles is the largest country in Africa, the sites suitable for irrigated agriculture are limited. The northern quarter, bordering on the Saharan Desert, is desert, and the southern quarter, "where the Middle East ended and Africa began," is swamp and rain forest. In the central Sudan, rainfed agriculture is possible, although not consistently, and irrigated agriculture is possible in the Gash and Tokar River deltas, along the Atbara River, and along the Nile. Of these four sites, the Gezira Plain between the Blue and White Niles immediately south of Khartoum where the two rivers meet to form the Nile, offered the greatest possibilities for irrigated agriculture. This wide flat plain sloped slightly and evenly away from the Blue Nile, and required little expensive leveling or contouring. A single dam at Sennar could raise the water level of the Blue Nile to the upper edge of the plain so that a substantial part of the Plain could be irrigated by gravity without pumps. Irrigation at Gezira would thus be both technically uncomplicated and inexpensive.

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The potentialities of Gezira were recognized as early as 1900 when Wingate wrote

I recently rode across the Gezireh from Wad Medani on the Blue Nile to opposite Dueim on the White Nile, a distance of some 80 miles, across a perfectly flat plain, sown almost throughout its entire length with dura. As there is only one crop grown during the short rainy season, and as this cereal is planted and harvested within a period of sixty to eighty days, it follows that if a system of irrigation were feasible in the Gezireh, it would become a huge granary capable of supplying not only the whole Soudan but other countries as well.⁴

Between 1899 and 1903 the entire Nile system was investigated by Sir William Garstin, the irrigation expert from the Egyptian Service who more than anyone had been responsible for the modernization of the Egyptian irrigation works. As these works approached completion, Garstin began to consider the possibilities of increasing the water available for Egypt by constructing works upstream outside of Egypt. He discovered that half the discharge of the mountain river Bahr el Gebel was lost by evaporation as the White Nile meandered through the swamps of the southern Sudan. The Blue Nile on the other hand flowed rapidly from Lake Tana to Khartoum and lost little from

⁴SAR, 1900 (Cmd. 441), p. 82.
evaporation. Garstin concluded that a canal cut through the Sudd could increase the water available for Egypt by decreasing the evaporation loss, while waters from the Blue Nile could be utilized for irrigation in the Sudan. The findings of this report naturally enhanced the attractiveness of Gezira as an irrigation site since it would use Blue Nile water. In the early 1900’s, immediately after the Re-Conquest, the issue of Sudanese use of Nile waters was extremely sensitive in Egypt, and Sudanese investment in irrigation works was directed towards areas like the Gash and Tokar deltas where increased Sudanese use had no impact on water available for Egyptian agriculture. An experimental farm was established in 1905 at Kamlin to determine what commercial crops, if any, could be grown in the Gezira. Originally consisting of two feddans watered by a sakia, the farm was soon extended to 100 feddans and a pump. It continued with varying success until 1911 when it was replaced by a more extensive project at Tayiba.

Wingate’s original choice of wheat as the most viable Gezira crop was soon replaced by cotton. Administrators throughout the Sudan were encouraging farmers to shift from native cotton to the high quality Egyptian varieties for which there was a lucrative international market. The British Cotton Growing Association had been established in 1902 to promote the growth of cotton within the British Empire and its export to the Lancashire mills. The Lancashire spinners relied on the undependable American crop and the static Egyptian crop for the long staple cotton necessary for the high quality yarns then in high demand, and through the B.C.G.A. made clear that
there would be a market for whatever long staple cotton the Sudan could produce. Administrators in the Sudan however, encountered considerable resistance to their efforts to promote the growth of the desired varieties, and recognized that the cultivators' reluctance was based on eminently rational grounds. Egyptian cotton was less hardy than the local varieties, less resistant to locusts and giving poorer results when sown, as was the custom, with dura. Further, the price offered at Khartoum North to the individual native was "not sufficient to attract him. He argues that he can get a better price locally, and that he can sell locally all that he can afford to grow, and that he need not pick it clean for the local market." Even more important, cotton did not fit easily within the framework of traditional agriculture:

The great difficulty with which a Sagia-owner meets with in cotton cultivation is that he cannot afford to give up a large proportion of his land to a crop which has no value for feeding purposes. The fodder of his Sagia animals is always his gravest anxiety. In the time which he takes to get one crop of cotton, he can take off his land two crops of dura, which commands in a year of scarcity an almost equally profitable sale, and the stalks of which will keep his cattle alive and in condition.  

5 Report, 1904, p. 52.
6 Report, 1905, p. 32.
Local administrators generally concluded that "a large output of cotton for export cannot be expected until an irrigation scheme has brought under cultivation greater areas of land," and weakened the link between the cash and fodder crops.

The Government was convinced that the Gezira Plain was fully suited to be the site of such an irrigation scheme. The first problem, noted by Wingate in 1900, was the lack of transport: "Without proper means of transport this rich district is of comparatively small value from a revenue point of view. Statistics show that in the Abud district of Gezireh the tax collected amounted to 5,094 ardebs but of this quantity 1,960 ardebs were issued as payment to the native camelmen, who conveyed it to Dueim." However, the expansion of the military railway (financed through advances from Egypt) placed the Gezira in a very favorable position. A railway was built from Port Sudan, a new port on the Red Sea, to Khartoum North between 1904 and 1906; the Blue Nile bridge was completed in 1909; and by 1910 the lines had been extended down the Gezira along the Blue Nile to Sennar, and then across the Plain to the White Nile at Kosti.

Once it was clear that Gezira's transportation requirements would be met, the Government began to study seriously the

7 Ibid.
8 SAR, 1900 (Cmd. 441), p. 82.
9 The standard reference for the history of transportation in the modern era in the Sudan is Richard Hill, Sudan Transport (London: Oxford University Press, 1965). Hill is a former Sudan railwayman.
question of Sudanese use of Nile waters. The Government was fortunate in having a long record to examine: there is a strong correlation between the water levels on the Blue Nile in the spring and the flood levels in Egypt, and accurate records had been kept of Nile floods in Egypt for centuries. The flow of Nile waters traces a perennial cycle of flood followed by low water. By the early 1900's, Egyptian agriculture was using the total flow of the low Nile, approximately from February 1st to July 15th, by erecting banks across the mouth of the river to prevent water from escaping into the sea. During the remaining six and a half months, a surplus flowed into the Mediterranean. The initial proposal for Gezira, the irrigation of 100,000 feddans by the erection of a diversion barrage, was one which most observers thought would only require water taken directly from the full flood and would not infringe on the flow needed by Egypt. The primary problem foreseen was that restrictions on water usage prescribed that the cotton growing season had to be shifted from July through November to mid-August through December, and no one knew what effect the shift would have on plant growth. Later, when the 1913 flood declined to the lowest level in 180 years and increased project costs enlarged the economic minimum cultivated area to 300,000 feddans, plans were changed to include a storage dam at Sennar rather than a simple barrage. This change initiated a new series of calculations and a concerned, at times passionate, debate over Nile waters which was resolved only by the Nile
Waters Agreement of 1929. In the project's early stages however, most planners were confident that enough water could be extracted from the Nile flow to assure the project's success. Later, though the controversy must have given them some bad moments, few doubted that the issue would eventually be resolved satisfactorily.

Land Ownership and Native Rights

In addition to the physical problems of transport, water, crop, etc., the planners of the Gezira Scheme were also very sensitive to the questions of equity as they related to land ownership. The first priorities in the Sudan after the Re-Conquest had been the expansion of cultivation, the resettlement of populations displaced during the Mahdiya and the Re-Conquest, the confirmation of native rights and the establishment of a yeoman farmer/proprietary class. The 'Title of Lands Ordinance 1899' established special commissions at the provincial and district level to determine ownership of lands, settle disputes, register titles and provide an equitable basis for taxation. Title to saqiya lands, which were cultivated regularly, was granted to those who could prove continuous cultivation for two to five year preceding the claim, while those whose legal rights predated such a claim but had been allowed to lapse, were compensated elsewhere. Ownership of land which could be cultivated only in periods of exceptional rains or floods was generally claimed on a tribal basis with

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10 Gaitskell, Chapter 9, "Nile Waters: The Controversy" gives an exhaustive account of the controversy.
specific parcels traditionally allotted to particular families or individuals. The return of displaced persons to their native areas increased the complexities of land settlement; however, most agricultural land was registered between 1907 and 1911, with the government recognizing cultivators as owners and dividing tribal lands into individually held plots.

The land of the Gezira Plain was surveyed and registered between 1907 and 1913, with the government recognizing about 40,000 individual owners, each holding an average of 25 feddans. An average is misleading however, since settlement and ownership varied in both type and scale. While the villages along the rivers were permanent settlements, many of the villages in the interior were only sporadically inhabited. Their semi-nomadic population arrived for the rainy season (July to September) and returned to permanent villages near the river or on wells after the November grain harvest. Whether a particular village was inhabited in a given year depended on the extent and magnitude of that year's rains. The population itself was divided into three types. First, large landowners, a landed gentry, farmed their land through sharecropping and, before the Condominium, slaves. Second, smaller landowners, a peasant proprietary class, farmed the land themselves with the help of their sons and a few slaves. The third category was landless peasants who owned no land but cultivated the land of the large landholders on a sharecropping basis.

Once the nature of land ownership in the Gezira had been ascertained, serious reservations were expressed about a policy of building a major irrigation project on top of the
existing landholding structure. The early British administrators in the Sudan had served in Egypt, and most, led by Lord Kitchener himself, were disturbed that the benefits of Egyptian irrigation had accrued primarily to a small class of landlords. Certainly few were willing to assign to Gezira landowners any large portion of the profits from what was expected to be the country's largest agricultural project. The value of the land would increase considerably once the Government had constructed irrigation works, and if the land remained in private hands, its owners would be able to reap windfall profits, either by increasing rents to cultivators or by selling their plots at inflated prices. Further, it was unlikely that a large area could be irrigated efficiently by supplying water to the existing patchwork of privately owned plots. The effectiveness of the modern agricultural technology depended on treating the entire project as a single unit. On the other hand, administrators were also reluctant to alienate the people of the Gezira by nationalizing the land, an option available to the Government under the Land Acquisition Ordinance 1903. As late as 1908 a British administrator and his Egyptian assistant had been murdered in the Gezira and the British had no desire to undermine their own authority by supplying dissidents with a cause celebre. The planners eventually compromised by separating the rights of land ownership from the rights of land cultivation. The Government leased Gezira land from its owners at a rate of two shillings per feddan and offered to buy land at LE 1 per feddan, the current rates applying to the best rain fed land (which the Gezira was not). The lease was to run for 40 years,
the period during which the Government expected to pay off
the loans for the irrigation works. Land ownership in the
Gezira then became the possession of a saleable security which
bore an attractive rate of interest. The land itself was to
be treated as a single unit for planning and laying out irri-
gation canals and was divided into 30 (later 40) feddan plots
which would be cultivated by tenants under central supervision.
Of the two, the tenancy rights were potentially more profitable
than the ownership rights, and the Government promised that
owners would be given the opportunity to become tenants of as
great an area as they could personally cultivate, as far as
possible in the vicinity of their own land.

While topics like transport, water rights and land
ownership could to a large extent be planned on paper, basic
questions on the possibility of growing cotton in the Gezira
using solely water drawn from the Nile at full flood could only
be answered by a pilot project. Accordingly, the Department
of Agriculture closed down its experimental farm at Kamlin and
prepared a site at Tayiba. They rented 600 feddans from local
landowners, selected the location of the pumping station and
undertook the ploughing and canalization. The Government chemist
analyzed the soil; the Public Works Department erected the pumps;
and cultivation began under the management of a private company,
the Sudan Plantations Syndicate. After two years of cultivation,
the Governor General wrote in his Annual Report

The object of the experiments was to ascertain,
before the Gezira Canal project was embarked
upon, whether cotton could be profitably grown
on the land coming within the scope of the Gezira Canal project by local cultivators with the water which is available during the period of the high Nile. . . .

The area on which the experiment was conducted amounted to 3,000 feddans and was carefully selected as being as representative as possible of the soil which the Gezira scheme would eventually irrigate.\(^\text{11}\)

He concluded, "These experiments having proved conclusively that Egyptian cotton of the best quality could be grown commercially in that district, the execution of the Gezira scheme was sanctioned by Lord Kitchener and approved by Sir William Garstin, Sir Arthur Webb and Mr. McClure, who were appointed to advise on the proposals."\(^\text{12}\)

LABOR

Quantity of Labor

The Gezira Plain was chosen as the site of the Sudan's principle agricultural project chiefly for its agronomic advantages, primarily the availability of water. The area was not densely populated and planners were aware that they could face serious difficulties in recruiting a labor force for the project. Further they had no illusions concerning the quality of the workers they would be able to attract.


\(^{12}\)Ibid., p. 102.
Once the planners added the idea of a storage dam at Sennar to the Scheme, the project's potential acreage increased to 510,000 feddans in the lowest estimated Nile flood and 900,000 in the next lowest. The first constraint on project size was now not water, but labor: "300,000 feddans only. . . were estimated as being necessary to make the scheme financially sound, and further since this area seemed to be all that could be sufficiently populated in the immediate future, it was selected for development."13 With each tenancy 30 feddans (10 feddans for cotton, 10 fallow, and 5 each for dura and lubia), the project would require approximately 10,000 tenants. The work of each tenancy was well beyond the efforts of a single individual and the basic unit of labor was presumed to be a man and his family with additional labor hired at peak periods. Specifically, the planners estimated that the minimum unit would consist of a man, his wife and two children, plus four or five hired men during cleaning (removing the seid grass) and three hired women or children during cotton picking. Additional crops would require additional labor because all crops had to be grown within the rain plus irrigation period rather than spaced throughout the year. Thus the Scheme had to attract 10,000 families plus a substantial quantity of seasonal labor.

Planners recognized that because of the nature of the work demanded by irrigation agriculture, recruitment of both tenants and seasonal labor could be difficult. Before the Condominium, manual work wherever possible was delegated to slaves; even after the abolition of slavery, field work especially retained its stigma of slavery. Poorer Arabs, faced with the alternative of starvation, spent ten days planting grain after the advent of the rains, left the crop for two months to ripen, and then returned for several weeks for harvesting. The rest of the year was spent in a more leisurely fashion, doing odd jobs and petty trading, and attending weddings and funerals. By contrast, irrigation agriculture demanded a high degree of effort and concentration throughout most of the year, and negligence on the part of one cultivator directly affected the yields of his neighbor. The Scheme's three crops, cotton, dura and lubia, all had to be sown and weeded within six weeks of the beginning of the rains. Dura watering ceased in November to allow the grain to reach maturity and allow harvesting before cotton picking began in January. Lubia watering ceased in December and the bean harvest coincided with the early cotton picking. The fall was spent regulating irrigation water, hoeing to remove the weed growth each watering produced, thinning and ridging the new cotton plants, spraying against pests, and ploughing, ridging and fertilizing the next season's now fallow land. The cultivator picked cotton continuously from January through April, and then in May's 115 degree heat, had to extract the old cotton plant by the roots and collect and burn the stalks. June was
the only month of relaxation for in early July the work began again with the preparation of the land and water channels for the new season. Irrigation agriculture was hard work, with visible profits easily balanced by obvious effort. Planners, who saw nothing irrational in a high preference for leisure in the hot Sudanese sun, worried that all the tenancies would not be taken up.

Their worries were confirmed in 1911, the first year of the Tayiba experimental farm when despite the low rent charged each tenant, only one cultivator applied from the Gezira area; all the rest had to be imported from the Syndicate's concession area at Zeidab. Applicants increased in 1912, encouraged both by the notable success of agriculture in the irrigated area and by the paucity of the rain crop in the non-irrigated districts. Labor recruitment faced another setback in the third season when the farm switched from rental charges to a profit sharing structure. The loss of individual profits entailed by the change set off demonstrations which were quelled only by the camel corps and left a legacy of resentment which plagued the Scheme's early years.¹⁴ Lord Kitchener's plan of leasing Gezira land from its owners and then leasing it back to tenant cultivators also drew opposition. It put, the complaints ran, the heads of prominent families on the same level as their former slaves, and labor recruiters feared

¹⁴Private letter H. Poyntz-Wright to Gaitskell, 25 March 1928, in S.O.S., University of Durham, Box 418/3.
that such radical democratization would induce local notables to stand aloof from the Scheme.

The Government moved carefully to establish profit shares. They had realized that a rental system would not work: a rent high enough to cover the Government's irrigation and management costs was too high to attract tenants who being accustomed to variable returns were averse to high fixed costs. The Government found that traditionally tenant farming was based on a profit sharing rather than a rental system, with the crops divided among the participants as follows:

Ownership of the land = 1/10
Ownership & repair of the waterwheel = 1/10
Ownership of the cattle (for ploughing, operating the waterwheel, etc.) = 2/10
Supply of cattle food, seed, implements = 2/10
Supply of labor = 4/10

Thus the capital assets entitled its owners to 60% of the crop, and the working tenant received 40%. The application of these shares to Gezira satisfied the prospective tenants that the profit division would be equitable, while the substantially larger crop possible in the irrigated area provided the irrigation/rainfed differential which could attract cultivators from the traditional sector. The planners then expanded the proposed irrigated area to 300,000 acres so that the Government's 60% share would cover management and capital costs.

The amount to be divided was the sale price from the cash cotton crop minus the cost of transport, ginning, insurance and other marketing expenses, including an export tax. When
the Sudan Government decided to allow the Sudan Plantations Syndicate to manage the Scheme, it retained 40% for itself to cover the costs of the rent of the land, interest and amortization of the loans made for the project (chiefly the Dam), and maintenance of the Dam and canal system; and assigned 20% to the Syndicate to cover the costs of management, buildings, machinery and subsidiary canalization. The tenants were expected to pay all labor costs, plus the costs of ploughing and seed, and were eligible for agricultural loans from the Syndicate as the work was completed satisfactorily. The Syndicate charged interest on the advances to the tenants, but provided ginning operations for the Scheme at cost.

As a further inducement to potential tenants, the profit-sharing schedule applied only to the cotton crop; the dura and lubia crops became the sole, and untaxed, property of the cultivator. The guarantee against famine provided by these irrigated food and fodder crops was probably the single most important inducement to join the Scheme offered to the subsistence farmers of the Gezira.15 The Governor General's report of 1926 remarked

In a country where the people have had to rely for their sustenance on a capricious rainfall, the guarantee of freedom from the menace of famine is the richest of blessings.

Some 50,000 acres of irrigated land was sown

with grain, and their harvest made a doubly welcome addition to the food supply in a lean year.\textsuperscript{16}

Steps were also taken to encourage the participation of local notables in the Scheme by expanding the rights of landowners. Under the Gezira Land Ordinances of 1921, 1923 and 1927, three classes of owners were accorded privileged treatment. 'Rightholders', those who owned 30 feddans, had first claim to provide tenants for an area equal to the land they owned. They could take up a tenancy themselves or appoint nominees: thus an owner of 90 feddans could cultivate one tenancy himself and name two cultivators as tenants for the remaining 60 feddans. 'Nominees' were normally relatives or dependents, sometimes former slaves, of rightholders. Tenancies had to be allotted to rightholders and nominees unless they had markedly poor cultivation records, in which case the rightholders were persuaded to name someone else. The third category was 'preferential tenants'. These were landowners who held more than 20 feddans but not enough to qualify as rightholders, and were assigned tenancies in preference to landless men. This recognition of privilege mollified the landowners somewhat and rightholders and their nominees took up approximately 70\% of the tenancies in the more densely populated southern areas and 60\% in the relatively sparsely populated north.

\textsuperscript{16}SAR, 1926 (Cmd. 2991), p. 7.
While the system of nominees appeased the landowners, it destroyed the concept of the family as the basic unit of labor. Landowners, rather than working with their sons, nominated them for separate tenancies. The individually managed tenancy placed a heavy burden on the tenant, and provided little latitude for illness or for holidays. Even more important, it increased the reliance on hired labor. The Gezira Scheme was fortunate that seasonal labor was available. The area contained a large population of ex-slaves and those who did not receive tenancies themselves were willing to work for wages. People from the surrounding districts were also willing to work on the Scheme: especially in years when the rainfed dura crop was poor, whole families would migrate to the Gezira for the cotton picking. A third source of labor was the West African pilgrims on their way to Mecca. These pilgrims worked along the pilgrimage route and stopped in the Gezira for varying periods to earn money for their passage. On their return from Mecca, many settled permanently near the Scheme, establishing small West African villages which served as centers for a large floating population of Nigerians, Equatorial Africans and Western Sudanese. The West Africans were a welcome addition to the labor pool, and were universally acknowledged as being generally better cultivators than their Arab counterparts.

Quality of the Labor Force

In addition to their pre-occupation with numbers, British administrators were also concerned about the quality
of the available labor, in terms of both the ability and the willingness of the native population to work on irrigation agriculture. The Inspector of Agriculture wrote in 1902, "Competent labour is what is most wanted and what will be wanted for many years to come in the Sudan." Ten years later the Principal of the Central Research Farm repeated the same theme:

An outstanding problem in the Gezira Scheme is the provision of large numbers of cultivators trained in the use of irrigation water and the growth of irrigation crops. The rain-farming now obtaining in this area does not provide this, and the number of 'sakia'-owning samads who could be drafted from other provinces is probably strictly limited.

The Syndicate were able to avoid this question in their first year's working at Tayiba by transferring tenants from their Zeidab Estate. During the current season some local cultivators have received land and training. . . . However, we can hardly expect from a commercial company the financial disinterest which should characterise any system of education.17

17Report, 1902, p. 170.

18Sawer was also arguing that the Department of Agriculture rather than the Syndicate should manage the experimental farm. C. R. Sawer to Currie, 6 March 1913; Public Record Office, F.O. 141/578.
One often proposed solution to the absence of local skilled labor was the importation of Egyptian peasants. The Egyptians were acknowledged to be more conscientious cultivators than the Sudanese and more highly skilled in irrigation agriculture. The British recognized however, that the Egyptians were expensive to recruit, transport and settle. They also acknowledged that the "attractions of the Sudan were "not sufficient to attract a really good class of cultivators."

The employment of Egyptians by the Sudan Plantation Syndicate at Zeidab was not altogether successful, and the Berber Provincial Governor remarked that "whether due to these Egyptian, or to the native labourers introduced, there is no doubt that Zeidab has become a den of thieves."¹⁹ While the idea of hiring Egyptians for Sudanese projects surfaced on a number of occasions, primary attention was given to the task of improving the skills of the Sudanese cultivator.

Gezira administrators attacked the problem of training local Sudanese in two ways. First they established a relatively low ratio of inspectors to tenants and placed most of the responsibility for the operation of the Scheme on the staff rather than the tenants. While the local inspectors did not directly employ the tenants, he "organized the distribution of their water, their seed, their fertilizer, their ploughing, their loans and their profits. He was their supervisor, resident among them, and his influence was far more concentrated than the intermittent uplift of a government agricultural

officer. His job was to make them succeed." Secondly, the pilot pump area was expanded in the Gezira, first by enlarging the acreage at Tayiba and then by erecting additional pumping stations at Barakat in 1915 and at Hag Abdulla in 1920. The Syndicate considered these a "training ground both for the native cultivator and for our inspectors." The Governor General cited them as part of the effort to "educate the natives in modern methods, so that as soon as the proposed irrigation system is in working order they will be able to cultivate the land in the most economical manner." The pilot projects were effective in overcoming suspicions of local cultivators who refused to join the projects until the benefits of the new methods had been demonstrated, an attitude which according to the Blue Nile Provincial Governor "showed commendable caution and a good deal of wisdom." By the second year of the Tayiba project, applications far outnumbered the available tenancies, "with people depositing their money, and sometimes their women's jewelry, on application as proof of their anxiety to become tenants." Only nineteen plots were allocated to local cultivators, but the Governor had been pleased by the response,

20Gaitskell, p. 103.
22Report, 1912, p. 33.
23Ibid., p. 45.
24Ibid.
and further noted that the projects made possible a general improvement in the skills of the Gezira cultivator: "As every tenant supplies several labourers to assist him, and as practically all these labourers are local men and women a knowledge of improved methods is undoubtedly being gradually spread among these people who are the landowners in that part of the Gezira, which will probably be the first to derive benefit from the proposed irrigation scheme." 25 Thanks to the long delays in completing the construction of the Sennar Dam, the Government and the Syndicate were able to train a substantial labor force, both managerial and semi-skilled, before the Scheme was officially inaugurated.

Provision of Social Services

The Gezira Scheme was able to avoid the financial burdens of providing extensive social services for its labor force. The British concept of colonial rule in the Sudan was "native administration", a system of indirect rule under which a small number of British administrators (110 throughout the Sudan in 1914, excluding technicians) ruled through the traditional leaders and institutions. The Gezira was already dotted with settled villages with established, although rudimentary, government services. While the Scheme staff assumed the functions of the Agricultural Department, education, local government, police, and medical and communications services remained under the direction of the Sudan Government. Social

25 Ibid., p. 46.
services were gradually expanded and village councils assumed increasing responsibility as the influence of the sheikh waned. The cost was never borne directly by the Scheme, however, and the primary goal of the Scheme remained unequivocally output and profit. In later years, problems arose over the financing of expanding social services, but the controversy centered around whether local services should be underwritten by the central government out of its 40% profit share, or by the tenants from their 40%. It was not suggested that extensive services become simply one of the costs of the Scheme's operation.

**CAPITAL**

Questions involving capital, both capital goods and financial capital, were important in the Gezira Scheme. While the major item of physical capital was the Sennar Dam and the irrigation network, the level of mechanization given the supply of labor was also significant. Similarly, the problems associated with the provision of financial capital were of crucial importance to the Scheme, as were the decisions regarding the role to be played by private enterprise.

**Physical Capital**

The Sennar Dam and the network of canals and field channels transformed the agriculture of the Gezira. The traditional agriculture relied on rainfall and the animal powered sakia for its water supply and was limited to crops which could be grown in the rainy season or which would supply fodder as well as the food or cash crop. The requirements of a large
scale cotton crop far exceeded the capacity of traditional methods: the Sennar Dam was the sine qua non of the Gezira Scheme.

Aside from the Dam and irrigation system, cotton production in the Sudan, as elsewhere, was primarily labor intensive rather than capital intensive. Even in the United States, the use of tractors for cultivation was only developed in the 1920's and did not spread until the 1930's. Mechanized harvesting was developed in the 1940's, but at the end of the decade 94% of the crop was still harvested by hand. During the 1950's mechanization spread in the U.S.: but in 1958, even in the southwest United States, the most mechanized cotton growing area in the world, hand labor was still used for weeding and a quarter of harvesting was still done by hand.

Despite problems of recruiting labor, the Sudan did not take the lead in mechanized cotton production. By 1908 the Syndicate had concluded at its own estate at Zeidab that direct farming by the company could not compete financially with the methods applied by their own tenants. The hired labor was "not over-industrious" and the incentives to labor of tenant farming were more effective than those offered to hired labor.26 Rather than increasing mechanization, an option not really available at this date, the company remodelled its policy and confined its operations to "leveling and preparing and supplying water to the land of our Concession, and then let

26Sudan Plantations Syndicate, Minutes of Ordinary General Meeting 7 October 1910; S.O.S., University of Durham, Box 41578.
it out on lease to the natives."27 The Zeidab system of
tenant farming, and the level of mechanization it implied,
was adopted in the Gezira. Ploughing and ridging were done
by tractor, fertilizing by hand. The seed was planted by hand
after the land had been watered, usually an adult opening
little craters with the traditional sowing stick and a child
throwing the seed in the craters and covering it over with his
foot. Weeding was done by hand, commonly with a long Dutch
hoe. Three weeks after planting the cotton was thinned to
three plants per hole, and the soil re-ridged, both also by
hand. The mid-September spraying against the jassid-fly was
done by tractor (aerial spraying having proved more costly
and not as effective). Cotton picking and the pulling out of
the old plants were both done by hand. If anything, in the
Gezira Scheme there was a slight bias against the replacement
of human and animal power by machinery. A 1937 report, after
illustrating that mechanical ploughing was cheaper, more
efficient and less demanding of staff supervision than bull
ploughing, concluded that the ownership of a pair of bulls
could be viewed as part of the process of transforming the
Sudanese cultivator into an Egyptian fellah and suggested that
the differential market cost be ignored for the sake of the
social gain.28

27 Sudan Plantations Syndicate, Minutes of Ordinary
General Meeting 8 October 1908; S.O.S., University of Durham,
Box 415/8.

28 Sudan Plantations Syndicate, A Report on Gezira
Rotations and Abdel Hakam Experimental Blocks, 15 February
1937. Typescript. S.O.S., University of Durham, Box 214/1.
Financial Capital

The provision of finance capital for the construction of the irrigation system was marked by recurrent crises, as the delays in obtaining financing during an inflationary period each time increased the amount of capital required. The original estimate for the Sennar Dam was £1 million. By 1910, the Scheme planners were envisioning a storage dam rather than a simple barrage, and increased the estimate to £2 million, to include not only the dam but also the major canals. Additional capital would be required to level the land, dig field channels, construct buildings and ginneries, purchase machinery and provide working capital. There was no way the Sudan Government could raise the necessary capital from its own revenues. Rather it had two options: convince the British Treasury to guarantee a loan, or invite private enterprise to develop the Gezira. In 1910, neither option seemed especially promising. While the Sudan and British Governments preferred the idea of public investment and control, the British Treasury was not enthusiastic about sponsoring an agricultural project in the Sudan whose success, in 1910, was at best uncertain. The involvement of private enterprise in the Gezira was seen as a possibly necessary evil. W. E. Garstin expressed the majority opinion in November 1910:

You know that I have always held that the Government should carry out these works itself. This opinion I still hold but if the money necessary for this cannot be
obtained then I would rather see the work carried out by a syndicate than not at all.\textsuperscript{29}

The only private company interested in the Sudan and capable of developing the Gezira was the Sudan Plantations Syndicate. Its directors offered to organize an experimental project in the Gezira at their own expense and indicated that they were prepared to raise the capital necessary for the entire project. However, the price for this assistance was a major concession in the irrigated area, and that the Governments were reluctant to concede.

The Sudan Government compromised by separating the experimental work from the financing and later the management from the financing. The Syndicate agreed to undertake the pilot project at Sudan Government expense and with the promise that if the project were successful S.P.S. would be given the option to purchase 10,000 areas of irrigated land or 30,000 acres of rain land.\textsuperscript{30} Public financing became considerably more feasible after Lord Kitchener, an advocate of increased British participation in the Sudan was named Consul General for Egypt in July 1911. He argued that it would be exceedingly dangerous for a private company to come between the Sudan Government and the Sudanese people on questions of the disposition of land, and more dangerous still for a private company

\textsuperscript{29}W. E. Garst in to Gorst, 12 Nov. 1910; PRO. F.O. 141/578/540.

\textsuperscript{30}Clayton to Stack, 17 February 1911; PRO. F.O. 141/578/540.
to have a voice in the division of Nile waters.31 Pushed by Kitchener, and pressured by Sir William Mather, the British Cotton Growing Association and the Lancashire weavers, and the Sudan Plantations Syndicate and its financial backers, the British Treasury agreed to guarantee a £3 million loan at 3½% interest. The guarantee made in 1913 and revised in 1914 allotted £2 million for the Gezira irrigation system, £800,000 for extensions to the Sudan Railway and £200,000 for other irrigation works and contingencies. The Treasury advanced the Sudan Government £500,000 to be paid back from the bond issue. Excavation was begun on the main canal in 1914; a contract was signed for the provision of special equipment needed for further excavation. Plans were made to begin construction of the Dam on the fall of the Nile in August 1914, and it was anticipated that the Dam and canals would be completed in time to begin irrigation in 1917. Unfortunately, the First World War broke out in August 1914 and all plans were suspended.

The construction of the barrage was postponed and the pace of work on the main canal reduced to the level necessary to prevent the waste of money already expended and to fulfill current contracts. In late 1916 the Sudan Plantations Syndicate offered to loan the Sudan Government £500,000 to continue work in the Gezira, but the offer was rejected because the Government was not sure it would be able to repay the loan within the specified two year period, and were still unwilling.

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31 Kitchener to Sir Edward Grey, 19 October 1911; PRO. F.O. 407/177/42501.
to commit themselves to assigning the Scheme's management to the Syndicate. Governor General Wingate outlined the effect of the War on Gezira financing, noting the construction costs were now estimated at £2,250,000 and the interest charged on Government securities considerably higher than the 3½% possible in 1913. He advised that the loan cover not only the Dam and main canal, but that, given the high interest rates charged private companies and individuals, £750,000 be added to cover buildings, implements, minor canals and an Agricultural Bank. Finally he suggested that since the Sudan Government would have great difficulty paying interest charges from current revenue, interest should also be included in the original loan. Wingate estimated that the £500,000 advance would probably be wholly expended by mid-1917 and prepared to ask for additional funding to continue the work. He was told in August 1917 that no additional funds would be available until "peace was in sight." However, the following March, thanks in large part to the wartime scarcity of cotton in England, the Treasury agreed to advance the Sudan Government £250,000 to carry out preliminary works and to consider a further advance when that amount was exhausted. The construction cost estimate now stood at £2,550,000.

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32 Bonham Carter to MacGillivray, 3 December 1916; S.O.S., University of Durham, Box 112/5.

33 Stack to Balfour, 24 November 1918; S.O.S., University of Durham, Box 156/4.

With the close of World War I, the Sudan Government revised its estimates once again and applied to the British Treasury for a new loan to replace the loans promised in 1913 and 1914 but never floated. By this date, the estimate for the Gezira works alone had reached £4,900,000. Fortunately, cotton prices were high and the potentially irrigable land in the Gezira was easily expanded to match increasing capital costs. The amount to be irrigated was raised to 300,000 feddans from the 100,000 contemplated before the War, and the Treasury in 1919 guaranteed a Sudan Loan of £6 million. A year later, Sir Murdoch MacDonald, Irrigation Advisor to the Egyptian Ministry of Public Works which still directed construction in the Sudan, reported that costs had again risen, and that the irrigation works could not be completed without additional funding. The Sudan Government again approached the British Treasury but their arrival coincided with a drastic fall in cotton prices, the post-war recession and cutbacks at all levels of Government. It was decided that work should continue with existing capital while a thorough investigation of costs was made. The report was issued in early 1922 and influenced primarily by the prospect of losing the £6 million already committed, the British Government guaranteed an additional £3½ million. This was increased to £7 million in 1924, which brought the total authorization to £13 million, of which £700,000 was for railway extensions.

Loan Acts 1913 and 1914 and the Arrangements for the Development and Management of the Area included in the Gezira Irrigation Scheme (Khartoum: Sudan Government, 23 March 1918).
and £ 400,000 was a loan to the Sudan Plantations Syndicate to erect ginneries. The cost of the Dam and canalization had grown from £ 1 million before 1910 to over £ 11½ million by their completion in 1925.

The major capital investment in the Gezira Scheme was thus public rather than private. The offer of privately raised capital in 1916 was in the form of a temporary loan to the Sudan Government rather than an equity investment, and was nonetheless refused. There was no suggestion that private financing supplement the Government loan in the 1921 crisis: the profits of the Syndicate itself had fallen from their 1920 high of £ 223,259 to £ 8,968 in 1921 and the postwar slump was a poor time for private financiers to raise large sums of loan capital. Rather, under the 1919 Agreement between the Sudan Government and the Sudan Plantations Syndicate, S.P.S. had considerable financial responsibilities of its own in the Gezira. It received a £ 400,000 loan from the Sudan Government, to be repaid with interest, for the construction of ginneries, housing, offices, storehouses, etc. and the purchase of heavy farm implements and machinery. In addition, the Syndicate "at their own cost and as their part of the joint undertaking," were responsible for constructing and maintaining the subsidiary canalization, providing surface drainage and roads and clearing and leveling the land. The Syndicate also supplied the working

35Agreement, made 17 October 1919 between Major-General Sir Lee Oliver FitzMaurice Stack...Governor-General of the Sudan...and the Sudan Plantations Syndicate Limited, Clause 7. S.O.S., University of Durham, Box 415/3.
capital to support the staff, lend tenants the funds for seed, implements and labor, collect and market the cotton, and maintain the buildings and machinery.

The division of the financing between public and private sources highlighted the areas where the Sudan Government was most concerned to maintain its control. Public financing of the Sennar Dam and major canal, the symbol and basis of the entire project, underlined the pre-eminent position of the Sudan Government. There was no question that the Government was the senior partner, and that Government administrators would make the major decisions concerning the division of Nile waters and the extent of the project. The Sudan Government was also concerned that the Syndicate might charge excessive fees for seeds, agricultural loans, ginning, etc. The £400,000 lent to the Syndicate from the Sudan Loan enabled the Government to extract the guarantees it wanted from the Syndicate: the ginning rates were set only to cover expenses, the loans to tenants had to conform to Government regulations on terms and interest rates, and most importantly, the Syndicate was "to consult the Government on all matters of importance affecting their joint undertaking with reference to the interests of the Government, the Syndicate and the Tenants, respectively."^36

When the Sudan Government finally decided in 1919 that the management of the project would be handled by a private company it stipulated that the company, the Sudan Plantations Syndicate, should contribute not only its expertise but a

^36Agreement, Clause 14.
substantial amount of capital as well in the form of an equity
investment. The Syndicate's return was drawn from its share
in the profits, and its responsibility to its shareholders
assured that the sanctions against inefficient management
would be fully operative. Compensation schedules were estab-
lished to become effective either at the end of the concession
period or in the event the Government expropriated the company's
assets before the end of the contract. The schedules detailed
which assets simply became the property of the Government (the
subsidiary canals) and which the Government would purchase
from the Syndicate (buildings, machinery) and provided that in
the case of early termination the Syndicate was entitled to an
annual stipend equal to an average of its last five years
profits, plus 6% interest on the valuation of working capital
and assets until the concession ended at which time the
Syndicate would be paid in full.\textsuperscript{37} The Syndicate asked for a
guarantee that their concession would not be ended prematurely
simply to increase the revenue of the Sudan Government. The
Government however refused, stating that they were unwilling
to tie the hands of future administrators:

If in the future the question of terminating the
agreement should arise, the Government itself
must be the sole judge of its own motive, and
this letter must not be taken as altering that
position. But it might be of some value to

\textsuperscript{37}Memorandum A, 'C' Account no. 2, Papers 1919-1926.
S.O.S., University of Durham, Box 417/3.
your Company in inducing those who at that time are responsible for the administration of the Sudan, to analyse carefully their motives for doing so, and in representing to them that, if the agreement is working satisfactorily in every other way, and if their only reason for making a change is the expectation that they will have to pay you less under the compensation clause than you would receive if you continued your management, they will be acting in a manner contrary to the intention of those of us who have concluded the present agreement on behalf of the Sudan. But it is not intended that you should have any legal remedy if these representations are disregarded.38

Government/Company Relations

The decision to entrust the management of the Gezira Scheme to a private corporation was not made easily. The Sudan Government had welcomed the assistance of private enterprise in developing Sudanese agriculture in the earliest days of the Condominium, but the system of granting concessions to likely developers had not proved particularly satisfactory. Most of the applications for land were speculative rather than developmental and the Government quickly concluded that it had been

38Schuster to Eckstein, 9 November 1926; S.P.S. Papers, Sudan Gezira Board Archives in Barakat, quoted in Gaitskell, p. 129.
a serious mistake to grant concessions before the completion of the land survey and settlement and the nature of the native rights had been ascertained. Governor General Wingate quoted the Director of the Agriculture and Lands Department, Ernest Bonus in his Annual Report for 1906 that the early concessions had "unluckily left a crop of difficulties by which the Department of Agriculture and Lands will be embarrassed for some time to come."\(^{39}\) In addition, the Department of Agriculture and Lands was not overly impressed by the expertise of the applicants. A 1906 report reviewing the progress of agricultural development through land concessions noted that while the circumstances of each concession were unique, all presented similar questions of locality, quantity of land and the configuration of the land. The report observed that the configuration of the ground must be studied in order to test the feasibility of the initial proposals of the applicant. It might be supposed that this could be safely left to the applicant, but it is not so. For example,\(\ldots\) I have.\(\ldots\)recently had an interview with a gentleman whose importunity for a concession in what he regarded as the very promising agricultural district of Kodak was somewhat abated by the discovery that the Nile and Red Sea Railway did not pass through it.\(^{40}\)

\(^{39}\)SAR, 1906 (Cmd. 3394), p. 123.
\(^{40}\)Report, 1906, p. 175.
By 1908 applications for concessions had diminished considerably. Only a handful of concessions were in operation, and few of these were likely to achieve any real success. The government admitted that "the difficulties that beset landed interest" were great, and included "not only a deficient water supply, but costly transport, a shortage of labour, and a lack of skill, expertise and inclination to work on the part of the labourers."41 Direct farming had proved generally unprofitable, the most promising activities being land reclamation rather than cultivation and the provision of irrigation water for riverain land farmed by natives.

The most successful of the land companies was the Sudan Plantations Syndicate which operated a concession on the Nile at Zeidab, north of Khartoum. The Syndicate was founded in 1904 by an American, Leigh Hunt, who intended to import American blacks trained in U.S. agricultural colleges to operate his estate. The imported Americans soon returned home, and Hunt sold out to his partners, but the Syndicate remained, directed by Frederick Eckstein, a pioneer of the Rand mines in South Africa, and Lord Lovat, a Scottish landowner, financed by Wernher Beit & Company, and managed by D. P. MacGillivray, another Scotsman, from a banking house in Cairo. The first pump was installed in 1906. By 1909, the Syndicate was able to obtain good crops but found that the expenses from direct farming generally exceeded the return. They decided to limit their activities to providing water for tenant farming, buying,
ginning and marketing cotton produced by local cultivators, and granting agricultural loans based on the amount and quality of work performed. The combination of private capital and management and local cultivators was watched with great interest by the Sudan Government, and in 1908 when the Syndicate offered to extend its rental water system to neighboring cultivators, the Government participated by offering loans for clearing land and digging water channels. The experiment was not a financial success because the crop itself was poor and cultivators had difficulty repaying loans from the proceeds. However, the experiment marked the first direct cooperation between the Government and private enterprise in agricultural development. For the Syndicate itself, revenue exceeded costs for the first time in 1910, and the first dividend was paid in 1912, eight years after its founding.

In 1910 when the Sudan Government began to plan concretely for an agricultural project in the Gezira and the pilot farm which was to precede it, it was initially assumed that the management of the experimental farm would be assigned to the Department of Agriculture and Lands. The whole of the Department however "consisted of Colonel Wilkinson as Director, a soldier who had been Governor of Kassala and according to tradition was reputed to be a very keen gardener;" 42 three British agricultural officers and two Egyptian assistants. Their experience in growing cotton on the Nile was limited to the small experimental station at Kamlin and additionally the

42 Gaitskell, p. 63.
Department's staff was fully occupied by its projects at Tokar and the Gash Delta. Inevitably there was some concern about the Department's ability to manage a major experimental farm, still more about its ability to run a large project. Doubts were also expressed on whether the findings of the inexperienced Department would carry enough weight in Britain that it would be possible to arrange financing for the Sennar Dam. The lack of agricultural expertise was a marked contrast to the expertise available to the government in the planning and execution of the irrigation works. These were planned by the British staff of the Egyptian Public Works Department who had had extensive experience in the construction of irrigation systems in both Egypt and India.

The alternative to Government management of the pilot project and the ultimate Scheme was management by a private company. The Government was fortunate that a company capable of managing the project existed in the Sudan, but regretted that there was only one such company: the Sudan Plantations Syndicate. The Government recognized the unique capabilities of the Syndicate: "MacGillivray and his staff have had much greater experience and success in growing and marketing cotton than anyone else in this country and could probably carry out experiments cheaper and better than anyone else especially as they propose employing tenants from Zeidab and following the same system which has proved successful there."\(^{43}\)

\(^{43}\) Wingate to Russell, 11 January 1911; PRO. F.O. 141/578.
Government resented however the strength of the Syndicate's bargaining position, and the terms on which it was willing to cooperate:

Mr. Eckstein gave us to understand that he was not prepared to go on with the Gezira experiment without some undertaking on our part that if successful his syndicate should have a concession for the conversion of Gezira.

Obviously the terms of the concession would be most difficult to settle now (though perhaps not much more difficult than it would be to settle later); and moreover the syndicate is opening its mouth very wide. On the other hand it is certainly very difficult to see how we can hope to get the Gezira developed if private capital is not called in.44

The government and S.P.S. agreed in 1911 that the government would pay for the experiments and the Syndicate would operate the pilot project in exchange for an option to purchase land in the Gezira, 10,000 feddans of irrigated land or 30,000 feddans of rainland, if the experiments were successful.

After two years the pilot project was declared a success and the Government had to fulfill its commitments to the Syndicate. Unfortunately the land settlement board revealed that the only large block of government-owned land lay in the

44H. P. Harvey, Minister of Finance, to Gorst, 21 January 1911; PRO. F.0. 141/578.
northern tip of the Gezira, an area of poor soil and well beyond the proposed canalization. The Government had to decide both who was to manage the full-scale project and how they could implement their agreement with the Syndicate. Also in 1913, Lord Kitchener had become Consul General in Egypt and the possibilities of a Treasury sponsored Sudan Loan were considerably more promising. Thus the Government's bargaining position was stronger vis a vis the Syndicate than it had been two years previously, but they foresaw some difficulty in extricating themselves from their legal obligations to the Syndicate under the 1911 agreement. The Government's concern over the negotiations was deeper than the feeling that they had made a bad bargain in 1911. Aware that they did not have a great deal of experience in dealing with private companies, they were afraid of being outwitted, of being easy prey for companies who would be quick to take advantage of them. The 1911 Agreement merely proved their point. Secondly, the primary concern for Sudan administrators was the development of the Sudan for the benefit of the native Sudanese. They were afraid that an agreement with a private corporation would restrict their flexibility and limit their ability to deal effectively with problems as they arose within a changing social and economic context. While they were unsure of the best developmental path for the Sudan, they were certain that two examples they did not wish to emulate were Egypt, where private landowners reaped most of the benefits of public projects, and

45 Private letter, Wingate to Stack, 10 April 1913; S.O.S., University of Durham, Box 108/15.
Rhodesia, where a royal charter empowered the British South Africa Company to rule in lieu of government. 46

Under Kitchener's direction, the Sudan Government ordered its Department of Agriculture to assume the management of the Tayiba experiment. The official reason was first to give the Government first hand data on which to base their conclusions, 47 and second, to give the Department of Agriculture, still understaffed and preoccupied with other projects, experience in growing cotton on the Nile which it needed if it was to manage the Scheme itself. Kitchener's real purpose was to provide credibility for the threat that the Government rather than the Syndicate would manage the Scheme. The ploy worked and the Syndicate agreed both to give up their option and to settle for considerably less than an absolute concession in the Gezira. The exact terms of the agreement were modified as circumstances changed, but the Government was able to establish the principle that the Syndicate's management of the Scheme would be of a pre-designated limited duration and could be terminated at specified intervals for economic or political reasons.

OPERATION OF THE GEZIRA SCHEME

After years of careful planning and pilot projects, the Sennar Dam was opened and the Gezira Scheme inaugurated in July 1925. The cotton area, one-third of the total, increased

46 Ibid.
47 Sawyer to Currie, 6 March 1913; PRO. F. O. 141/578.
from 21,600 feddans under the pumping stations to 80,000 feddans the first season and the full 100,000 the second.

Even before the Dam was open, the Government began to re-negotiate the 1919 Agreement. The Government wanted to expand the area to reduce its overhead costs, and increase its profit share at the expense of the Syndicate, but still needed private capital to finance the construction of buildings and canals, purchase equipment and provide working capital. It offered the Syndicate an extension of its concession from fourteen to twenty-five years over an expanded area in exchange for a decrease in its profit share from 25 to 20% (and an increase in the Government share from 35 to 40%). The Syndicate reluctantly agreed after the Government threatened to undertake the extensions itself, and then called on Lord Lloyd, British High Commissioner in Egypt, to announce that he would not approve the extended concession period without the adjustment of profit shares. The formal concession agreement was finally signed on 17 October 1929, with the stipulated time period July 1925 to July 1950. Total irrigated area was expanded to 527,000 feddans in 1929 and then again to 682,000 feddans in 1931. Conservation of water and a change in rotation to include two fallow years with cotton grown only on ¾ of the total area made possible further expansions in the 1930's. Work was begun on a major extension in 1955: by the mid-1960's, the total area of the Gezira Scheme stood at over two million feddans. The site of the Gezira Scheme, with its available land and water, its access to transport facilities, its attraction for an adequate labor force, had been well chosen.
Fears that the Sudan would be unable to provide an adequate labor force for the Scheme, raised anew with each extension, proved illusory. The concept of each tenancy being maintained by the tenant and his family was never realized. The tenants not unnaturally preferred to view themselves as managers of tenancies rather than laborers, and the tenants have spent a perhaps inordinate amount of time arranging for hired labor rather than working themselves. The system of annual allocation of tenancies implies a high degree of insecurity which did not in fact exist: the rate of eviction for incompetence was never high and after the first few years averaged about 0.1%. Tenancies have been surrendered voluntarily in both good years and bad: in the former because the tenant moved into petty trading with his profits, and the latter because he considered the return too low given the effort required. The resignations were a problem only in the early 1930's when a succession of bad years led to the disaffection of non-local tenants. Even then, the Scheme remained popular with the natives of the Gezira for whom the assured food and fodder crops compensated for losses on the cotton crop. Seasonal labor, never individually reliable, always appeared in sufficient quantity to supply the peak labor demands. Numbers, and therefore wages, fluctuated somewhat each year with the rain fed grain crop and other unpredictable factors. The Annual Report for 1937 for example noted that some of the West African immigrants had become unsettled in the early months and, attracted by tales of hidden treasure, emigrated to
Eritrea and Abyssinia. By the end of the year they were mostly back but without any treasure. They are a not unlikeable community of hooligans who work, drink and fight their way through life with a commendable joy. They are one of the main props of the Gezira Scheme and without their aid the average tenant would be lost.  

In general, the Gezira Scheme was extremely fortunate that its location was on a major pilgrimage route to Mecca and that the people of the Sudan were willing to move to better their livelihood. As one observer remarked, "Good money will always find a taker in the Sudan," a comment which underlines the degree to which the Sudanese people were already part of a monetary economy. It is worth noting however, that to a large extent, the adequacy of the labor force was fortuitous rather than planned.

Non-economic questions did not become visible issues until the late 1930's. British administrators disapproved of the Syndicate's system of direct control in the Gezira. It was an anomaly in the then popular practice of leaving local government to be administered only through the traditional structure of sheikhs and notable families which the British political service viewed as the first stage in a very gradual

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49 Gezira Irrigation Scheme. Typescript. 1950 or 1951, S.O.S., University of Durham, Box 403/13, Section 5.
evolution towards Sudanese independence. However, they feared that any diminution of supervision by Syndicate inspectors would entail a loss of profits which the three partners could ill afford. The Syndicate, besides insisting that the traditional leaders were incapable of managing the complex technicalities of the Scheme, disagreed with the basic concepts of indirect administration. Led by Managing Director Alexander MacIntyre, the son of a Scottish crofter who had no love for hereditary authority, they espoused a more egalitarian philosophy and resisted the elevation of the traditional notables to positions of authority in the management of Gezira agriculture. They felt that the interests of the individual tenant were best served when a direct and close relationship between tenant and inspector provided a secure basis for the economic advancement of the tenant. The conflicting attitudes strained the relations between the Syndicate and political service during the Depression years. The Government could not afford to jeopardize the Scheme's profits by social experimentation; the Syndicate staff were forced to admit that the low returns offered little opportunity for economic advancement by the tenants.

Improved economic conditions and disenchantment with the vision of an Arab squirearchy provided a context for a major review of Gezira policy in 1939 when the Government had the option of re-negotiating the concession. Blue Nile Provincial Governor R. C. Mayall outlined the administration view:
The ideal object of government, if she is to be faithful to her principles of trusteeship should be, before the concession period is ended, administratively and agriculturally to have trained up a class of small peasant proprietors, who can, when the control period is ended, make the best use of the irrigation system. 50

He proposed the establishment of village councils which would gradually assume responsibility for civic and agricultural life; the formation of a local board of field management with Government, Syndicate and eventually tenant representation on which would devolve much of the authority currently held by the Syndicate's Managing Director, and a new emphasis on training the tenant as a yeoman farmer with as much attention directed to food and fodder crops and animal husbandry as to cotton.

The Syndicate staff found these proposals much easier to accept than the concept of indirect rule. They recognized that the Sudan was moving towards political independence and acknowledged their responsibility to help prepare the Gezira tenant for self-government. They were more concerned than was the Government over the potential loss in efficiency occasioned by the decreased supervision. They also distrusted the ability of the native leadership to handle agricultural loans without corruption.

The solution, standardization of loans, made loans independent

50 Mayall's Memorandum, 15 February 1939; Sudan Government Files, Khartoum; quoted in Gaitskell, p. 205.
of performance which inspectors feared would also affect productivity. Third, the Syndicate pointed out the initial cost of the program in time and staff. The Government recognized the possible difficulties, but saw no advantages in postponing the inevitable transformation. In February 1940 the Government and the Syndicate agreed to a very general declaration of policy in a document known as "Schedule X" which embodied both Mayall's proposals, and a commitment to the gradual Sudanization of the Scheme and agricultural education for selected farmers. Implementation began cautiously with a pilot project at Hosh where a village council was established and a tenant was selected to be villager responsible for agricultural management. It was envisaged that councils and their 'samads' would gradually be established throughout the Gezira as the structure proved its effectiveness. World War II intervened and as elsewhere greatly enhanced political consciousness and speeded political development.

The first effect of the War was the departure of many British field officers and their replacement by Sudanese. Village councils then spread much more quickly than had been planned in an effort to integrate the 'wartime samads' into the village council structure. Further the effectiveness of the modern agricultural councils brought them into conflict with the semi-feudal local government councils. Stagnation in local government was blamed for the lack of progress in areas of housing, diet and public health, and the general failure of the Scheme's economic advantages to be translated into social advancement. Local government was reorganized in 1943 with
rural district councils created and given the authority to
issue local by-laws, boundaries adjusted to make viable budgetary
units and salaries adjusted and more progressive men placed in
responsible positions. Modernization in the Gezira seemed
briefly to acquire its own momentum and the local managers of
the Syndicate submitted a comprehensive program for social and
agricultural progress to their board. The emphasis of the
proposal was better coordination between the Government and
its political rural councils, and the Syndicate and its agri-
cultural village councils. The managers felt that each
partner's reluctance to interfere in the other's sphere of
responsibility had resulted in a dichotomy between political
and economic development to the detriment of both.

The pace of political events however accelerated.
Sudanese nationalists demanded self-determination after the
War and increased Sudanization of the Government and the Scheme.
In 1944 the Government decided, in order to preserve for them-
selves maximum flexibility in dealing with political questions,
to notify the Syndicate that the concession would not be
renewed on its termination in 1950. The Syndicate Board
expressed regret, but recognizing the political and social
pressures behind the Government's decision, pledged to cooperate
fully with the Government to assure that the transition was
made smoothly. Ironically, the momentum of social and political
change was lost as Syndicate staff turned to their primary
responsibility of closing out Syndicate operations in a manner
most beneficial to their stockholders. Cooperation in developing
village councils continued, but new initiatives were impossible.
The idea of a local management board to replace the Syndicate's Managing Director conflicted with both the Sudan Government's vision of the Gezira Advisory Board in Khartoum as the supreme policy making body, and with the Syndicate Board of Directors' desire to control management decisions until the end of their concession. A Gezira Local Committee was established, but its lack of any real authority deadened its capacity to initiate proposals for social change. Real social development had to await the end of the concession when new boards were established and part of the 20% profit share formerly accruing to the Syndicate was earmarked specifically for social projects.

While the choice of land for the Scheme proved even more advantageous than planners had originally hoped, and issues involving labor were satisfactorily resolved, problems of capital almost ruined the project. The physical capital of the irrigation network provided by the Sudan Government performed as planned. It freed the cultivator from the inefficiency of the traditional sakia and permitted irrigated agriculture over a wide area during the seasons prescribed by the necessary agreements with Egypt. The technology provided by the Syndicate however, proved inadequate. Despite the years of pilot projects and experimentation, the technical knowledge of the Syndicate, and all cotton growers, was ineffective against two major enemies of productivity: blackarm, a bacterial disease which caused defoliation and in severe cases the death of the cotton plant, and leaf curl, a virus disease which caused sterility. Blackarm had been sporadically observed at Tayiba but had been blamed on climatic vagaries. It appeared in the
Gezira in 1922 but had been brought under control when the increase in the irrigated area after the opening of the Sennar Dam necessitated the importation of large amounts of new seed from Egypt. Isolated cases of leaf curl were first noticed in the 1925-26 crop, with the disease widespread by 1928-29 but occurring too late in the season to do serious damage. The 1929-30 crop was infected by both diseases, and the yield plummeted from the 4.8 kantars per feddan achieved in 1925-26 to 2.3 kantars in 1929-30 and 1.4 kantars in 1930-31. At the same time the depression of the world economy resulted in a fall in raw cotton prices from 18 pence per pound in 1926-27 to 8 pence in 1929-30 and then 6 pence in 1930-31. The result was that the return per feddan divisible among the three partners fell from L 33 in 1926-27 to L 1.7 in 1930-31.

The following years saw slow and discouraging efforts to find solutions to the problems of disease complicated by the additional burden of weed growth in the irrigated land. A complex 8-year rotation was devised, allowing four years of fallow which assisted in the demise of weed growth when the land was not watered. New emphasis was put on pulling out ratoon cotton, plants which grew on the previous season's roots and which had been found to harbor the blackarm bacteria. New seed was brought from Egypt and treated with ababit, a mercuric disinfectant. Finally, R. A. Lambert, a botanist at the Research Farm, developed a new strain of cotton which grew well in the Gezira and was resistant to both blackarm and leaf curl. The 1934-35 season marked the turning point from the series of bad crops to a period of high yields; prices however
did not surpass the 1925 level of 18 pence per pound until 1947.

The failure of technology naturally had repercussions on the return to finance capital. The tenants went heavily into debt as the return on the cotton crop did not cover the agricultural loans advanced them by the company. The Syndicate suffered a loss in 1931, and paid no dividends in 1931 and 1932 and minimal dividends the following years. The Sudan Government ran deficits throughout the 1930's: the Government's direct return reached a cumulative deficit of £2.4 million in 1939 and did not show a cumulative surplus in 1945. In the years of depressed prices and yields, the Scheme was probably saved by the indirect income earned by each partner: the tenants by the dura and lubia crops, the Syndicate by the interest it was allowed to charge cultivators on its agricultural loans, and the Government by freight charges and export duties on the Gezira crop.

It was only in the post war era when cotton prices finally recovered that the Scheme fulfilled the promise envisioned by its early planners. In the last four years of the Syndicate's involvement, the Scheme earned more than it had in the first twenty-one. The Government's cumulative direct profit rose from £1 million to £16 million, the average annual tenancy profit from £30 to £300, and the shareholder's dividend to 15%. The Scheme had finally proved that each factor of production was capable of earning a return high enough to warrant its commitment. That the Scheme had been able to weather the Great Depression however, is probably even
better testimony to the intrinsic soundness of the concept of a large agricultural project on the Gezira Plain.

The Gezira Scheme served as an inspiration for administrators throughout Africa. Its carefully chosen site, extensive pilot phase, plentiful labor supply, experienced management, well designed irrigation network and competent research staff combined to produce high returns for all of its participants. The Gezira example was particularly impressive to the planners of the late 1940's, many of whom applauded Gezira's post-war prosperity while remaining unaware of earlier trials and disappointments. Many subsequent projects, especially those whose designers copied the forms established at Gezira without understanding the substance they represented, were unable to match the achievements of the Gezira Scheme.
GLOSSARY FOR SELECTED ARABIC TERMS

Ardebb  
a measure of weight for dura, in the Blue Nile  
equal to 560 pounds, elsewhere in the Sudan  
equal to 336 pounds

Dura  
Sorghum vulgare, a millet, the primary food  
crop in the Sudan

Feddan  
an area of land, equal to 1.038 acres

Kantar  
a weight used for cotton, equal to approximately  
100 pounds of ginned cotton

Khalifa  
the Khalifa Abdallahi, successor to Muhammad Ahmad,  
the Sudanese Mahdi, as leader of an independent  
Muslim state in the Sudan at the end of the  
nineteenth century

Lubia  
Dolichos Lablab, a bean grown principally for  
fodder

Sakia  
the traditional ox-powered waterwheel; saquia-  
lands are lands watered by a waterwheel and  
are therefore continuously settled and cultivated

Saquia  
the village representative responsible for  
agricultural management of tenancies
CHAPTER V

THE COLONIAL ERA

The success of the Gezira Scheme served as an inspiration for large scale agricultural projects, especially in colonial Africa where administrators envisaged recreating Geziras in their own territories. Enthusiasm for such projects rose still further after the Second World War when the seeming availability of large tracts of virtually empty but potentially productive land suggested a solution to European post-war food shortages. Following the biblical injunction of turning swords into ploughshares, planners attempted to mobilize for agricultural development the same resources of capital, men and machines which had won the war. Unfortunately, the process was more complicated than most realized and few of the projects initiated in the 1930's, 1940's and 1950's ever achieved the long-term success of the Gezira Scheme.

LAND

Physical Characteristics of the Site

In nearly all the cases considered in this chapter\(^1\) the government decided on the project's site and crop before

\(^1\)The projects on which Chapter V is based are discussed individually in Appendix I. Source material for each project is listed in the Bibliography under "Case Studies." The projects are arranged alphabetically, by country.
inviting the company to participate. The only exceptions are Firestone's operations in Liberia, where the Liberian Government was interested only in the capital and presence of an American company; and the Bunyoro Scheme in Uganda, where the Protectorate Government wanted to open up a sparsely populated tsetse fly infested area but had no particular crop in mind. In all other cases the government had picked an area it wanted developed and selected a crop it thought would do well; or, especially common in the post-war era, had chosen a crop it wanted delivered to the home market and found a site it thought would be suitable. Once the site and crop were specified, the governments then approached a private or semi-private company to manage the project.

For many of the projects there was little relationship between the choice of crop and the choice of site. The sites of the Gambian Poultry Scheme and the Tanganyika Groundnut Scheme were chosen in order to produce eggs and poultry and edible oils within the Sterling Area for the benefit of the British post-war householder. The Gambia and Tanganyika were chosen because unencumbered land was apparently available and the countries themselves could benefit from agricultural development. Neither site was thoroughly investigated before resources were committed and the effects of the lack of preliminary studies became quickly apparent. In the Gambia, the planners assumed that the timber from the acreage would pay for the costs of clearing and that the land would then supply sufficient feed for the flocks. Local administrators could have informed the London-based directors that Gambian timber has no value
except as fuel, but they were not consulted. The grain yields were approximately half what had been anticipated and in addition the feed was deficient in vitamin B which affected flock fertility rates. None of the three sites of the Tanganyika Groundnut Scheme was suitable for growing peanuts. Techniques had not yet been developed for clearing the type of woody vegetation found at the sites, and where the vegetation was finally removed problems of erosion developed. Rainfall was inadequate and unreliable. Ports, land facilities, storage and internal communications were poor and the sites were isolated. The project was subject to constant delays because of slowness in delivering equipment and spare parts. The criteria of 'unencumbered land within the Sterling Area' was not sufficient to guarantee the projects' success.

Other schemes which suffered from inadequate information about the site were the Office du Niger's project in Mali and the Kassala Scheme in the Sudan. The Office du Niger discovered that rainfall was considerably above the estimates and that it was impossible to grow long-staple cotton in the designated sectors. Further, the concentration of rains to within 40 to 50 days and their unpredictability made it particularly difficult to gauge the amount of irrigation water which should be applied. The area would have been more productively committed to rice whose watering requirements are less particular. Finally the relationship between the rains and the Niger flood was not well understood. Since they generally coincide, irrigation water is not available in the period immediately before the rains when pre-watering would
facilitate land preparation. Ignorance about available water also plagued the Kassala Scheme. The Kassala Cotton Company discovered only after they were well into the Scheme that the Gash flood had been greatly over-estimated. They also found to their dismay that there was no way that the Sudan could prevent the Italians from building a dam upstream and siphoning off their share of water. The result was that there was sufficient water to irrigate 18,000 rather than the expected 100,000 acres in the Gash Delta.

In some instances developers were able to compensate for the shortcomings of the site. The Kassala Scheme was scaled down to match the available water. Since the smaller scheme could not support the company's overhead, its management was assumed by a Board of the Sudan Government. The irrigation system in the Mali project was redesigned with irrigation canals converted to drainage ditches. The adjustments improved the system, but efficiency did not reach the level which would have been possible if the original design had been appropriate to the climate of the site. In the Groundnut Scheme, large sums were spent on infra-structure to improve transport and communications systems. Methods for clearing the vegetation were eventually developed, although only after expensive delays. The project was never able to compensate for the inadequacies of the water supply and its directors finally shifted to separate experimental projects of mixed farming and livestock. The Gambian project was reduced to an experimental farm and then abandoned altogether.
Pilot Projects

After the well-publicized failure of the Tanganyika Groundnut Scheme, planners began to be somewhat more cautious in initiating their projects. The Richard Toll project in Senegal and the Niari Valley development both included pilot farms as a stage in development. In the Niari Valley however, the Grand Moulins de Paris (a private French company) was asked to begin production in 1949 concurrently with the establishment of the experimental farm by the public research institute, Compagnie Generale des Oleagineux Tropicales (CGOT). Thus a pilot project was operating to discover the best methods of growing peanuts, but the results were not available when GMP was expected to be in full production. In 1954, GMP shifted from peanuts to sugar and after three more experimental years, was able to develop viable methods of commercial production. GMP would probably have saved substantial sums if it had been allowed to postpone its activities until after CGOT had achieved some success at the CGOT experimental farm.

An unusual conflict concerning the necessity for caution arose at the Bunyoro Agricultural Scheme between the Ugandan Protectorate and the managing company, Mssrs. Steel Bros. The government was very aware of the Groundnut Scheme failure and insisted on extreme caution and prior accumulation of data. They stipulated however that the costs of collecting the necessary data should be charged to the project rather than their agricultural department. Steel Bros. were more conscious of the known costs of research, management and clerical staff
than of the possibly higher costs of errors due to ignorance. They pointed out that a breakeven point would not be reached until larger areas were brought under production, and urged rapid expansion. The company eventually withdrew, stating that they did not envisage a commercial success for the project in the foreseeable future.

The experience of the Firestone Plantation in Liberia is a more positive example of the potential value of pilot projects. Firestone was fortunate in being able to take over an already existing although overgrown rubber plantation at Mt. Barclay. That estate was used first as a pilot project and later as a nursery for the larger plantations at Harbel and Cavalla. Firestone was thus able to experiment with various growing techniques before undertaking large scale clearing operations. When the depression caused rubber prices to topple, Firestone stopped planting and tapping in Liberia. They used the pause in operations profitably however, by developing a long range research program. By the time production had resumed in 1934, the Firestone laboratories had determined that the most cost efficient method of expanding production was by grafting high yield clones onto the native root system rather than by expanding acreage. The effectiveness of the Firestone research program and its ability to produce its findings before large investments were made in unproductive or more costly directions, has been one of the keys to Firestone's prosperity in Liberia.
Land Ownership and Native Rights

Most of the projects of the colonial era were situated in sparsely populated areas. Their aim was production rather than agricultural development and employment and the designers opted to deal with the problems of labor recruitment and mechanization rather than the social and political problems of alienating large numbers of people from the land. Exceptions were the Kassala Cotton Scheme, which did then encounter problems of native rights and local resentment; and the Bunyoro Scheme where the Bunyoro Native Government was made a partner in the enterprise. In the latter case, the return to which the contribution of land valued at L 20,000 entitled the Native Government was a heavy drain on the project's resources and one of the reasons for its demise.

The attempt to avoid problems of alienation by choosing unpopulated sites and substituting a high level of mechanization for large quantities of labor, foundered on the inadequacies of both the machinery and the site. The designers of the Congo's Niari Project, Mali's Niger Project and Senegal's Richard Toll assumed that a high degree of mechanization would compensate for the sparse population. They found mechanization to be both an expensive and often an inadequate alternative. The managers of the Tanganyika Groundnut Scheme found that their chosen sites were sparsely populated because the native peoples had avoided them for good reasons, among them tsetse fly, poor soil and insufficient and irregular rainfall.
In the colonial period, administrators were not as sensitive to charges of exploitation as they would be in the era of independence. Even so, the only example of actual land purchase rather than lease was in the Niari Valley. In all other instances land was either leased to the company or title was held by the government. The British in particular wanted to avoid the problems they could see developing in Rhodesia and went to considerable trouble to avoid granting land titles to foreigners. They carried this philosophy to the extreme in Tanganyika where the government was unwilling to entrust the management of the Scheme to the United African Company for more than one year. Unfortunately in the transfer between the UAC and the public Overseas Food Corporation, much valuable experience was lost.

Errors concerning the choice of site have been common, especially in the post-war era. Most were due to carelessness and a lack of understanding of the importance of the decision. The administrator's faith in the ability of western technology to overcome all obstacles was at a high point. It took time to discover that the relevant question was not "whether" technology could triumph over the difficulties of a site, but "at what cost".

LABOR

Quantity and Quality of the Labor Force

The population density of the project site defines in large measure the kinds of problems which are likely to arise in the recruitment of a labor force. All of the colonial
projects were located in sparsely populated areas, so that all but two avoided controversy over native rights and none created a great body of displaced unemployed, dissatisfied peasantry. Instead, the sparse population implied a problem of labor scarcity which the companies tried to overcome through tempting incentives, recruitment from more populated areas and a high degree of mechanization.

In most projects, the designers assumed that the high yields which modern technology would make possible, would provide sufficient incentives to attract local farmers to join the project, either as laborers or tenants. This had been true in Gezira where the contrast between the irrigated agriculture of the scheme and the rainfed crops of neighboring areas offered sufficient incentive for Sudanese to participate in the project. The contrast was not sufficiently striking in many later projects, especially those which did not involve large scale irrigation works.

An example of the difficulties encountered in attracting local labor was the experience of the Mokwa Scheme in Nigeria. Since the Scheme was located on tribal land, Nigerian administrators assumed that traditional leaders would be inalterably opposed if settlers of non-Northern origin were accepted as laborers or tenants. Unfortunately the Northern Province was not heavily populated, and the Mokwa area itself was poorly regarded: soil was poor, water was scarce, and animals did not thrive. There was no compelling land hunger; nor was there evidence, once the scheme began, that a man would prosper more by joining the project than by farming independently. The
original plan for the project included an initial period of
direct farming with hired labor so that technical problems
could be resolved before dividing the project into tenancies.
The managers discovered that hired labor was inordinately
expensive given the yields achieved, and decided to move
directly to tenant farming as an inexpensive method of hiring
labor. This was a mistake since prospective tenants believed
that they were being expected to rescue a proposition doomed
to failure and were even more reluctant to associate themselves
with the project. The managers of the Bunyoro Scheme in
Uganda also shifted from direct to tenant farming in hopes of
cutting labor costs, and met with a similar lack of success.
They discovered that in areas where there is no particular land
hunger, a project which cannot afford competitive wages for
hired labor cannot offer sufficient incentives to attract
capable tenants.

An alternative to paying high wages to disinterested
or reluctant local laborers is the importation of workers from
more heavily populated areas. Several project managers
chose this option but their ability to avoid unfortunate social
or political consequences varied. Firestone's plantations in
Liberia were located in the non-tribal coastal zone and the
local inhabitants had no objections to non-local recruitment
of labor. Firestone embarked on a major recruiting effort
which involved sending recruiting agents through tribal areas
to convince chiefs to permit workers to migrate to the planta-
tions and paying the paramount chiefs $1.50 a year per man.
Firestone has also been able to attract workers by establishing
a policy of paying the highest prevailing wage in the country for skilled and unskilled labor, and by providing its workers with housing, health facilities, education and subsidized food. 

Local attachment to the land was considerably stronger at the Kassala Scheme in the Sudan. The Hadendowa, the traditional owners of the Delta, were essentially pastoral and few had any real enthusiasm for participating in a cotton scheme. Those who accepted tenancies retained their herds and the division of their attention between their tenancies and their cattle made them indifferent tenants. In contrast, the immigrants from West Africa and the Nile and Red Sea coast areas of the Sudan were capable and conscientious cultivators, and therefore greatly favored by the company. When the acreage available to the project was cut, it became clear that there was not enough room for both the indigenous tribesmen and the 'foreigners' and that the Scheme involved a serious curtailment for the herdsman of his access to water and pasturage. By the third year of the Scheme, the Hadendowa's objections to the infringements on their traditional rights had taken a violent turn and the government, fearing widespread disorder, offered the company a concession in the Gezira and took direct control of the project. Responsibility for the scheme was assumed by a government board which was expected to operate on commercial lines but show greater flexibility in its dealings with the indigenous inhabitants.

Another solution to the problem of labor scarcities is the incorporation of a high level of mechanization. Mechanization is an especially good substitute for hand labor in
clearing operations, ploughing and ridging, but proved less valuable in many schemes for sowing, harvesting and the tedious job of weeding. In the Nigerian Mokwa Scheme, where mechanization had been expected to allow each settler to cultivate 24 acres rather than the traditional four acre plot, planners found to their dismay that only ploughing and ridging could be mechanized. All other operations (clearing, sowing, harvesting and weeding) were better done by hand, and there was no way a farmer could work his assigned plot with the low level of mechanical help available.

Mechanization also demands a technically adept, albeit smaller, labor force. The Tanganyika Groundnut Scheme for example found mechanization an expensive alternative because it involved training programs for workmen and high breakdown rates, partly due to the inexperienced operators. The Gambian Poultry Scheme foundered on breakdowns of its refrigeration equipment at critical points and the lack of local personnel capable of making the necessary repairs. SIAN's highly mechanized project in the Congo did not begin to prosper until management began to place heavy emphasis on personnel training to keep their equipment in running order.

The importation of skilled labor can be either an alternative to training local mechanics and technicians, or, more commonly, a temporary expedient while locals are being trained. In either case, it is an expensive procedure as the managers of the Groundnut Scheme discovered when they added the high wage scales to the costs of providing housing and amenities acceptable to foreign labor. The Gambian Poultry
Scheme recruited 40 semi-skilled workers from the Bahamas to help train Gambians in the care of poultry and the operation of large scale production of eggs and meat. Friction arose between the two groups as native Gambians did not understand the reasons for the pay differential between the two groups since both were doing essentially the same work.

Provision of Social Services

The provision of social services in an undeveloped region for large numbers of workers has been an expensive burden for a number of schemes. The Firestone enterprise was sufficiently profitable that the company was able to provide a full range of health and educational facilities and housing. They used the availability of these services as a major incentive to attract workers to the plantation. For less profitable projects, the need to provide social services was an added burden. The Groundnut Scheme found it both expensive and frustrating. It was never able to establish enough of a normal social context to attract workers and their families. Instead the site retained the aura of a boom town, and the reputation of an area suitable for batchelors only. It was thus a very volatile labor force with no particular attachment to the project, all of which increased the expense of providing technical training.

The labor problems which the project designers created for themselves by their choice of site were some of the most frustrating and costly in the projects' experiences. They had
unforeseen technical, social and political implications and effectively destroyed the myth that Africa would be an area of empty land and cheap labor, awaiting only the application of western technology to become agriculturally productive.

CAPITAL

Physical Capital

Of the two types of capital, capital goods and financial capital, the former presented by far the greatest problems for the colonial schemes. Most of the schemes were conceived in the metropole and financing for at least the initial stage was not difficult to arrange.

In several projects the machinery which project designers had assumed would mechanize operations had not yet been developed. Methods of clearing vegetation at the Tanganyika Groundnut Scheme for example, were developed slowly only after numerous trials with various pieces of equipment. The lack of harvesting machinery for peanuts (groundnuts) hampered both the Groundnut Scheme and SIAN's operations in the Congo. Managers in Nigeria discovered that little of the machinery required to mechanize the Mokwa Scheme had been invented. Given time, modern technology can generally devise appropriate machinery; but this does not imply the existence of all types of machinery at the moment when it is first needed.

Other types of technology also have to be adapted. All the schemes had to experiment with crop varieties to find types which were appropriate to the climate and resistant to
local diseases. Senegal's Richard Toll project for example started with 1500 varieties of rice, searching for a high yield variety which would mature uniformly so that it could be harvested mechanically. The Gambian manager discovered that the housing designs which had been appropriate for poultry in the Bahamas withstood neither the sun nor tropical rains in Gambia and left the fowl vulnerable to disease. SIAN experimented for three years before finding a crop/fertilizer combination which would result in high sugar yields in the Congo.

One of the drawbacks to the problem-solving capacity of Western technology is that it tends to obscure cost considerations. Technicians eventually can find productive crop varieties, devise defenses against disease and pests, and develop suitable machinery, but experimentation is expensive especially when done while the project is supposed to be fully productive rather than in a pilot project. In addition, western machinery is able to open up large tracts of land, by clearing machinery and irrigation works, and offers the prospect of cultivating substantial areas with machinery rather than massive labor forces. In several places - Mali, Tanganyika, Nigeria and Senegal, for example - the ability of the machinery to bring large areas under cultivation was not matched by an ability of the project to pay for the machinery. Enthusiasm for western technology led to an overcapitalization of the projects. The level of productivity possible on marginal land was never able to support the level of mechanization necessary to bring it into production.
Financial Capital

The colonial projects were financed by funds from several sources, both public and private. There were no large international organizations lending development funds to this area, but the metropolitan powers had established lending agencies for agricultural development within their empires. The individual countries had some funds at their disposal and in some instances the private companies provided investment capital.

Investment by the managing company does provide incentives for the company to manage the enterprise efficiently. In the Congo for example, once the parent company was convinced to stay by the French authorities, it re-organized its management to avoid further losses and eventually did create a profitable enterprise. In the Richard Toll Rice project, the private company which had invested nothing in the project, had no particular incentive for efficient management, and simply informed the Senegalese Government that it wished to withdraw. Public management was able to cut the losses of the project substantially, although unfortunately not before it became cheaper to import rice than to grow it locally. If the company had had funds invested in the project, it might have been sufficiently interested in the project returns to assure that management was as cost effective as possible. As it was, it could simply withdraw with no loss to itself; even if it had stayed, since the government was underwriting all deficits, the company had no incentive to re-organize management.
From the country's point of view, there are negative aspects to private investment. The Liberians had few complaints concerning the financial benefits of Firestone's rubber plantation. Many however, deeply resented some of the conditions of the contract and were concerned that Firestone would be able to exercise an undue influence in Liberian political affairs. The Ugandan protectorate was disappointed to learn that the private companies were not willing to subsidize major social change at their own expense, especially when the return from the project did not cover the normal operating costs.

There were several projects which might have become profitable if the management had persevered rather than closing the scheme. Nations generally can absorb losses over a longer period than can private companies, and one could expect the directors of publicly financed projects to take a longer view than privately financed companies. In the case of the Tanganyika Wattle Scheme, the company withdrew when it appeared that wattle (a product used for tanning leather) would not be able to compete on the world market. The Tanganyika Government and the publicly financed Colonial (Commonwealth) Development Corporation (CDC) continued the project and diversified into wheat and maize. Eight years after the company withdrew, the enterprise had eliminated its accumulated deficit and was able to pay dividends to its stockholders.

Government sponsorship does not always result in a long term successful venture. In retrospect, it would seem that a scaled down version of the Gambian Poultry Scheme could have covered its expenses. The CDC however was under considerable
political pressure to abandon unprofitable enterprises, and
decided not to prolong the experiment. The Tanganyika Groundnut
Scheme and the Mali Niger Project are two examples where the
availability of public funds led to a continuation of uneconomic
projects. The Niger Project, which was subsidized by the French
for years, is a good example of bureaucratic oversight whose
criteria are unrelated to the standards of commercial success
and corporate efficiency.

Government/Company Relations

The division of responsibility for different aspects
of the project hampered the effective management of several
projects: the Nigerian Mokwa Scheme, and the Tanganyika
Groundnut Scheme for example. The governmental choice of a
sparsely populated site simplified the political and social
problems of native rights and employment for the government.
In many cases however, this decision complicated the task of
recruiting an adequate labor force. Staffing the project of
course was the responsibility of the project management, and
the government seemingly had little concern with the labor
implications of their site choice, possibly because labor
recruitment was not a sphere of governmental responsibility.
Further, in setting the sparse population as a primary criterion
for locating the project, governments tended to ignore the
physical properties of the site which would make its development
as an agricultural enterprise feasible. Problems which might
arise in connection with soil fertility, water, transportation
and storage facilities were again the company's responsibility.
Another area where the assignment of responsibility was a problem was the area of crop research. In the Congo the French authorities enticed GMP to purchase a concession with the assurance that the government-sponsored CGOT would provide the technical expertise for cultivating groundnuts in the Niari Valley. Neither the government nor GMP realized however, that CGOT had not yet developed the required technology, and would not be able to provide it to private companies for several years. More frequently, the company was expected to provide advanced technology for the project, and given this expectation, in a number of projects the governments apparently erred in their choice of managing companies. In the Ugandan Bunyoro Agricultural Scheme, the Sudanese Kassala Scheme and the Gambian Poultry Scheme, the companies had managed agricultural projects but had had no experience in the local area. In the Richard Toll project, the company had local experience, but in construction rather than agriculture. In the Tanganyika Groundnut Scheme, the United African Company had little experience in the region of the chosen sites and none in cultivation. Thus none of these companies had immediately available a technical expertise which they could apply to the project. The division of responsibility between company and government and the unreadiness of each to undertake those responsibilities in the project was the downfall of many of the ventures of the colonial era.

Most of the projects of the colonial era were disappointing to their designers. They neither provided the markets of their European sponsors with the expected massive increase of
produce, nor their local governments with a substantial increase in revenue. In addition, they were far more costly than planned, and the problems they presented were far more complex than anticipated. The vision of re-creating Geziras throughout Africa did not materialize. By 1959, an observer of the Groundnut and Gezira Schemes as well as other projects in Africa would rationalize

Having said all this and having added the thought that the Gezira Scheme is outstanding because of its success amidst failure in large-scaled agricultural development, it must again be reiterated that the setting, circumstances and conditions are special and could only rarely be found similarly associated again in Africa.²

This attitude was common among administrators of the late colonial era, and most recommended that governments abandon the concept of large-scale agricultural projects, and concentrate on programs of rural education. Few were willing to recognize that, while the circumstances of the Gezira Scheme had been particularly favorable, many of the projects of the colonial era had failed because of administrative errors in judgment. Sites had been carelessly chosen, with little regard for their suitability for the specified crop. Machinery and technology had been poorly adapted. In their effort to avoid

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political problems of native alienation, administrators had created insurmountable problems of labor recruitment. That most of the projects of the colonial era had failed was only too evident; that large-scale agricultural projects, with or without the participation of private enterprise, could not succeed, had not been proved. Planners in the era of independence would test the concept again.
CHAPTER VI
THE ERA OF INDEPENDENCE

The revival of interest in contracting western companies to manage large scale agricultural projects in Africa and the Middle East seems somewhat paradoxical in the era of independence. Exploitation by private corporations had been considered one of the worst features of colonialism. Certainly the leaders of the various independence movements were committed to removing all traces of western corporate influence from the economies of their newly liberated homelands. Most also embraced programs of agrarian reform which included the fragmentation of large estates and the development of the peasant farmer, either individually or cooperatively. By the late 1960's and early 1970's however, many of these leaders had begun to accept the agricultural expertise available from private American and European companies. The change in attitude stemmed from a variety of reasons, both economic and political.¹

While few of the post-war large scale projects achieved any notable success, their failure is generally shared by most of the alternative approaches to agricultural development. The adoption of modern agricultural methods spread by government

¹For a discussion of the international political reasons for employing Western agribusinesses in Third World agriculture, see Robert Springborg, "New Patterns of Agrarian Reform in the Middle East and North Africa," Middle East Journal, XXXI, 2 (Spring 1977), 127-142.
extension workers has been slow, retarded by shortages of trained staff, misunderstandings about peasant needs and aspirations, and inadequacies in the technology available to be taught. Settlement schemes have disintegrated, often because of poor planning, misguided objectives or mismanagement. Cooperatives have generally disappointed their supporters in Africa; collectives have been judged unsuitable for the African or Middle Eastern context.

Secondly, the reputation of western agricultural technology has reached a new high. The Green Revolution has re-awakened an awareness of the potentialities inherent in scientific advances rigorously applied. The various agricultural research institutes have now been in existence long enough to formulate strategies which can increase the productivity of tropical agriculture. The barriers to increased production seem to lie in the application of the new techniques, and large scale projects managed by the companies which are developing the agricultural technology seemingly unites the technology and its application.

Third, the example of the United States has influenced attitudes in the Middle East and Africa towards developing the agricultural sector. The U.S. has been able to combat the rise in petroleum prices by an increased export of agricultural products. In current terminology, the U.S., as an exporter of agricultural products, is an 'agro-power,' not merely a producer of primary goods. Further, the U.S. has achieved this status by apparently abandoning the concept of the family farm for that of the agribusiness. Third World countries can hope
to duplicate the American success in balancing its international obligations by hiring western agribusinesses to develop their own agricultural sectors for export, or at least, for significant import substitution.

Another factor which has contributed to the renewed interest in private enterprise and large scale farming in the Middle East and some countries in Africa is the availability of development funds. Oil revenues are being liberally used for development in the Middle East, and through various funds, are being lent to sympathetic African states for development. The influx of large amounts of capital has re-awakened the post-war concept of substituting money for time in development. The hiring of western companies is thought to be perhaps expensive in the short run, but can save generations of time in increasing production in the agricultural sector. While a few large scale projects relieve the burden of production needs, rural development can then concentrate on social and economic benefits for peasant farmers, rather than the economic demands of the nation as a whole.

A final factor is the rise of technocracy in independent Africa and the Middle East. Over the last fifteen years, the revolutionaries who obtained independence for their countries have, for the most part, been replaced by leaders whose interests are practical rather than ideological. Concepts like neo-imperialism and arguments between socialist and capitalist approaches are irrelevant. Confronted by problems of over-population, malnutrition, unemployment, low productivity, poor management and untapped resources, these leaders are more
insistent that solutions be practical than that they be ideologically pure. To them, contracting western firms to develop the agricultural sector, is just one plausible answer, or partial answer, to a series of complex inter-related problems.

For some or all of these reasons, by the mid-1970's the process of affiliation with Western corporations which had begun with the purchase of machinery for industry had reached the point of commissioning private companies to finance and manage agricultural projects. Ghana has asked the Volta Aluminum Company, owned by Kaiser and Reynolds, to organize a rice plantation using irrigation water from the Volta Dam hydroelectric project. A Georgian firm, the Food Machinery Corporation, has organized the beginnings of a livestock industry for the Sultanate of Oman. Senegal, despite its disappointment with the efforts of private enterprise in the 1950's, has contracted Hawaiian Agronomics to plan a sugar complex at Richard Toll, and the Bud Antle Company to grow winter fruits and vegetables for the European market. Even countries with such impeccable socialist credentials as Iraq and Egypt have contracted American companies to raise cattle, plant citrus groves and establish sugar plantations. Like their predecessors, these more recent projects are having a varied success in achieving their goals.

LAND

Physical Characteristics of the Site

The pattern of government choice of crop and project site followed by the involvement of the private company persisted
in the era of independence. The companies continued to have little influence on the choice of site. At most, a company would adjudge a designated site during a feasibility study as desirable or unsuitable for growing a specified crop. While the governments generally have some reason for expecting that the desired crop will do well at the chosen site, the compatibility of site and crop has not necessarily been the highest priority in the choice.

In the Senegalese groundnut scheme, the three administrative regions chosen for the project were areas where groundnuts had traditionally been produced. The aim of the project was an increase of output rather than the introduction of a new crop. The technology the planners hoped to impart had been developed in and for that part of Senegal, and there was every reason for confidence that total output could be increased if the new technology were rigorously applied. The Sudanese Blue Nile project was located on rangeland which historically had been used for raising livestock. However, where the plan envisioned the establishment of large and small scale cattle and sheep ranches, the nomads of the area are primarily known for their camel herds. Since the project has not evolved beyond the proposal stage, it is difficult to know whether the project administrators will be able to wean the local tribesmen away from the one animal in which they have a

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2 The projects on which Chapter VI is based are discussed individually in Appendix II. Source material for each project is listed in the Bibliography under "Case Studies." The projects are arranged alphabetically, by country.
considerable financial and emotional investment. In both cases, the problems which arose or could arise with the choice of product and site are not climatic or pedological, but stem rather from judgements made by local inhabitants concerning the desirability of the product for the region.

The choice of development sites in Iran was based primarily on political and historical criteria, rather than economic and agricultural. Khuzestan was a center of ancient Persian empires and its development is seen as part of the restoration of the historical glories of Iran. The production of sugar was an idea inspired by the knowledge that Khuzestan was famous for the production of sugar cane in the 12th century. In addition, Khuzestan is the source of much of present day Iran's oil wealth and the government judged that it would be politically desirable if some of that revenue was returned to the province in the form of development funds. Once the decision was made that a major effort would be focused on the development of Khuzestan, the Development and Resources Corporation surveyed the province for likely dam and agricultural sites. The specific site of the Haft Tapeh sugar project was selected because it was within the area to be irrigated by the Dez dam where the soil was considered appropriate for sugar cane. The site was fairly far north and entailed a danger of frost. The third year of production, this danger was in fact realized and a promising crop damaged. Designers remained convinced, however, that, given the general location of the project, in the trade-off between the better soil conditions
and the more northerly climate, the problem of occasional severe frost was an acceptable risk.

The site of the Mumias Sugar Scheme in Kenya was chosen primarily because the Mumias township was an area of high unemployment and low agricultural productivity. Local farmers grew some sugar, so that the government planners were fairly certain sugar could be grown economically in the region. Most peasant production was converted into alcoholic beverages, and the local problem of rural drunkenness provided another reason for siting the plantation at Mumias: its factory would provide an alternative market for the native grown cane.

Planners are generally fairly aware of other siting criteria such as proximity to markets and availability of transport, processing and storage facilities. The core of sugar estates is the mills and refineries. One problem at both Mumias and Haft Tapeh however, was the development of transport arrangements from the field to the mill. Transport of refined sugar from the estates to their markets was considered during the projects' planning phases: for example, the easy access to rail transport, provided by a ten mile spur to the main line, was a major consideration in the choice of Mumias as the site for the project. Planners were somewhat less conscious of the potential infrastructure problems in the Sudan. The improvement of 250 miles of stock routes was incorporated into the regional plan to assist the movement of livestock to quarantine stations, market places and the slaughterhouse and cannery complex. The construction of processing facilities (slaughterhouse and cannery) was also integrated into the plan.
However, the plan has overlooked the severe national problems of transport which has been called "the most visible and damaging bottleneck in the economy."\textsuperscript{3} Motor transport is often immobilized by gasoline shortages, all weather roads are rare and the railroad is already used to capacity. The situation should improve with the construction of a petroleum pipeline and all weather road from Port Sudan to Khartoum and the creation of a road network around major agricultural centers, but until these are complete, projects which entail production for export may face damaging delays in moving their product to the export outlets.

Pilot Projects

The contrasting experiences at the Haft Tapeh and Mumias sugar projects underline the continued benefits of pilot projects. Bookers Agricultural and Technical Services (BATS) carried out a three year feasibility study and pilot project at the proposed site in Kenya. During those years, basic decisions were made concerning production techniques in the Mumias context. Once the project was officially inaugurated, there were few problems of production. The project at Haft Tapeh was initiated to provide early tangible evidence of the benefits of the Khuzestan regional development plan. As such, there was no time for Hawaiian Agronomics (HAI) to conduct a

pilot project. One result however, was that the first three years of the Haft Tapeh project were disappointing. Years that had been planned as an example of high productivity were in fact spent adapting machinery and correcting errors in land preparation. Productivity did not approach the level HA.I had been able to achieve in other parts of the world until the fourth year of production.

Land Ownership and Native Rights

Questions of the ownership of the land used for the project and therefore the division of the benefits from the project were posed in different forms in the different projects. The Kenyan sugar project and Sudanese cattle project were sited on tribal land. In Kenya the difficulties in acquiring land for the nucleus estate created a major delay in the early stages of the project. Eventually the government simply expropriated the necessary acreage. Those farmers with some claims to land within the estate were given compensation and most purchased land nearby. They were encouraged to join the project as "outgrowers," and produce sugar under the guidance of company and government extension workers for sale to the estate factory. In the Sudan, all land legally belongs to the government and presumably the government would exercise its right of eminent domain to establish the Er Roseires million acre ranch. Unless the nomadic population can be tied closely and profitably to the ranch, however, it is easy to predict social and political problems for the region.
The Senegalese program aimed at increasing the productivity of already existing farms. While there were not great economic disparities between farmers, the project did draw a distinction between those farmers who possessed larger amounts of land and draught animals and those who did not. Different techniques and levels of mechanization were proposed for the two groups, with the former being expected to contribute most to production targets. Thus one result of the project was to accentuate and widen the economic differences in the Senegalese countryside.

The context of land ownership has changed twice in Iran during the life span of the project and the lack of stability results in considerable confusion over the intended social goals of the entire regional program. The construction of the Dez dam and irrigation works was originally intended to increase general productivity, with benefits increased in proportion to the traditional landlord tenant relations: 20% each to the landlord, water owner, owner of draught animals, provider of the seed and the worker. The laborer/tenant usually received about 40% of the return. Under the new arrangements the Khuzestan Water and Power Authority would receive 20% of the return in water fees as the 'provider of the water.' For most of the area irrigated by the dam, the regional planners assumed that the shares in the return would remain the same, but that irrigation would considerably enlarge the return to be shared. In contrast, the land for the Haft Tapeh project within the irrigated area was simply purchased from a large
landholder with his tenants presumably becoming part of the project's workforce.

In 1962 the Shah's land reform program limited each landlord to one village and a maximum of 500 acres. The remainder of the land was deeded to the tenants, to be purchased over a 25 year period. The peasant could then expect to receive the total return from his farming operations, from which he could pay KWPA for water, the government for the mortgage (approximately 10% of the return) and finance the capital and operating expenses of running a small farm. The difficulty, as seen by the project's designers, was that the extension work required to increase the productivity of thousands of individual farmers proved to be enormously expensive. By the mid-1960's the government decided rather to expropriate 65,000 acres of land below the dam and assign it to large scale privately owned corporations.

The expropriation of land newly granted to small peasant farmers would seemingly be the grounds for serious political unrest. The Iranian peasants however, have been apparently indifferent or favorable to the move. Their attitude is conditioned by the fact that they never believed that the land reform did more than substitute the government for their former landlords. Secondly, those displaced have been compensated and moved to model villages and for the first time are enjoying the luxury of electrification. Third, most

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4Conversation with Thomas Mead, Development and Resources Corporation of New York, 26 November 1975.
peasants consider the livelihood attainable from the corporation estates and the Khuzestan petro-chemical industry superior to that of an individual subsistence farmer. The only exception to the generally favorable attitude has been the resentment directed towards one company which cleared the peasants from its entire concession and then only planted part of it; in that case the peasants saw that they had neither their farms nor the anticipated number of positions with the company. The instability of the land ownership situation has had one major disadvantage. Medium-sized farmers have been reluctant to develop their land, first because of fears that it would be expropriated by the land reform, and later because of fears that it would be expropriated and made part of a large concession. The uncertainties of the middle class landowners have undoubtedly resulted in lost agricultural production for Khuzestan.

LABOR

Quantity and Quality of the Labor Force

The availability of labor for agricultural projects and government attitudes towards labor have changed in recent years. Governments have become more concerned about problems of employment and less about alienation of tribal farmers from the land. One reason for this change in attitude is the problem created by the migration of the rural population to the cities, where they swell the numbers of the urban unemployed. The migration is an indication of a weakening of the link between the rural people and the land, and of an awakened desire for
well paying jobs. Therefore there is a greater tendency to place projects in well populated regions in hopes of providing rural employment and under the assumption that the potential problems of alienation will not be insurmountable. In addition, today's planners are less apt to identify modern techniques with capital intensive techniques. Where desirable, they actively promote labor intensive methods in modern agricultural projects.

Most projects expect to obtain the greater part of their labor supply from the local farmers. The Mumias project is a good example of a decision to locate a project in a well-populated area in order to provide job opportunities in the rural areas. The process of acquiring land in the populated setting was difficult and eventually the government was forced to exercise its right of eminent domain and expropriate land for the nucleus estate. Farmers were compensated and most either purchased land nearby and were incorporated into the project as outgrowers, or obtained jobs on the estate or in the factory. While local farmers had some experience in growing cane, they were not trained in modern agricultural methods or for factory work. The Kenyan Agricultural Ministry expanded its extension work and with the aid of a few field workers from BATS, trained the local farmers in more modern methods. The company sends cultivation units to plough, harrow and furrow outgrower plots, provides planting material and fertilizer, and organizes the harvest and transport of the cane. The extension workers train the farmers in the value and methodology of clearing, planting, fertilizing and weeding
their acres. The company is responsible for training the members of the cultivation units and harvesting groups (the latter often the same local farmers whose crop is being harvested), and for organizing and training all factory personnel. Labor policy includes an ongoing program of recruiting Kenyan citizens to fill as many positions as possible within the company, and "a maximum use of labour commensurate with efficient production."\(^5\) Harvesting, for example is done by hand rather than by machine. Thus the Kenyan policy has been one of placing the project in a heavily populated area of traditional farmers, and then working on the problems of land acquisition and training that such a choice implies. More positively, this approach has forestalled problems of recruiting adequate numbers of workers for the project's labor force.

The Senegalese project also intended to use local farmers. Since the goal was solely to increase the productivity of existing farm units, there was no nuclear estate and therefore no problems of land acquisition. SATEC established an intensive network of extension workers, recruited from among the local peasants. A major thrust of the program was the training of these extension workers in agricultural methodology and communication techniques. The 700 extension workers in turn instructed the farmers of the eight or nine villages in their districts. The use of peasants as extension workers

undoubtedly facilitated the communication of the package of techniques between the extension workers and the farmers. However, since most project personnel above the lowest level were initially European, the program began with a significant communication gap between the extension workers and their supervisors. The gap was gradually closed by the Africanization of supervisory positions in the program.

The Sudan project also intends to use local inhabitants as the main labor source in the project. Its designers have not yet thoroughly analyzed the problems of land acquisition from the inhabitants for the Er Roseires Ranch, or the need for substantial training. Nor does the proposal describe the incentives the project can offer to induce the local nomadic people to change their lifestyles sufficiently to become part of a highly structured, market oriented livestock industry.

The siting of the project in a sparsely populated area and the importation of unskilled workers from other areas for the labor force is not an alternative proposed for any of the projects discussed here. Managers do, however, recruit skilled workers for the initial stages of the project until local workers can be trained. This was the case in both Senegal and Kenya, where the original staff was predominantly European but was gradually Africanized. The Sudanese project will also have to recruit skilled personnel from outside the region. The Sudan has a shortage of trained agriculturalists and the extensive agricultural development program has placed a heavy demand on those available. In addition, the project proposal does not suggest a source of factory workers for the slaughterhouse
and cannery. These workers will probably not be local, but will have to be recruited from urban centers some distance away or from among Ethiopian refugees.

Another alternative to the employment of a large local labor force is a high level of mechanization. The Senegalese program has stressed mechanization but emphasized three small items of equipment, a drill sower, disc hoe and mechanical picker, designed to increase productivity rather than displace labor. The Senegalese mechanization program is unusual because it not only established the acquisition of these three items as a goal to be reached by all local farmers, but also designated this degree of mechanization as a level not to be exceeded. Mechanization beyond the stipulated level would begin to replace local labor, and that was not the intention of the program.

The Iranian projects are also highly mechanized, but in Iran mechanization is seen as a substitute for labor. While the natives of Khuzestan are traditionally agriculturists, they do not seem to have a strong attachment to subsistence farming. Planners foresaw that as Khuzestan developed industrially, the pool of underemployed agricultural workers would diminish. They therefore incorporated a high level of mechanization into their proposals. At Haft Tapeh the anticipated level of mechanization was higher than the actual: technicians have been unable to develop an efficient method of harvesting the cane mechanically. The planners' predictions of labor shortages have proved to be accurate. In the full employment situation in Khuzestan, the farm corporations have had some difficulty recruiting an adequate labor force.
A method of labor recruitment which has been almost discarded in the independent era is the large scale use of unskilled migrant labor. Since most countries in Africa and the Middle East have their own development plans, large numbers of foreign workers are generally no longer available for temporary work on agricultural projects. An exception might be the Sudan, whose sparse population, widespread agricultural projects and position on the pilgrimage route between West Africa and Mecca, may combine to create the demand and supply of migrant workers. There are also periodic suggestions that Egyptian peasants could be imported to work on Sudanese projects, a suggestion which generally finds favor with neither the Egyptian fellahin nor the Sudanese nationalist.

Provision of Social Services

The provision of extensive social services for the project labor force is no longer considered a responsibility of the project. Most countries have attempted to provide essential services for their nationals and projects that are situated in well populated areas benefit from already established schools and clinics. At Mumias for example, the company established a small school for management staff and employs a nurse and medical assistant, but primary and secondary schools and a Roman Catholic Mission hospital and a government clinic were all in operation before the inauguration of the project. The Blue Nile project proposal also assumes that social services are a Sudanese government responsibility. The proposal outlines the need for the development of schools and medical centers and
the improvement of child nutrition, food distribution and village water supplies, but suggests that the government contact UNICEF to help prepare the necessary social development plan. The Khuzestan project promoted an extensive public health program, including not only the work force of the pilot project but the entire population of the region to be served by the Dam. The intent of the program was to spread the benefits of development to people beyond those served by the pilot project designated by the World Bank. The public health program was then not a direct charge on the agricultural project, but rather part of the wider regional development plan. In general, most governments consider the provision of social services a public concern rather than the responsibility of an individual project.

CAPITAL

Capital in both senses, mechanical and financial, has become more readily available in recent years for agricultural projects than was formerly true. Part of the technology developed by the tropical agricultural research institutes is mechanical, and in recent years equipment has been developed and adapted for the African and Middle Eastern environment. Advances in education have created a pool of technically trained labor, and thus reduced problems of maintenance and repair of equipment. Financial capital is also available for agricultural projects. In addition to aid provided by European powers to their former colonies, financing can be obtained from international agencies and the United States and the Soviet bloc.
Oil revenues are also a source of development funds, either directly or indirectly through such agencies as the Kuwait-based Arab Fund for Economic and Social Development. Given the amount of public money available for agricultural development, private companies tend to contribute only a minor share of the projects' capital.

Physical Capital

Project designers are more aware than formerly of the costs of over-capitalizing projects and have lost some of their enthusiasm for highly mechanized, complex irrigation projects. The Khuzestan regional project is an exception. The Dez dam is the core of a regional development program and is designed to provide electricity for fertilizer and petrochemical plants, and irrigation and flood control for the plain. The regional plan has achieved a self-generating industrial and agricultural cycle in the region. The oil revenues fund the construction of the dam which in turn provides electricity and water for industrial and agricultural development. The fertilizer factories are based on the natural gas from the oil fields (formerly burned off), and supply the local agriculture. Processing industrials have grown up around the modern agricultural units: Haft Tapeh not only produces refined sugar but sells the cane as a raw material for a nearby paper plant. An important point however, is that the

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agricultural development is not expected to bear the capital costs of the construction of the dam network, but pays only for the operating costs of the irrigation system.

Machinery for tropical agriculture is both developed by public institutes and adapted by managing companies on site. The Institut de Recherche sur les Huiles et Oléagineux and the Institut de Recherche d'Agronomie Tropicale for example, have finally developed a mechanical harvester for peanuts. The mechanical picker was introduced in the Senegal peanut project and effectively relieved the harvesting bottleneck, decreased the reliance on temporary imported harvest labor and allowed the harvest to be postponed until the crop is fully mature even though the ground is too hard for hand picking. The Institutes also developed a drill sower and a disc hoe, the latter a pre-requisite for fertilization. All three items were adapted for use by the individual small scale farmer of the Senegalese project.

Transportation equipment for cut cane was developed by the managing companies on site at Mumias and Haft Tapeh. Expeditious transport from field to mill is especially important for cane because delays cause a reduction in the sugar content of the cane. The problem at Mumias was one of road construction on the nucleus estate, a phase of operations which had not been tested on the pilot project. BATS was forced to experiment with different types of road building equipment after the project was inaugurated before evolving a satisfactory technology for constructing the necessary roads at Mumias. The problem at Haft Tapeh was the unsuitability of the transport
carts. The design of the carts used in the first year of production resulted in considerable spillage of cane between the field and the mill and contributed to an estimated loss of five tons of cane per hectare. The carts were redesigned for the second harvest and the elimination of spillage helped decrease losses to 500 kilograms per hectare.

Yields at Haft Tapeh were also reduced by errors in the layout of fields, a water table that was too high, poor internal drainage and salt accumulation. Most of these problems were corrected by 'reconditioning' and improving the layouts of fields and by the construction of a drainage system which could guarantee a continuous flow of excess irrigation water with deep main drains which returned the water to the Dez River. The water flow prevents the accumulation of salt and has removed the salt left by earlier improper irrigation methods. The HAI managers also admitted that the optimum technology associated with the methods and timing of planting, weed control, cultivation practices and water applications depends on the local environment and cannot be learned from a textbook or adopted from the experience of production in other countries. HAI was able to supply the firm theoretical basis of crop technology, but specific methods had to be developed on site over a number of seasons.7

Financial Capital

Financing for most current agricultural projects is provided by public funds, either national or international. Capital for the Senegal program was supplied by the French Fond d'Aide et de Coopération and the European Development Fund. The loans were part of the Common Market effort to assist former European colonies make the transition between exporting to the narrow protected market of their metropolitan power and selling in the relatively freer Common Market. The Kenyan Mumias project was financed by a package of development funds supplied by the Commonwealth Development Corporation, the Kenyan Government, the Kenya Commercial Bank and East African Development Bank, and the British Overseas Development Administration. In both cases, the public source of funds has tended to divorce project policy from the commercial dictates of profitability. The Senegalese groundnut program was unable to achieve its production targets because individual farmers were unwilling to plant a crop whose price was falling and whose return was less than that of alternative crops. The fact that the program was initiated to increase production to offset lower prices and thus stabilize national export earnings, was irrelevant to the individual farmer. He noted the relative market prices, considered the risks heightened by the drought years inherent in growing cash crops rather than food crops, and switched to millet. The Kenyan project has been more successful and more profitable. However, profitability is not a prime consideration of the Kenyan Government and the
The project will be continued even if the return declines. The government is as much concerned with the scheme's wider and long-term economic advantages and its social benefits as with its immediate profitability. Since sugar prices are controlled in Kenya and the project's goal is import substitution rather than export; and since the capital provided by CDC does not have to be repaid specifically from revenues from Mumias, there are no pressing reasons to insist on commercial profitability.

Ironically, the projects for which oil revenues are theoretically freely available are the ones which developed the most severe financing problems. The oil rich Arab governments are enthusiastically planning the development of Sudanese agriculture: Kuwait for example has proposed a ten year $5 billion plan to increase Sudanese production of cereal, meat and sugar. The Blue Nile project however was stalled by the withdrawal of the American company AZL whose financial difficulties in the U.S. cattle industry has limited its ability to participate in new ventures abroad. In addition, there was apparently some misunderstanding concerning the use of the funds provided to AZL by TRIAD: AZL used them to formulate the development plan, while the project's financial backers expected something more concrete for their money.

The Iranian projects also suffered from shortages of funds. The negotiations between the Iranian Government and

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the World Bank on the financing of the Dez Dam were protracted and frustrating. The World Bank's insistence on governmental reforms and pilot projects, however well-meant, were deeply resented by the Iranians. One result is that once the Iranian became financially independent of the Bank, the Bank has had little influence in guiding decisions on the use of land below the Dam. The Bank does not approve of the decision to allocate 65,000 acres to private corporations for large scale farming, but the Iranians have been largely indifferent to the Bank's opinions. The Haft Tapeh project also suffered from shortages of funds in its early years. The project's need for financing coincided with a cut in the Plan Organization's share of oil revenues and the construction phase of a number of other projects. Haft Tapeh's development area was cut from 10,000 to 6,000 acres. The scheme's managers were able to resist a further cut to 2500 acres and the sale of the sugar refinery to private investors. The poor yields of the project's first three years accentuated the problem because it underlined the difference between the costs of producing and refining sugar at Haft Tapeh, and importing refined sugar from Cuba. Fortunately, for the future of the project, both yields and the general financial position of Iran improved, and the project was continued and expanded.

**Government/Company Relations**

A positive characteristic of recent projects has been a closer coordination between the development efforts of the
governments and the companies. There is less tendency for governments to assume that the project will, or can, operate independently of the development of the region. At Mumias, for example, the Kenyan Government and BATS have carefully defined their respective responsibilities for the training of outgrowers and estate and factory workers for the project. The training, however, has been coordinated, and occasionally overlaps. Even more important, through its responsibility for outgrower training, the Kenyan Government maintains a continuing role in the operation of the project. It is therefore in a position to observe problems, technical and social, as they arise, and assist BATS to formulate solutions before a crisis is reached.

Fairly close relations between government and company have also been evident in Iran. There, however, it has taken the form of gradual Iranian assumption of company responsibilities, with the companies themselves, D & R and Hawaiian Agronomics, retaining an advisory role. Companies given concessions below the Dez Dam have been expected to operate more independently, and the lack of government support may be one explanation for the inability of several to prosper in the Iranian environment.

The record of projects initiated in the independent era is somewhat better than that of their predecessors. Sites have been chosen with more attention to their physical characteristics and have been more compatible with the selected crop.
Projects have been located in well populated areas, where social and physical infrastructure is already in place, and where problems of labor recruitment are less acute. Machinery and technology have been developed over the years for the local context. Enough projects have eventually succeeded in accomplishing the purposes envisioned by their sponsors that management of large scale projects by western companies remains a viable method of increasing the output of Third World agriculture. In a period when time seems less abundant than money, the purchase of technology and managerial services for agricultural development becomes a fairly attractive option.
CHAPTER VII

SUMMARY AND CONCLUSION

The spectre of grave food shortages and the promise of favorable prices for agricultural products have persuaded leaders of Third World countries to re-evaluate their programs for agricultural development. Development plans which subordinate agricultural production to industrial demands or establish social progress as the pre-eminent goal for the development of the rural economy, do not respond to the demand for increased production from the agricultural sector. One development strategy which is designed specifically to increase production is the commissioning of private western agribusinesses to organize and manage agricultural projects. These projects can be established in limited areas for the production of designated crops, and are often conceived independently from the broader programs of rural development.

The involvement of western companies in Third World agriculture is not a new phenomena. European and American companies have directed Third World plantations for over three centuries, and have done so in cooperation with benevolent governments for more than fifty years. The experience of that half century however emphasizes that the process of transplanting western technology and management to a site in Africa or the Middle East is complex. There is a marked lack of consistency in the degree to which the transplant has flourished under different circumstances. The earliest of those projects, the
Gezira Scheme in the Sudan, has been considered an outstanding success by most of its participants and observers, while later projects have foundered on a variety of unsuspected reefs. Clearly some approaches do not work well in the less developed context; others may be successful in one period or location but unproductive in another.

The following discussion reviews a series of projects of the twentieth century within the framework of the basic components of agricultural development. It compares the arrangements evolved in the Gezira Scheme to those developed for the projects which followed, and the experiences of those various projects. It concludes with an assessment of the circumstances in which projects managed by private corporations can contribute to an increase in agricultural production in Third World countries.

LAND

In nearly all of the projects, the government chose the site for the project and designated the crop to be grown before inviting a private company to participate. A major determinant of the success of the project is the criteria applied in selecting the site and the degree to which the government considers the site's agricultural possibilities.

The possible sites for a large scale irrigated agricultural project in the Sudan were limited. There were only four feasible locations, and of them the Gezira Plain was by far the most promising. The area had long been a center for agricultural production, but cultivation had been limited to
crops which could be grown in the brief rainy season. The Plain was physically well suited for irrigation agriculture, and calculations for available water could be based on centuries of data accumulated in Egypt on the Nile flood. It was also well placed for the infrastructure required by a major project. The preliminary processing of cotton, chosen for its assured export market, could be done on the project and the cotton shipped in bales to the Lancashire spinners in England. The entire project was within 200 miles of Khartoum, the capital city, and by 1910 was linked by rail to both Khartoum and Port Sudan on the Red Sea.

Despite the administrators' confidence that the Gezira was an ideal site for an agricultural project, the scheme's authors planned a series of pilot projects designed to prove that it could grow commercial crops of cotton. An experimental farm was first established in 1905 at Kamlin. In 1911, the Sudan Plantations Syndicate was hired to conduct a pilot project at Tayiba, and this pilot program was continued and extended until the inauguration of the Sennar Dam and Gezira Scheme in 1925. The experimental phase of the project was prolonged by the exigencies of the First World War and the difficulties of financing well beyond the period originally planned. However, while not all questions were answered and production problems solved, the period allowed for extensive experimentation with crop varieties, rotations, the use of irrigation water, pesticides and fertilizers, and the intensive training of staff and tenants.
Like the Gezira Scheme, the planners of most projects specified the crop they wanted to be produced and selected the project site before inviting a company to participate. The choice of crop was generally based on available export markets, especially in the colonial era, or significant possibilities for import substitution, more frequent in the independent era. However, in contrast to the obvious care in choosing and testing the site displayed by the designers of the Gezira Scheme, planners of later projects exhibited a carelessness and disregard for the agricultural potentialities of their projects' locations. In many cases, the choice of project site was based on criteria which had little to do with its suitability for the designated crop.

A primary criterion in the choice of site was the availability of the land. Planners, especially in the colonial era, were very conscious of problems of alienating native peoples from their traditional land. They assumed that much of the stability of the native culture was derived from its association with the land and feared that the disruption of the relationship would create a class of footloose, uneducated de-tribalized natives. In the British colonies, which attempted to rule through the traditional leaders, there was concern that those alienated wanderers would no longer respond to traditional authority and would thus constitute a continual challenge to the stability and security of the native society. Further, planners assumed that modern technology was by definition less labor intensive than traditional, and they foresaw that in general, a project placed in traditional agricultural areas
would not only displace the local farmers, but necessarily leave most of them unemployed.

As a result of the administrative reluctance to displace native peoples, many of the projects, especially in the colonial era, were located in remote, virtually uninhabited regions. The planners had little information on such vital considerations as soil types and fertility, rainfall and other sources of water, or potential problems of disease or land clearing and preparation. This apparent indifference to the physical qualities of the project's site stemmed in part from an exaggerated confidence in the capacity of Western technology to overcome agricultural deficiencies of a given site. The basic qualities of the site were an almost superfluous consideration, since modern techniques, fertilizers, irrigation and machinery would be able to correct any flaws of nature.

The remoteness of the sites also complicated the provision of supportive infrastructure. In the colonial era, some of the projects were virtually inaccessible and project managers had great difficulty transporting equipment and spare parts to the site, and later produce to the market. Communications systems and port and storage facilities were also rudimentary, and power systems were non-existent. In many cases, the costs of providing a surrounding infrastructure which western companies take for granted, were charged to the project and became a drain on the project's revenue.

A change in attitude about project locations and the economic growth of the countries of Africa and the Middle East has eased in the current period some of the difficulties of
project location. Administrators are less concerned about problems of alienation and more willing to locate agricultural schemes in populated areas. As a result, they are more likely to place a project in a region which has been studied and analyzed by their ministries of agriculture. In addition, during the years since the inauguration of colonial schemes, national infrastructure, physical and social, has been extended and projects, especially when sited in fairly well populated districts, are almost certain to be served by transportation, communications and power networks, and to be within reach of storage and market facilities.

Designers of current projects have rejected availability as the prime criterion for the siting of agricultural projects. In many cases they have replaced it with the contribution the project can make, in employment and production, to regional development plans. This criterion, of course, is no more oriented towards the suitability of the area for the designated crop than was the criterion of availability. However, the willingness to place projects in more populated districts does mean that planners can usually base their production calculations on fairly detailed information about the physical properties of the area simply because, again, their ministries will probably have studied the district as part of its agricultural development and rural extension programs.

Of the twenty projects examined here, only a third were preceded by a pilot project, and in several of those, the experimental stage was curtailed. The sponsors and managers were generally impatient to begin full scale production and
few believed that a pilot program would discover anything useful. Project designers assumed that technology could be readily transferred between sites, and a company which could commercially produce the designated crop in one locality would be able to embark directly on a project in a different location. To these enthusiasts, a pilot project was an unnecessary delay and a needless expense.

Thus while the success of the Gezira Scheme inspired planners to initiate large scale agricultural projects designed to increase production, exports and revenues, few of those later planners exercised the care displayed by the designers of the Gezira Scheme in selecting and testing the proposed site. This neglect was primarily a consequence of a compulsion, especially in the years immediately after the Second World War, to begin supplying the export market as quickly as possible; and of a confidence that modern technology would have little difficulty in making whatever minor adjustments might be necessary. The combination of neither analyzing the proposed area carefully before designating it as the project site, nor testing it after it was chosen to assure that it was capable of growing the desired crop commercially, proved to be disastrous for many of the large scale agricultural projects inspired by the Gezira Scheme.

The provisions for the ownership of the land on which the project is placed determines in part the allocation of the benefits of the project. There are three basic alternatives. The first is to leave the ownership of the land in the hands of the original owners. This option decreases the problems of
alienation but assigns project benefits in proportion to previously existing disparities between farmers. It also decentralizes the decision-making authority, with no certainty that decisions made by individual farmers will be compatible with the demands of the project. The second option is to expropriate the land required for the project, with or without compensation, and to remove the local inhabitants from the site. This option enhances the project manager's authority in production decisions but can discourage nearby farmers from improving their land for fear of similar expropriation, and may occasion resentment among the local inhabitants. The third alternative, a compromise, is to vest control over the land in the project in the project management, but to associate its owners or former owners closely with the project.

The designers of the Gezira Scheme opted for the compromise solution in order to avoid assigning a disproportionate amount of the benefits of the Sudan's major agricultural project to large landholders, and at the same time obtain their support for the project. They separated ownership rights from cultivation rights by renting the land of the Gezira Plain at a fixed rate equal to the rental of the best rainfed land. The increased value of the land due to the irrigation system accrued to the tenants, company and government. The owners however, were allowed to designate the holders of tenancies over as much land as they owned. They generally named themselves, members of their families or dependents. Of the two rights, ownership and cultivation, the cultivation rights were by far the more valuable and the former owners supported the scheme because
arrangements enabled them to participate in the actual work of the project, rather than because of opportunities to reap an unearned capital gain.

Most of the projects which followed the Gezira Scheme also attempted to follow the middle path on the issue of land ownership. Some of the exceptions were the Iranian projects where at Haft Tapeh land was purchased outright from a major landowner; and in the Khuzestan Regional Project, where three separate sets of arrangements were made, none of them wholly satisfactory. In the Senegalese Groundnut Productivity Scheme, land was retained by the inhabitants with a result that economic disparities have been aggravated and owners exercised their rights to designate the crops to be grown on their own land and decided not to grow groundnuts. In regions which were remote and relatively unpopulated, where land was not particularly valued by the inhabitants and individual claims to particular parcels of land were not well-established, the government often simply designated an area to be developed for the general benefit of the peoples of the region or tribe. The important element for most projects was not the formal arrangements for land ownership but the degree to which the local inhabitants could be associated profitably with the project as tenants or laborers.

In most of the projects which followed the Gezira Scheme, the crucial elements involving land concerned its physical properties rather than its legal arrangements. The planners' faith in Western technology engendered an indifference to the fundamental natural characteristics of the site, which contributed to the demise of projects when the sponsors found that
basic incompatibilities between the demands of the crop and the endowments of the site could not be economically overcome.

**LABOR**

The recruitment of a project labor force, adequate in numbers and skills, is the first major charge on the companies once they begin management of the project. The difficulty of the task is conditioned primarily by the governmental choice of crop and location. Different crops have widely different labor intensities; in the Sudan, for example, the harvest of grain crops, which can be mechanized, requires only 6% of the labor required for the harvest of a cotton crop. The location of the project determines the availability of local labor and the probable quality of that labor. One of the prime difficulties faced by company management has been that decisions concerning crop and site have been made by the government with little regard for their labor implications.

There are four sources of labor for agricultural projects. First, the project can use locally recruited labor. Projects which rely on local sources will probably have to incorporate training programs into the project operations; the ease of attracting sufficient quantities of labor will depend on the population density of the region in which the project is located. A second source is non-local labor recruited from well-populated areas within the country. This alternative is tried when the location of the project is sparsely populated, but it requires a high level of organization to recruit workers
from populated areas for a project "in the middle of nowhere," and considerable imagination to create a viable social context for large numbers of re-located semi-skilled workers. A variation on the use of non-local nationals is the recruitment of large numbers of foreign migrant workers. Migrant labor is especially practical for peak labor periods such as harvests. Finally, a project can promote a high level of mechanization as a substitute for labor. In this case, the labor force demanded by the project will be smaller but more highly skilled.

The labor force of the Gezira Scheme was recruited by drawing from all four sources of labor. Since the area was cultivated before the advent of the project, there was a substantial body of local farmers available to become tenants. At the inauguration of the scheme, these local Gezira farmers held between 60 and 70 percent of the tenancies. The remainder of the tenancies were granted to farmers from nearby districts. These two groups were attracted to the Gezira because it offered a dramatic improvement over the livelihood obtainable from subsistence farming. The cotton yields which could be obtained within the project's irrigation system were clearly far above those of rainfed agriculture. In addition, and especially important to a peasant farmer, the Gezira offered guaranteed and tax free food and fodder crops. Since the tenants tended to be single farmers rather than family units including grown sons, the stable labor force was insufficient to provide enough workers for the cotton harvest. The project was fortunate that the area contained large numbers of ex-slaves and a substantial floating population of West African pilgrims on their way to
Mecca. Both groups were willing to work for wages on the scheme at peak periods. In addition, in years of inadequate rainfall when rainfed food crops were poor, farmers from nearby districts would migrate to the Gezira for the harvest. Finally, some operations were mechanized: ploughing and ridging, and spraying pesticides against the jassid-fly.

Few of the workers available to become tenants on the Gezira Scheme were trained in the application of irrigation water or the growth of irrigated crops. Much of the effort during the project's pilot years were spent training competent supervisors and creating a pool of experienced semi-skilled tenants. The company instituted a low ratio of inspectors to tenants, and placed most of the responsibility for the operation of production on the inspectors. The inspectors were Europeans, predominantly English, often former servicemen. Many had had some technical training and all were expected to acquire an understanding of Arabic and the local culture. The foreign inspectors were only replaced by Sudanese during the Second World War, by which time the Sudan had begun to develop a pool of agriculturally trained technicians of its own.

In the projects which followed the Gezira Scheme, labor was recruited from local and non-local national sources, and operations were mechanized as a substitute for labor; no project planned to depend on temporary migrant labor. Projects which were located in sparsely populated areas had severe problems of recruiting an adequate quantity of labor. The intrinsic productivity of the later projects was usually inferior to that of Gezira, and designers were unable to offer sufficient
incentives to entice either local farmers in a land-abundant region to renounce independent farming, or more distant peasants to leave familiar albeit impoverished, livelihoods and enlist in the project. Those managers which tried operating with both hired labor and tenancies discovered that the formal arrangements were not nearly as important as the economic realities: projects which found hired labor excessively expensive were unable to promise a high enough return to attract tenant farmers.

Projects located in more heavily populated areas not unnaturally have fewer problems attracting an adequate labor force. Land is less likely to be abundant, local underemployment may be common, and thus the alternatives to working on the project will be less attractive. The company will almost certainly have to institute a training program for the local cultivators, but this is a much easier task than recruiting workers in a sparsely populated region.

A number of projects have mechanized operations as a substitute for labor. Several discovered that the techniques or machinery which were supposed to relieve labor bottlenecks were not appropriate for tropical agriculture. Others found that the costs of mechanization were inordinately high, because local labor did not appreciate the need for preventive maintenance and were not proficient in mechanical repairs. Some of these obstacles have been removed since mechanization was tried in the colonial era. Machinery has been adapted and developed to suit the requirements of tropical agriculture. Vocational schools have produced a pool of technically trained nationals. It is somewhat ironic that as governments have become more
willing to adopt labor intensive techniques in order to attack problems of rural unemployment, the pre-requisites for capital intensive techniques have finally been acquired.

A subsidiary question is the responsibility of the project to provide extensive social services for its labor force. The Gezira Scheme avoided the need to initiate social services by locating in a district of settled villages. These services, although rudimentary, were already offered by the local government. Subsequent projects which were sited in fairly well-populated districts shared this advantage. Only projects which were established in sparsely populated areas and which then attempted to attract large numbers of workers were burdened with the responsibility of creating model villages with schools, clinics, dispensaries, shops, etc. To most, the attempt to create a vital social context was both expensive and frustrating. The managers of few of the projects were sufficiently sensitive to the needs of the local populations to be able to re-create traditional villages in the wilderness.

As in the case of land, the economic realities involving labor are more important than the details of the formal arrangements. The Gezira Scheme's ability to guarantee food and fodder crops to subsistence farmers and exhibit a visible increase in the yields of the cash crop, attracted tenants and laborers to the scheme. Those projects whose technology does not demonstrate a clear improvement over the living obtainable from subsistence farming, cannot induce peasant cultivators to trade the freedom of independent farming for the discipline of a major project. Secondly, and not surprisingly, projects placed in populated
areas are less likely to have difficulties recruiting labor than those in remote sparsely populated regions. Unemployment in densely populated areas is more common, the work force is usually more sophisticated and skilled, land is less abundant, and the ties to land more economic and less emotional. Thus it is often more profitable to locate a project in a well-populated area with already existing social services and address the problem of displaced unemployed farmers by incorporating labor intensive methods into the project technology, than it is to site the project in a sparsely populated area and deal with the problems of labor shortages. Third, in contemporary Africa and the Middle East, the use of migrant labor is no longer a viable option. Even the Gezira Scheme, with its advantageous position on the pilgrimage route, is now having difficulty recruiting labor from this source.

CAPITAL

Capital, both physical and financial, has been vitally important to the operation of agricultural projects. Capital in the form of the machinery, the technology and the supporting infrastructure has been the feature which distinguishes the project from the traditional agricultural sector which surrounds it. Investment capital of course finances the project, and its source will influence the degree to which the project is operated according to commercial principles and the extent to which the host country can maintain control over the project.

In the Gezira Scheme, the major item of physical capital was the Sennar Dam and main irrigation canals constructed by
the Sudan Government. Some other operations were mechanized: clearing, land preparation, ploughing and ridging, provision of irrigation water. Most operations however, were done by hand, a necessity because the technology for cultivating cotton in the 1920's was essentially labor intensive. The few mechanized operations had been well tested in the pilot phase and offered no surprises after the inauguration of the scheme. The managers were not as fortunate with the capabilities of the technology dealing with cotton diseases. Gezira crops suffered from blackarm, a bacterial disease, and leaf curl, a virus, between 1929 and 1934. The project was saved only by dedicated experimentation at the Research Farm, which finally developed a cotton variety which was resistant to the two diseases and a suitable rotation system.

Despite the post-war faith in Western technology, the machinery and techniques applied in many projects were disappointing to their adherents. Machinery was inappropriate for tropical agriculture and its cost often could not be supported by the project's return. Techniques developed for temperate agriculture proved unsuitable for conditions in Africa and the Middle East. The situation improved as companies, governments and international research institutes experimented with fertilizers and pesticides, developed varieties of tropical crops which combined high yields, uniform growth and resistance to local disease and pests, and designed and adapted machinery which could clear, plough, sow, and harvest tropical crops without damaging the fragile soil structure. The disenchantment with large irrigation projects and immense agricultural
schemes has reduced the temptation to develop vast tracts through massive capital investment but with little consideration for the project's capacity to repay that investment. Thus contemporary projects draw from a greater pool of knowledge about tropical agriculture and are less likely to overcapitalize a marginal project.

One operation, however, which remains almost uniformly difficult and unexpectedly expensive is that of land clearing and preparation. There are a number of possible explanations. It is likely to be the one operation with which the company will have no prior experience. Even in projects with pilot phases, the experimentation is often located on already existing farms. In addition, local experienced contractors find that the clearing of large areas can be more expensive than the preparation of smaller areas. Contractors may have to hire less skilled and ultimately more expensive workers for the larger area; or, as in Iran, may raise prices because they assume that the project manager has no alternative and the project can afford the higher fees.

None of the later projects faced the difficulties in obtaining funding experienced by the Gezira Scheme. Financing has been available from participating companies, metropolitan governments and development funds, local governments, international agencies, and recently, regional development funds.

Financing for the Gezira Scheme was provided by a public loan guaranteed by the British Government for the Sennar Dam and major canal, and an equity investment by the Sudan Plantations Syndicate to construct housing, ginneries, offices
and storage facilities, to purchase farm implements, and to construct and maintain the subsidiary canalization, drainage, roads and land preparation. The Syndicate also supplied the working capital. Some of the company's investment was financed through a loan from the Sudan Government to be repaid with interest. This arrangement allowed the Government to stipulate the ginning rates and conditions of tenant loans while assuring that the commercial sanctions for efficient management would be in effect.

Most later projects obtained the bulk of their financing from public sources, often a metropolitan power interested in a new source of scarce agricultural produce. The interest of the metropolitan power meant that projects were not delayed while funding was arranged, but in many cases divorced management from the economic incentives for efficiency. Governments tended to base management decisions on political rather than economic considerations, both prolonging expensive failures and curtailing projects which, if re-organized, could potentially succeed. Companies, with no financial commitment to be saved, were happy to withdraw from faltering projects rather than make the effort to re-organize. A new development is that the magnitude of public funds currently available in some countries for agricultural development has attracted opportunistic companies with little experience in Third World agriculture. Where most of the investment is expected to be public, these companies have little to lose by offering to participate in African and Middle Eastern projects.
Local governments have often mistrusted foreign investment because it can be accompanied by undue influence in the economy by the investor. Comparing two projects which did depend on foreign funding, Liberia found Firestone's preeminent position in their economy on the whole less onerous than Iran found the World Bank's well-intentioned restrictions. Other countries were less uncomfortable with foreign influence, finding that at most it directed their choice of a company for the project management.

Capital is the least troublesome input in contemporary Third World agricultural projects. New techniques and machinery have been developed for crops in the Middle East and Africa and can be incorporated into project cultivation practices. Financing for agricultural projects is abundant from a variety of sources. The difficulty is less one of obtaining investment funds and more one of maintaining the "sanctions which operate against management of enterprises which are not, in commercial terms, successful."¹

Viewing the promise and problems of agricultural projects in Africa and the Middle East managed by western private companies, it is possible to assess the circumstances in which these corporations can increase a nation's agricultural output and thereby provide a partial solution to the problem of filling the gap between the global supply of food

and the demand. Analysis of the Gezira Scheme and the twenty other projects considered here suggests eleven specific factors which must be considered if an agricultural project involving a western corporation is to be successful.

First, the choice of the project site must be based on sound agricultural considerations. The government must have a thorough knowledge of local soil conditions, availability of water, problems of local pests and disease. It must also be certain that the infrastructure necessary to support the project (transport and communications networks, storage facilities, etc.) is either already in place or can be constructed within the project's development schedule. Planners cannot expect western technology to compensate economically for a poor choice of site. They should not base their siting decisions primarily on employment, or regional development, or anti-insurgency criteria, and expect the technology provided by private corporations to remedy agricultural deficiencies. The measures necessary to make a marginal site productive are generally too expensive to be balanced by any foreseeable return. A government may wish to pursue non-economic projects for their social or military benefits. However, it must recognize that the projects are fundamentally unprofitable, and the participation of a private company will not change the basic economic realities.

Second, not all crops are suitable for projects involving western corporations. Subsistence food crops are better promoted through the Departments of Agriculture using technology developed by public research institutes. Since subsistence crops have not been the focus of western corporations in the
past, it is unlikely that private companies will have technology breakthroughs to offer, and increased productivity will depend primarily on improved management techniques. Thus the productivity, and therefore return, differential between the project and the traditional farmers will not be great enough to support the company's management overhead or to attract peasants into a system of company direction. Nor will the return be high enough for the political and social risks of alienation and private foreign control over land to be worthwhile.

Projects involving high value food and industrial crops are most appropriate for the participation of western corporations. Such crops include citrus, sugar, fresh vegetables for winter European markets, livestock, cotton and rubber. These are products in which western corporations have considerable experience and can contribute a developed modern technology. As in industry, the companies themselves are most interested in products which can be exported or which offer significant opportunities for import substitution. There is less likely to be restrictions on repatriation of earnings where clear national savings in foreign exchange can be demonstrated. From the country's viewpoint, projects which intend to export their production can then use the company's international marketing expertise as well as its production technology. The participation of companies in projects which involve some immediate processing is also particularly appropriate. The company will then transmit its processing expertise and contribute to industrial as well as agricultural development.
Third, the government must exercise extreme care in its choice of company, preferably selecting a company which has both experience in the cultivation of the desired crop (not merely in its processing or marketing) and some background in Third World agriculture. Many western companies do possess technical agricultural expertise and management skills in short supply in Africa and the Middle East. Those companies which have operated for some time in the Third World have in addition accumulated valuable local experience and have been able to adapt their fundamental knowledge of plant and animal physiology to the African and Middle Eastern environment. Few governments will be able to find companies with the background of the Sudan Plantations Syndicate, whose twenty years of experience growing cotton along the Nile and on the Gezira Plain was invaluable to the Gezira Scheme. However, governments should be wary of optimistic promises made by companies with no experience in the area. Companies like Booker McConnell or Hawaiian Agronomics will obviously be able to duplicate their successful African and Middle Eastern projects more easily than companies with no local experience will be able to repeat the success of European or American enterprises in the unfamiliar locale. As the abundance of public financing for agricultural projects in the area attracts inexperienced and opportunistic companies, the choice of a competent firm becomes a crucial decision for the success of the project.

Fourth, the host government must recognize that contracting a western corporation is not a method of increasing a country's production within the space of a season or two.
While a company can structure its management quickly and gather its relevant expertise for application to the proposed project, it will not be able to begin full scale production for a number of years. It is essential that the company conduct preliminary surveys, formulate feasibility studies and operate several seasons of a pilot project before beginning major development work. Thus the manager from Hawaiian Agronomics, a company with 150 years of experience growing sugar cane in Hawaii, wrote after the second season at Haft Tapeh, "Procedures have developed, which...considering the short period of experimentation and experience with the introduced and modified operation, can be considered as a very good start in developing Haft Tapeh plantation as an example of modern cane agriculture."\(^2\) Hiring a western corporation can reduce the introduction of modern technology from a process requiring generations to one requiring perhaps five years. It is not however a devise which would enable a country to deliver new products to the international market almost instantaneously in order to take advantage of volatile commodity prices.

Fifth, the government must realize that once the company is chosen, the government loses some of its flexibility in agricultural production. Changes in international commodity prices may encourage a shift in production to a more profitable crop. The government will probably discover however, that the company is specialized in only one crop, and the ability of

the project to respond to commodity price changes is restricted by the limits of the company's expertise. The government must be willing to accept these limitations and not expect the company to switch to products in which it has no experience.

Sixth, the project must be located near sufficient supplies of labor. Projects located in unpopulated areas have generally been unable to attract a sufficient labor force, because of their remoteness, their unproved technology and the inability of a western company to create a satisfactory social environment. The development of unpopulated areas is best accomplished through government settlement schemes where the government can organize the population movement and provide an acceptable social context. Projects involving western corporations should be located in fairly well-populated areas, where underemployment may be a problem, land is less abundant, and therefore the prospects of working on the project seem, by comparison, more attractive.

Seventh, the company must expect to train nationals for the skilled, supervisory and management levels of its labor force. If the project involves processing facilities, it should also expect to train local people to operate the factories. The company should assume that almost all of the expatriates initially recruited to staff the project will eventually be replaced by host nationals. Where the project is located in a well-populated region, the company will be able to draw upon a pool of semi-skilled, literate workers who can fill the semi-skilled positions in the project (tractor
operators and factory workers, for example), and can be trained for higher levels.

Eighth, the project must avoid alienating large numbers of people from their land. In a well-populated area, this requirement necessarily restricts the size of that part of the project which should be operated directly by the company. The concept of a nucleus estate whose core is the processing and research facilities, surrounded by local farmers who are encouraged and assisted to supply the project with produce, is most appropriate for projects involving western corporations. It avoids removing large numbers of peasants from the land and provides employment in the factory and on the estate for those who are displaced. Further, it associates the peasant farmers of the region profitably with the project, thereby securing the support of local inhabitants for what may otherwise appear an alien and disruptive element in their traditional way of life.

Ninth, project designers will have to exercise extreme care to assure that the physical capital is appropriate to the productive capacity of the project. Fortunately, the disenchantment with large dam and irrigation networks has meant that planners are less likely to overcapitalize marginal land with expensive capital works. The company must expect to adapt lesser items of machinery and production techniques to the local environment. Where feasible and socially desirable, the company should plan to include labor intensive methods in its production techniques.
Tenth, planners must assure that incentives for efficient management are incorporated into the project design. This is most easily provided by a stipulation that the company invest some of its own funds in the project. Equity investment by the company will stimulate management's concern for efficiency and considerations of profit and loss. An arrangement of public financing and fixed company fees on the other hand, separates the return to management from project efficiency and places the responsibility for project oversight almost exclusively on the civil service. The project will then be judged with reference to a value system which has little to do with commercial criteria. While such criteria are undoubtedly valid (commercial loss offset by social gains, for example), they should be applied to publicly rather than privately managed projects. Otherwise the project risks failing by both commercial and social criteria, since it is unlikely that the private company will be sufficiently sensitive to the implications of social policy to operate a project successfully on that basis.

Finally, the host government must appreciate that contracting a foreign company is not a substitute for the construction of local infrastructure, the provision of social services, or the organization of rural extension work. Projects, even when managed by western companies, operate best when they are part of a regional development plan, and the management of the project works closely with local officials and representatives of the national ministries. The government will not be able to abdicate its responsibility for the project
area and expect the project to operate independently of the region in which it is located.

Given all these factors and limitations, and despite the success of the Gezira Scheme and the excellent precedents it set for subsequent projects, the Gezira Scheme is probably not the best model for the current generation of agricultural projects. Rather the government and company would be advised to design their project on the nucleus estate/outgrower model. The nucleus estate would be relatively small, large enough only to supply the processing plant with enough raw materials to operate at their minimum productive capacity and support the project research facilities. The small size increases the probability that all labor displaced will be absorbed by the processing plant and estate work, thus defusing the issue of alienation. Additional production can then be encouraged from surrounding farms whose cultivators can be trained in modern techniques of cultivation. Individual farm techniques can include the mechanization of some operations with the nucleus estate organizing whatever capital sharing seems feasible.

The small size of the project makes possible the choice of a site in a fairly well-populated area, without displacing large numbers of people. Such a site has three advantages. Labor recruitment will not be a severe problem. The government will most probably have accumulated an adequate amount of information on the soil, climate and local pests and diseases. Third, the region will already be served by publicly supported physical and social infrastructure.
The nucleus estate/outgrower structure also establishes a framework for greater cooperation between the government and the company. One of the most serious problems faced by many projects has been that the responsibility for different elements of the scheme is divided in such a way that one party makes decisions with little regard for their consequences for other aspects of the project. Thus the government chooses the site and crop with little consideration for how the company will be able to recruit a labor force or remedy natural deficiencies. Where the government continues to be responsible for the training of cultivators outside the nucleus estate but contributing to the project, it is more likely to remain involved in the operation of the project and to consider that operation as it makes its preliminary decisions. A framework is also established for ongoing cooperation between the government and company research laboratories, and between company management and local government officials.

Finally, as the social context changes, the nucleus estate/outgrower structure can be modified in any of three directions to respond to the altered circumstances. First, through the extension network established to communicate the technology of the original commercial crop to the outgrowers, the government can expand its education program to include the subsistence food crops and promote a system of mixed farming. The system will be greatly aided by the already existing capital sharing arrangements, which should make double cropping more feasible. Second, as modernization decreases the attraction of agricultural occupations for local farmers, the nucleus
estate can operate with increasingly capital intensive techniques thus reducing its reliance on hand labor. And third, as modernized farmers decide that they want greater control over the processing and marketing of their produce, the nucleus estate/outgrower structure can be converted into a cooperative society for which the initial organizational and operational problems will have already been solved.

American and European firms have much to offer Third World agriculture. They can deliver a package of technological and managerial skills for growing, processing and marketing agricultural products and are willing to apply their expertise and even train local nationals as their successors. Properly organized, experienced companies can make a substantial contribution to the increase of the productivity of Third World agriculture. The employment of Western firms can thus be a partial solution to the problem of closing the gap between the demand and supply of food supplies in much of the world. It is not, unfortunately, a solution for the very short run because even experienced companies need to develop and adapt their techniques on the site of a new project. Nor is it an appropriate technique for all crops or even for every site. A writer of the 1950's commented that there is no "Midas-touch in agriculture in the repertoire of politicians, administrators and public servants." 3 Neither is there in the 1970's a magic

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formula which achieves instantaneous agricultural production, even in the repertoire of western private corporations.
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APPENDIX I

PROJECTS OF THE COLONIAL ERA

A. CONGO, REPUBLIC OF (BRAZZAVILLE)

SOCIÉTÉ INDUSTRIELLE ET AGRICOLE DU NIARI (SIAN)

The development of the Niari Valley in the Republic of the Congo (Brazzaville) was a major postwar project designed both to develop the agriculture of the Congo and to provide an area for French settlers to colonize. This 400,000 hectare area was attractive because of the availability of road and rail connections to Brazzaville and the port of Pointe-Noire; the deep and well-structured although not particularly fertile soil; the low density of native population and flat topography which made both necessary and possible a high degree of mechanization; the vegetation of grassy savannah and scattered bushes which permitted relatively easy clearing. The climate is equatorial with two rainy seasons which permit double cropping, although the shortness of the second (mid-January to mid-February) reinforces the need to maintain a tight schedule of harvesting one crop and planting the next.

In the postwar period a number of isolated attempts were made at colonization, but it became clear to the government that large scale development would require coordination and in-depth study of climate, soils, crops and agricultural techniques. In 1952, the Committee for the Development of the Valley was established, composed of administrators, representatives of the Brazzaville and Pointe-Noire Chambers of Commerce,
inspectors from the Agricultural Service, local notables, and representatives from the five research Institutes and the private agricultural, mining and manufacturing projects. This Committee established a research center and coordinated the research and information from the experiences of producers in the Valley.

With government assistance some forty concessions were established in the Valley. One of the most important was the Société Industrielle et Agricole du Niari (SIAN). This company was founded in 1949 by a group of French industrialists, the Grands Moulins de Paris (GMP), at the instigation of the major edible oil research institute, the Compagnie Générale des Oléagineux Tropicale (CGOT). The French authorities asked GMP to buy land in the Valley for the commercial cultivation of peanuts and promised that the company would have the necessary technical assistance from the pilot project and research laboratory of CGOT.

The attempt to grow peanuts commercially was not particularly successful. In an area of scarce labor, difficulties were encountered because the machinery which would allow mechanical harvesting had not yet been developed. Neither SIAN nor CGOT had in the early 1950's much experience in growing peanuts: CGOT's experiments in the region had barely begun, while GMP's experience was in milling rather than cultivation. Finally the project manager was also inexperienced. SIAN lost a great deal of money and was saved from liquidation only through considerable pressure from the public authorities.
Faced with the failure of the peanut trials, in 1954 SIAN began experiments with sugar cane. The crop flourished and by 1956 the plantation had been converted complete with the necessary sugar refinery, silos, stores and auxiliary buildings. Finance capital for this new venture was provided by a French government fund, the Fond d'Investissement des Territoires d'Outre-Mer (FIDES) and two civil servants of the colonial administration were placed on the Board of Directors. Unfortunately the lack of competent and experienced personnel still plagued operations and the substantial funds invested by FIDES were still insufficient to place SIAN on a firm financial basis. The company was again near collapse.

SIAN only began to prosper in 1957 when GMP finally took decisive steps in the areas of financial support and personnel. They obtained the backing of the Compagnie Financière pour l'Outre-Mer (COFIMER), a private organization with public funding which both takes equity shares of its own and locates other potential investors for African ventures. They also sent out M. Urbain, an experienced manager to take control of the project. Under his management, greater emphasis was placed on the training of personnel, new sections of cane were tested and additional use was made of fertilizers. Production markedly improved, with production increasing from 10,000 to 35,000 tons a year.

Once SIAN succeeded in creating a profitable enterprise in the Congo, it was invited to extend its activities to other African states within the former French territories. Its activities have included sugar production and refining, the
recovery of molasses and cattle fodder, milling and the production of soap; and have been located in Chad, Cameroon, Ivory Coast, the Central African Republic, Upper Volta and Gabon. SIAN has also extended operations in the Congo, establishing SOSUNIARI with the equity participation of the Congolese government. All the affiliates within the SIAN Group are also partnerships with the local governments. The governments hold a minority share and their contribution takes the form of land, concessions, harbors, etc. rather than cash. These enterprises have been financially successful since they sell their product in highly protected markets, but only the sugar related ventures are able to compete on the world market.

B. GAMBIA

GAMBIAN POULTRY SCHEME

The Gambian Poultry Scheme was conceived early in 1948 when the Chairman of the Colonial Development Corporation met Mr. Millard J. Phillips, the American manager of a successful poultry farm in the Bahamas, and the latter agreed in principle to establish a similar enterprise for the CDC. The scheme's premise was that since it was not financially possible to import chicken feed into Great Britain or to expand British production of feed, Britain could obtain eggs and chickens from countries within the Sterling Area raised on feed grown locally. The Gambia was chosen because of its need for agricultural development and diversification from its single export crop of groundnuts (peanuts) and because of its proximity to the British market. A 10,000 acre site was selected in and around the Yundum airport
about 15 miles from the capital city of Bathurst. Phillips and a member of the CDC staff inspected the site, consulted with the Governor, and presented a report to the CDC Board; the plan was prepared and approved in May 1948, and operations began in August. The object of the scheme was the production of twenty million eggs and one million pounds of dressed poultry within three years with an estimated investment of £750,000.

Clearing operations and construction were efficiently managed: a saw mill was built to use the cleared timber, pigsties were constructed to supply the staff, brooder batteries, chicken houses and runs, freezing rooms and a packing shed were built. Ten thousand Rhode Island Red eggs were flown from the U.S., of which seven thousand hatched and formed the basis of the stock. Phillips also imported forty Bahamian workers to help train Africans in the care of poultry and large scale production of eggs and meat.

Several problems arose because of Phillips' unfamiliarity with the Gambia. The original plan had assumed that the timber cleared from the area was of export quality and that its sale would finance clearing operations. Local experts could have informed the CDC that Gambian timber has no value except as fuel, but they were not consulted. Further the clearing of all trees was probably a mistake: it contributed to soil erosion and eliminated needed shelter for the flocks from the tropical sun. A second problem was that the 10,000 acres was not adequate for growing enough feed for the flocks, with the Gambian soil producing yields that were only half the expected.
The crops were also deficient in vitamin B which affected fertility rates and necessitated increased expenditures for fertilizer for the land and vitamin supplements for the flocks. A third problem was that the housing designs which worked well in the Bahamas were inappropriate for the Gambian climate. The roofing did not provide adequate shelter from the heavy rains and the flocks were decimated first by pneumonia and later by fowl typhoid. Newcastle disease, spread by rats and vultures from local flocks was also an ever-present danger. The laying stock of poultry were all kept in one location, so that once the diseases were contracted they swept through the entire flock, severely cutting egg production. An epidemic of Newcastle disease was finally brought under control by mass inoculation, and the veterinarian proposed that the flock be separated into isolated ranges of 1000 birds each.

Phillips also encountered labor problems. Some friction arose between the highly paid Bahamians and the native Gambians. The Gambians did not understand the reasons for the salary differential since they were all doing the same, essentially manual, work. A more serious problem was the lack of mechanically skilled labor. The success of the scheme depended heavily on the efficiency of the ancillary services, especially the refrigeration units. Refrigeration plants repeatedly broke down, repairs were slow and 70,000 pounds of poultry already slaughtered had to be destroyed. Finally, manual labor was difficult to recruit. There was no large pool of unemployed labor in the Gambia, and the attraction of the capital city eighteen miles away were considerably greater than those of the poultry farm at Yndum.
The Gambian Poultry Scheme was rather abruptly abandoned in 1951 after an investment of £825,000. While the difficulties faced by the scheme were gradually being brought under control, the CDC was unwilling to invest additional funds in the project. Their reluctance to follow the example of the Tanganyika Groundnut Scheme and the presence of a convenient scapegoat in Phillips were probably of greater weight in the decision than any judgement of long-range feasibility. A general criticism of the scheme was the absence of a pilot project which would have tested the yields and the costs of first growing feed and then the assembly line production of poultry and eggs. The Manchester Guardian commented on 13 March 1951 "Mr. Phillips may take credit for working well on a project which every administrator, veterinarian, agricultural expert and business man on the spot believed should never have begun without a pilot scheme."\(^1\) The CDC originally planned to continue the project as an experimental farm, but, as the 1951 CDC Annual Report remarked with the simplicity of a cautionary tale,

\[\begin{align*}
\text{"1.a. In April 1951 there was an epidemic of Newcastle disease which wiped out the poultry flock; } \\
\text{b. that was the end of poultry farming."}\]


\(^2\)p. 73.
C. LIBERIA

FIRESTONE PLANTATIONS

Firestone's decision to establish rubber plantations in Liberia was part of a more general response to the Stevenson Plan of 1922-1928, a British restrictive agreement to maintain the price of rubber at a level high enough to ensure the profitability of their Malaysian and Ceylonese rubber plantations. The company's founder, Harvey S. Firestone, organized with Henry Ford, survey parties to investigate the possibilities of growing rubber in the Philippines, the Netherlands East Indies, Sarawak, Malaysia, Ceylon, Mexico, Central America and in Africa within a belt of 10° north to 10° south of the equator. Henry Ford established a plantation in Brazil, but plagued by labor problems and the South American rubber blight, sold out to the Brazilian government in 1943. Firestone selected four areas for possible development: Mexico (actually too far north to be ideal), Sarawak, the Philippines and Liberia. A rubber plantation was leased in Mexico in 1925 but abandoned a year later because of political instability and inadequate labor supply. Firestone was offered a concession in Sarawak, but the offer was withdrawn under pressure from the British government. A plan for large scale development in the Philippines foundered on legal obstacles to foreign ownership of land. Thus Liberia was the only success in the series of plantation projects planned by Firestone in the 1920's.

Liberia's interest in the Firestone project stemmed from its hope that foreign investment might alleviate some of its financial problems and that an American presence might
eliminate British and French pressure on Liberian borders. The disruption of trade during the First World War had caused customs revenues to drop dramatically. These duties were not only the main source of government revenue, but were also used to pay off a $1.7 million loan to America, British, French and German bankers. Liberia appealed to the U.S. in 1918 for a $5 million loan but was turned down by the U.S. Senate. President King decided that direct investment by a U.S. corporation might provide the needed assistance, either directly or by encouraging U.S. government participation in a loan. The negotiations held under the auspices of the U.S. State Department were protracted. Liberia, fearful that a loan by a foreign corporation within Liberia would give that corporation too great an influence over domestic affairs, wanted a U.S. government loan. Firestone, fresh from its experience in Mexico and convinced by the U.S.-appointed General Receiver of Customs that the Liberian government was equally unstable, wanted to grant the loan as a sort of insurance for its plantation investment. Firestone also insisted on some guarantee of widespread fiscal and administrative reform in the Liberian government itself.

In the final compromise, Firestone established a separate corporation to make the loan to be repaid by revenue obtained from import duties, the head tax and the Firestone Company. The Liberian Legislature also reluctantly agreed that an American financial advisor and subordinate advisors and auditors be given extensive powers over the Liberian fiscal structure. Firestone was granted a 99 year lease to a maximum
one million acres at six cents an acre and agreed to pay one per cent on the gross value of rubber exported by the Company (changed in 1950 when Liberia adopted an income tax). Firestone received rights to plant, process and export rubber, mine its leased acreage, and build transportation and communication facilities. In a separate agreement, Firestone agreed to construct a deep-water harbor in Monrovia for not more than $300,000 to be eventually repaid by Liberia. This agreement was cancelled by mutual consent after Firestone spent $115,000 before realizing that the project was beyond its capabilities. The port was finally constructed by the Army Corps of Engineers after World War II at a cost of $22 million.

While the Liberian plantations were Firestone's first venture in planting, their first manager Donald Ross had had years of rubber growing experience in Southeast Asia and Ross in turn hired an experienced staff in London. The Company was also fortunate in being able to take over the Mt. Barclay estate, a plantation established by a British company in 1910 but abandoned with the fall of rubber prices in 1920. Firestone was able to rehabilitate the estate and Ross used it as a pilot project to learn the techniques specific to growing rubber in Liberia, and later as a nursery for the larger plantations at Harbel and Cavalla.

By the end of 1928 over 15,000 acres had been cleared and planted. The company began by planting seedlings grown at Mt. Barclay, but switched to a technique of grafting buds from high yielding clones onto the stronger root system of the ordinary seedling. Research has been primarily directed
towards developing higher yield clones which now yield as much as 2000 pounds of latex per acre compared to the 400 pounds of ordinary seedlings. With the emphasis on higher yields per acre, Firestone has never approached the million acres envisaged in 1924: in 1960, approximately 87,000 acres were developed at Cavalla and Harbel.

Rubber prices fell after 1929, reaching a low three cents a pound in 1932. Planting was stopped, mature trees were left untapped and planters and engineers returned home. The hiatus was profitably used however to develop a long range research program. In 1934 rubber prices began to rise and the plantations were quickly rehabilitated and put back into production. During World War II, Firestone overtapped its plantations to meet Allied demands and production rose dramatically. Overtapping was stopped after the war but the expansion of acreage and the use of higher yielding clones maintained output. Expansion ceased in the 1950's and emphasis was placed on intensive replanting of older sections with higher yielding clones.

Relations with the Liberian government have generally been good. They reached a low point in the early 1930's when Firestone's halt in production coincided with a League of Nations inquiry into reports of slavery in Liberia, and the government felt that it was receiving neither the economic nor political benefits it had anticipated from the association. On its side, Firestone asked the Department of State to send a warship to Monrovia to prevent default on its loan in 1933, but the Department refused to do more than exert diplomatic
pressures. The crisis was resolved by a new agreement which prescribed a lowered interest rate and a repayment schedule based on annual government revenue.

Relations subsequently improved, especially during the War when the U.S. war effort included the construction of a major airfield, a military troop presence, and later the construction of a deep water port for Monrovia. President Tubman, who assumed office in 1944, established an 'open door' policy towards foreign investment and by the early 1950's iron had outstripped rubber as Liberia's major export and source of income. In addition, Firestone's own extension efforts had encouraged the cultivation of a large number of locally owned rubber plantations and other foreign corporations have purchased rubber concessions. Thus while the Firestone Company continues to prosper and remains an important part of the Liberian economy, it is no longer the dominant force in Liberian economic growth.

D. MALI

NIGER PROJECT: OFFICE DU NIGER

The objective of the Niger Project in Mali (French Soudan) was to rejuvenate the uninhabited inland delta of the Niger River by controlling the river flow, and to produce exportable quantities of cotton and rice. The project was conceived after a 1919 study mission noted the failure of dry-land cotton cultivation and proposed an irrigation system for the area. The success of pilot projects in attracting sufficient quantities of labor and in growing good quality cotton led to
the approval of a program for the general development of the Middle Niger Basin and the establishment of the Office du Niger, a French public enterprise which was supposed to operate on commercial lines. The Office undertook the development of 2½ million acres and the attraction and settlement of the necessary population. The project was to produce cotton for export and rice as a subsistence crop.

The Markala barrage, its navigation canal and the canals leading to the main sections under irrigation, were officially opened in July 1947. The initial area of approximately 55,000 acres in two regions of the Central Delta was gradually expanded under the Office du Niger until 1964 when it was turned over to the now independent Mali government. At that time, the project included about 125,000 acres and 33,000 people with a production of 43,000 tons of rice and 9,000 tons of seed cotton. The acreage achieved was well under the 2½ million acres originally planned, and the yields have been generally disappointing. During its management, the Office was subsidized by the French; it was never able to amortize or earn a return on the approximately $175 million capital investment.

The inadequate data on which the project was based led to an under-estimation of the amount of rainfall available and therefore an expensive irrigation network which supplemented the rain only in a very limited period. Since the dam is not a storage facility, and the flood coincides with the onset of the rains, river water is not available for irrigation at the end of the dry season when pre-watering of the hard soil could
substantially increase yields. Lack of detailed micro-relief data resulted in significant shortcomings in the irrigation and drainage networks, with canals originally designed for one use having to be converted to the other.

The primary problem of the scheme, however, has been the lack of adequate manpower. Mali itself has no particular population pressures, and recruits from more distant areas do not identify themselves closely and continuously with the project. Mechanization has supplemented manpower, but has proved expensive in relation to output, partly because of the relative isolation of the project from markets and supply, and partly because of the shortage of trained administrative and technical personnel. The labor situation continues to deteriorate as opportunities in other areas of Mali develop, especially cotton growing in the dryland farming areas and rice cultivation in the valley of the Niger River and its tributaries. The Office expanded the project's area despite labor shortages: high yields could be obtained on newly developed virgin land and outside funding has been available for new extensions. Since independence, Mali authorities have attempted to re-emphasize manual labor over machinery, and cotton over rice, and have begun to introduce sugar cane as a cash crop.

E. NIGERIA

NIGER AGRICULTURAL PROJECT (MOKWA SCHEME)

In 1947 the West African Oilseeds Mission noted several areas in West Africa where it appeared that groundnuts and
other oilseeds could be profitably grown by mechanical methods. The Nigerian Government selected one of the Nigerian sites for immediate development and invited the newly formed Colonial Development Corporation to take part. A limited liability company, the Niger Agricultural Project, Ltd., was formed with a capital of £450,000 subscribed in equal shares by CDC and the Nigerian Government. CDC warned that because of its high component of social experimentation, the scheme involved high risk and marginal profitability, and the Nigerian Government agreed to meet the estimated operating loss during the first years up to a maximum of £31,793. Both the Corporation and the Government assumed that after the initial losses during the experimental years, the project would evolve into a commercial success.

The site was 32,000 acres of virtually uninhabited land near a small town named Mokwa, about 325 miles north of Lagos and 25 miles north of the Niger River. Since local land tenure laws prohibited plantation farming, the government declared the site a Settlement Area. The company was to clear the land and direct agricultural operations in return for 2/3 of the total crops; peasant settlers would provide labor for the remaining third.

The aim of the Project was the production of groundnuts for export and sorghum for local consumption, and the promotion of modern farming methods. Since the chosen site was sparsely populated, these modern methods incorporated a high degree of mechanization and managerial supervision rather than the traditional labor intensive techniques. It soon became clear, however,
that most operations had to be done by hand. Only ploughing and ridging could be mechanized, and even there the prolific lateral root system damaged the agricultural machinery. Clearing, sowing, weeding and harvesting were done by hand. Thus while planners had assumed that mechanization would enable each settler to cultivate a 24 acre farm, rather than the traditional 4 acre plot, in fact adequate machinery for most operations did not exist. Farmers found that they were expected to provide an impossible amount of labor for only one-third of the crop. Productivity on the project was not high enough to make these terms attractive, especially since alternative land was easily available and the recruitment of labor from more densely populated parts of Nigeria was discouraged for political reasons.

The original plan had proposed that in the early years the project would be operated by direct farming with hired labor. It was thought that the expected high yields would offset development costs and that settlers would be attracted by the prospect of joining an operating enterprise whose success had been clearly demonstrated. Direct farming was actually tried only in 1950. Costs were high and yields low, and the government decided that direct farming was uneconomic and that the project should move immediately to profit-sharing settlers. The decision was a mistake: without solutions to the problems of low yields and mechanical failures there was no way the project could attract an adequate number of competent settlers.
The project was never able to work with crops whose return would justify the high overhead. The CDC Annual Report for 1953 noted that by the end of 1952 some information had been gained, but that the commercial prospects of the project were poor. The government regarded the scheme as a valuable contribution to rural development, but its commercial losses put the project outside of CDC's frame of reference. CDC, although publicly financed, was expected to confine its operations to commercially viable ventures. In 1954, the Niger Agricultural Project, Ltd. was liquidated and its assets were purchased by the regional government for an experimental farm and training center.

F. SENEGAL

RICHARD TOLL

Richard Toll ("Richard's Garden" in Woloff) on the banks of the Senegal River has been the site of agricultural experiments since 1816. In that year a French expedition, including a Royal Gardener of Louis XVIII named Richard, succeeded in settling the area and growing various fruits and vegetables. The settlement was disbanded in 1833 when difficulties with poor soil and salinity produced poor harvests and tribal unrest made maintenance of the security of the outpost untenable. The French Agricultural Service and the Colonial Cotton Association made several attempts to grow cotton between 1904 and 1923 but all were unsuccessful. After the Second World War, Senegal was faced with a dual problem of dependency on a single export crop (groundnuts) and on the almost total
importation of its main food crop, rice, from Indo-China. The Mission for the Exploitation of the Senegal (MAS) suggested the creation of a giant rice farm at Richard Toll to solve both problems.

The site is a large flat uninhabited plain, and the planners opted for a high level of mechanization rather than settlement. Since the Senegal River is salt water except in the rainy season, fresh water is supplied from the Taouey River which flows from Lake Guiers to the Senegal. A barrage was built across the Taouey to prevent the fresh water from escaping into the Senegal, and a pumping station distributes the water through the project's 375 miles of canals. Other capital construction included 415 other dams, bridges and culverts, 350 miles of drains, a rice mill and a small river port.

Tentative experiments were made on 120 hectares in 1945; a pilot project was established in 1947 on 175 hectares and expanded to 550 in 1949. By 1955, 2000 hectares were under cultivation. Experiments were made with nearly 1500 varieties of rice in an effort to find high yield types which fulfilled the demands of mechanical cultivation for rigidity and homogenous maturity. Other problems which preoccupied the managers were the utilization of fertilizer and choice of rotations to avoid the exhaustion of the soil; salinity; wind erosion; wild rice as a weed; and the annual plague of mange- mils, small birds which swooped down on the crop at harvest time like locusts.
By 1953 Richard Toll had cost 2 billion CFA francs and it was anticipated that this cost would double by the time the planned 6,000 hectares were under cultivation. Critics pointed out that, although yields were high, at best Richard Toll would be able to supply only one-fifth of Senegal's rice requirements, and that such results were not worth their high costs. In an effort to decrease costs, MAS turned over 1500 hectares to a private company, Entreprises Africaines Ortal, for cultivation in 1953 and signed a fifteen year contract for the management of the entire project in 1955. Ortal was an engineering company rather than an agricultural firm and had been involved in the project's construction. The government agreed to absorb any future losses. The project continued to operate with paid labor, except for a small section of 300 hectares that was allotted to settlers in 1957. This latter experiment was not particularly successful as many of the settlers operated with share-croppers, canals and drains were not properly maintained, and rice fields were poorly managed. After five years of substantial deficits, Ortal announced its desire to withdraw from the contract, and on 1 February 1961, in the absence of a suitable candidate to replace Ortal, the state resumed direct control. Government management temporarily cut losses, but by the time the project was operating reasonably efficiently, the world market price of rice had dropped substantially. It was more economical to import rice than to grow it locally.
Richard Toll has been described as a technical success and a financial failure. Its rice yields have been among the highest in Africa and most of the technical problems were solved. However, both capital and operating costs were exorbitant and it would appear that the return from even highly satisfactory crops was insufficient to support the expenses of the highly mechanized project.

G. SUDAN (ANGLO-EGYPTIAN)

KASSALA COTTON SCHEME

The Kassala Cotton Scheme in the Gash Delta of the Sudan's Kassala Province inaugurated in 1925 at the same time but with considerably less preparation than the Gezira Scheme. This project was part of a long-standing British policy in the Sudan to introduce modern methods of cotton cultivation for export. The government's program had included several experimental irrigation works in the Gash Delta and constant admonitions to cultivators to use high quality seed, but administrators had concluded that "to get full value from the flood it is necessary...to study the problem as a whole and work out a comprehensive plan."^4

The major obstacle to large-scale development in the Gash Delta was supposed to be adequate transportation; climate, water and soil were all judged to be suitable for cotton

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^4Report by His Majesty's Agent and Consul-General on the Finances, Administration and Condition of the Sudan for 1920. (Cmd. 1487), p. 128.
cultivation. Concrete plans were made in 1922 for the construction of a railroad linking Kassala to Port Sudan, the Sudan's major outlet on the Red Sea, and the Sudan Government informed the Sudan Plantations Syndicate, its partner in the Gezira Scheme, that it would welcome the assistance of the Syndicate in the management of the agricultural development of Kassala. The railroad was built, the Kassala Cotton Company was established to manage operations in Kassala, and a tripartite profit sharing agreement was arranged for the Company, the government and the native tenant.

The Scheme encountered two major problems which led to its demise. First the amount of water actually available was considerably less than the original estimates. The flow of the Gash watered a smaller area than the planners had thought, and further, the Italians constructed a dam 25 miles upstream at Tesenei in Eritrea which also reduced the arable acreage in the Gash Delta. While a compromise was reached with the Italians on the amount of water they could abstract from the Gash River, by 1927 it was clear that the normal irrigable area was approximately 18,000 acres rather than the originally estimated 100,000 acres.

The second problem which became intertwined with the first was the problem of labor. The Hadendowa, an essentially pastoral tribe, were locally regarded as the ancestral owners of the Delta. While not particularly interested in cotton tenancies themselves, they were dependent for about half the year on the Gash flood for food and fodder crops, and objected when immigrants were given tenancies which interfered with
their traditional rights. Even when Hadendowa accepted tenancies, the care of their herds remained their first priority, so that they tended to be poorer tenants than the immigrants and naturally less favored by the managing company. If the project's acreage had been as originally estimated there would have been room for everyone. Unfortunately with the project reduced to 18,000 acres, the Company struggled to take advantage of every clause in its contract and still could not meet its debenture obligations.

The Sudan Government decided not to allow the situation to drift: the Company was gradually exhausting its capital and the conflicts between the Hadendowa and the immigrant labor began to escalate. The government offered the Company part of an extension in Gezira in exchange for giving up its Gash concession, and K.C.C. gratefully accepted. A government board was established to manage the project on Commercial lines but showing greater flexibility toward local conditions. The Board, encumbered by only half the debenture obligations of the Company generally broke even and most years managed a comfortable profit.

H. TANGANYIKA

TANGANYIKA GROUNDNUT SCHEME

The Tanganyika Groundnut Scheme was initiated in 1947 in order to supplement British postwar rations by producing large crops of edible oils within the Sterling Area. The scheme was conceived by Frank Samuel, Managing Director of the United African Company, and was promoted by Sir Benjamin Smith, the
British Minister of Food. The designers envisaged clearing three million acres of bush, mainly in Tanganyika, and sowing them with groundnuts (peanuts). Emphasis was on speed, scale and heavy mechanization.

While the Scheme's inspiration was from the private sector, its founders decided that funding and eventual management should be public. The British government decided, and Samuel agreed, that it would be inappropriate to involve private enterprise in a project which involved the alienation of so large an area in a colonial territory from native control. In addition, Samuel thought it unlikely that a private company would be able to secure the necessary supplies in an era of shortages, and that even the United African Company would find it difficult to raise the risk capital. Because of the speed in which the scheme was put into operation however, the UAC managed the project during its first year while the public Overseas Food Corporation was being organized and staffed. In addition, private contractors were employed throughout for all clearing operations.

Three areas were chosen for the project, Kongwa, Urambo and Nachingwea. All were in virtually uninhabited and inaccessible parts of Tanganyika. Planners considered the low population density an advantage, since it avoided problems of native rights and they were convinced that only capital intensive/labor saving methods could produce groundnuts on a large scale. This dependence on mechanization however, was expensive since it implied high costs for recruiting European personnel and training African mechanics, and high breakdown rates for equipment which
was poorly adapted to the African terrain. The remoteness of the sites necessitated considerable expenditure on road and rail systems and heavy costs of transporting machinery from the coast. In none of the three areas were the crop yields high enough to cover the costs of mechanization. Since little of the labor was from local sources, the project was also financially responsible for the whole gamut of social services for both European and African personnel.

Crops also suffered from erratic and inadequate rainfall at Kongwa, and rosette disease at Urambo.

The project was discontinued in 1949, having spent £35.87 million and cleared only 220,000 acres. Development of the three areas continued but centered on other crops: cattle ranching at Kongwa, flue-cured tobacco at Urambo, and mixed farming including groundnuts at Nachingwea. The project suffered throughout from basic misconceptions of its feasibility due to inadequate preliminary studies and to an unwarranted faith in western technology to overcome obstacles in unfamiliar surroundings. The discontinuity caused by the exit of UAC and assumption of management by the newly formed and inexperienced Overseas Food Corporation delayed recognition that the scheme had fundamental conceptual flaws which even additional time, money and enthusiasm could not surmount.

I. TANGANYIKA

COMMONWEALTH DEVELOPMENT CORPORATION WATTLE ESTATE

This project for growing wattle, a tree whose bark produces a tanning extract, was initiated by the Colonial
(later Commonwealth) Development Corporation in 1948 at the request of the Tanganyika Government. Its object was to establish a 30,000 acre wattle estate in the Njombe district, construct an extract factory, and encourage local Wabena tribesmen to grow wattle and sell their produce to the Corporation factory. CDC planned to make the initial investment in the estate and factory, and once the enterprise was at the production stage, to relinquish management to a private company.

Preliminary studies were made in March 1949 when a research team from the Wattle Research Institute at Pietermaritzburg, South Africa, examined land in a thirty mile radius at Njombe and selected those sites where mechanical cultivation was possible and the soil was suitable for healthy growth. They inspected small plantations which had been established over the years by the Tanganyika Native Authority and analyzed the bark in sample plots. With the help of government officials, they were able to map 50,000 acres, and confidently reported that at least 30,000 were suitable for the proposed estate. They chose sites for the factory, housing and other buildings, gauged the water supplies and found sand and clay for brick-making.

The area in the Southern Highlands chosen for development had once been covered with forest, but by the time of the project, uncontrolled fellings coupled with clearing for cultivation had replaced the forests with coarse grass. The grass was subject to periodic fires in the dry season, which left the ground bare and vulnerable to erosion in the heavy rains. The area was Wabena tribal land, and the government negotiated with the tribal chiefs to establish the levels of compensation CDC
should pay to those Wabena who had to abandon their homes and move to other tribal lands. In general, local inhabitants welcomed the prospect of employment and 75% of the displaced tribesmen worked as laborers on the estate, many living in CDC constructed villages. The primary difficulty with the site was its isolation: the nearest railhead was 320 miles away, and a 91 mile loop road connecting the site with the African Great North Road had to be built in order to transport equipment and later production.

Land clearing began in 1950 and by the end of 1956 managers had planted 33,000 acres of black wattle trees, 650 acres of pine and 1,000 acres of mixed farming to provide food for the labor force. In 1955 the government asked CDC to help the Wabena tribe to establish a 20,000 acre plantation: CDC ploughed, harrowed and sowed an area which was then divided into small plots. CDC gave advice on tending and the cultivators were expected to supply the CDC extract factory. While delays were initially caused because of skill shortages, equipment that arrived late and damaged, and bad weather, the relatively small scale of the project and long maturation period for the trees, enabled CDC to make up lost time and the planting program was completed on schedule. The factory and labor quarters were completed in 1955 and 1956, and at the end of 1957 the Tanganyika Wattle Company, Ltd. was incorporated to take over the project's assets. Its authorized share capital was £ 600,000 of which the East African Tanning Extract Company, now partners and managers, took £ 50,000, and CDC took up £ 400,000. In addition, CDC provided loan capital of £ 850,000.
While production was successfully accomplished, the project had serious problems with marketing. The scheme faced competition from increased capacity in the industry and from heavy production of other tanning extracts. In addition, in the late 1950's, synthetics offered strong competition to vegetable tanned leather. The project was able to cover its operating costs and produce a surplus after amortization of development and the plant, but had an overall deficit when the CDC loan interest was subtracted. Faced with rising losses, EATEC sold out its interest in the project in 1959 and management reverted to CDC. The Forestal Land, Timber and Railways Company, Ltd., of which EATEC was a subsidiary, became consultants to the project, and acted as distributors and agents in London. Under the CDC the project diversified into wheat and maize, and by 1967 had eliminated its accumulated deficit and in 1968 began paying dividends to its stockholders.

J. UGANDA

BUNYORO AGRICULTURAL SCHEME

The Bunyoro Agricultural Company, Ltd. was established in 1949 to open up a sparsely populated tsetse fly-inhabited area bordering on the Nyama River. It was charged to investigate the feasibility of mechanized cultivation and develop a profitable cropping pattern, and eventually to settle tenants in the area, possibly on a modified Gezira pattern. The capitalization of the Company was £100,000: £40,000 subscribed by the Protectorate Government, £20,000 each by two commercial companies, and £20,000 contributed by the Bunyoro Native
Government in the form of undeveloped land leased to the Company for 33 years. The scheme's managers were to be Mssrs. Steel Brothers, a company which had suffered wartime losses in the Middle and Far East and were interested in investment opportunities in East Africa. It was assumed that Steel Bros. would be able to develop an area profitably, turn it over to native producers, and themselves move to a new area for development. The other company, Mssrs. A. Baumann and Company, a trading company with considerable experience in East Africa, was charged with the marketing of crops and was expected to remain after Steel Bros. had moved on, to sell supplies to African farmers and market their produce.

The Ugandan Department of Agriculture was very conscious of the lack of information available to the initiators of the ill-fated Tanganyika Groundnut Scheme. From May to October, 1950, before work was actually begun on the Bunyoro Scheme, they gathered information about soil conditions in the Kigumba area, and in 1951 did an aerial survey of the initial area. The costs of this research were then charged to the Company. The Agricultural Department also made preliminary estimates of expenditures and possible crop rotations and yields and returns. A. D. Ilewellyn-Jones, the manager-designate, visited the site and submitted an independent report of his own in July 1950 which stressed problems of land clearing, especially potential erosion, labor and mechanization.

Land clearing began in October 1950. Handcutting of trees was replaced by the use of winches in January 1951. This method was successful in removing both trees and the roots
which could damage cultivating machinery, but was slow. The adoption in 1952 of the technique of clearing land with a Caterpillar D.6 coupled with cultivation with a disc plow which rode over roots without damage, speeded clearing so that in 1956 2,400 acres were available for cultivation. Based on the standards of speed, cost and minimum damage to the soil, the most mechanized method was judged the most efficient. Even so, the clearing cost of £15 per acre was too high to be amortized over a short period.

Given the scarcity and therefore the expense of labor, it was necessary to find high priced crops which could be largely mechanized. The scheme experimented with a number of crops. Tobacco was considered the most suitable high priced crop, while maize, finger millet, sorghum, sunflower, groundnuts and beans were tried because their cultivation could be highly mechanized. Cotton was introduced later as an alternative to tobacco. The conclusions were that the costs of mechanical cultivation were not unreasonable, while the costs of weeding which in all cases was done by hand led to an excessively high cost component for labor and made sorghum and millet in particular uneconomic. The general problem for other crops was low yields and returns rather than high costs. A major financial problem with the project was that it took three years to ascertain that the area was unsuitable for tobacco.

After 1954 the Scheme experimented with supervised tenant cultivation. Monthly cash advances were made to tenants to help them pay labor, build houses and meet current expenses. Unfortunately many of the advances were used for other purposes.
When it became clear to the tenants that the return from the crop would not meet their indebtedness to the Company, large numbers left the crop unpicked. The Company's inexperience with tenant farming was partially to blame for the failure of the tenant portion of the Scheme: if the Company had insisted that the advances be used for cultivation and harvesting as intended, the return to the tenant would have been substantially higher and probably would have covered the debts owed the Company. Nevertheless, it was undoubtedly unwise to shift from commercial to tenant farming before a profitable crop rotation had been developed. This was especially true since the easy availability of land meant that the Scheme offered no compelling attractions to potential tenants other than the promise of high profits.

The Scheme was also troubled by a division of the administration. The farm itself was directed by a manager at Kigumba. However, records and accounts were kept by the Managing Agents in Kampala. Without the records and up-to-date costings, the manager found it difficult to plan farm operations. In addition, he had little influence on overall policy decisions.

Finally, the Scheme was plagued by two conflicting approaches to development. The Government, conscious of the expensive failure of the Groundnut Scheme wanted to move with extreme caution and prior accumulation of data. They were not however, willing to charge the cost of collecting the necessary data to the Agriculture Department, insisting rather that it be borne by the Scheme; nor had they hired firms which had previous agricultural experience in the area of the project.
The commercial companies, on the other hand, wanted to expand as quickly as possible. They were aware of the high overhead costs of research, European management and clerical staff, and pointed out that the project had to expand before it would reach a break-even point. The companies also complained that assessing the land contributed by the Bunyoro Native Government at £20,000 had over-capitalized the project from the beginning. The 20% of the return to which this contribution entitled the Native Government was a drain on the scheme's resources, especially since the Native Government made little effort to assist the project further.

By 1956, the companies had concluded that the project was never likely to pay its way and announced that they intended to withdraw. The government recognized that a scheme which combined the agricultural experimentation of opening a new area for cultivation and the social change of tenant farming, could probably not be financially profitable as well, at least in the early stages. The Bunyoro Agricultural Company was wound up, with a loss of £67,000 of its original £100,000. The estate was taken over by the Agricultural Department for a seed multiplication farm, and the rest of the area was converted to a settlement scheme in an effort to maintain the tsetse fly barrier and prevent the area from reverting to wilderness.
APPENDIX II

PROJECTS OF THE ERA OF INDEPENDENCE

A. IRAN

HAFT TAPEH: HAWAIIAN AGRONOMICS COMPANY (INTERNATIONAL)

The development of Khuzestan as planned by the Development and Resources Corporation of New York was a fourteen-dam, multi-billion dollar undertaking which was obviously expected to take years to complete. The Iranians and D & R wanted to develop a showcase which would attract private investors to the region and convince them that large scale farming and food processing, when operated according to modern technology, could be a profitable enterprise. Probably at the instigation of the historically-minded Iranians, planners decided to include a sugar cane project in the overall design: Al Istakri wrote in the 12th century: "I have travelled on the river Masrukan by way of Ahwaz...of its waters not a drop is lost, and it is all used for watering palm grooves, grain and sugar cane fields...In all this great area there is no place in which sugar cane does not grow." Modern Iran imported most of its sugar at an ever-increasing rate, and the idea of re-establishing Khuzestan as a major producer of sugar cane was appealing, economically as well as historically.

The contract for the development and operation of the project was awarded to the Hawaiian Agronomics Company (International), a wholly owned subsidiary of C. Brewer and Company.
While HAI was established only in 1958, the year of the initiation of the Iranian project, the parent company has been in operation since 1826. Founded as a trading company in Hawaii, C. Brewer moved into sugar production in the 1850's, first as an agent and later as an equity partner. By 1925, C. Brewer and Company handled 25% of Hawaii's sugar and was one of the Big Five companies of Hawaii. In 1958, now possessing almost a century of experience in large scale integrated sugar production, the Company founded Hawaiian Agronomics to market its agronomic expertise.

The project was sited at Haft Tapeh, 35 miles below the Mohammed Reza Shah Pahleви Dam on the Dez River. This was the first of the dams to be constructed as part of the Khuzestan Regional Development Project. Eventually the dam was expected to provide the necessary irrigation water for the plantation, and electricity for the sugar mill and refinery. However, since the Dez dam was not scheduled for completion until 1963 and the first commercial crop planting was planned for 1960, electricity was initially provided by large diesel powered generators and irrigation water by three diesel pumping stations using water from the Dez River. Once water was available from the dam, part of the pumping system would be moved to areas not served by the Dez project.

The plantation was expected to produce 300,000 tons of cane annually, or approximately 30,000 tons of refined sugar. The mill was capable of grinding 3,000 tons of sugar daily. Thus the factory capacities were approximately three times plantation production, or about 90,000 tons of refined sugar.
a year. The discrepancy results from the role of the plantation as a pilot project which was intended to attract private investment into agricultural production. A laboratory was also established to experiment with control of disease and pests and the selection of cane varieties that produce sturdy growth and a high sugar content in the Khuzestan climate.

Planners assumed that the industrialization of Khuzestan implied urban migration and shortages of labor in the rural areas. They therefore planned on mechanizing sugar cane operations, arguing that mechanization would train farmers in techniques which would become increasingly important as under-employed peasants took up jobs in the nearby oil and petro-chemical industry. To support the high level of mechanization, the plan included the assembly of machinery and spare parts on site before the first commercial planting and the construction of a repair shop and warehouse to service the equipment. The estimated number of sugar workers was 650, and a plantation village, including a mosque, bazaar, school and housing, was planned to accommodate 2500 people.

The first three years of the Haft Tapeh project were disappointing. The 1961-62 crop, grown on the 2200 hectare developed area, was only 12,000 metric tons. Managers found that cane harvesting could not be mechanized efficiently and that the design of the carts which transported cane from the fields to the mill was inadequate. Production per hectare was low, primarily because the average yields were pulled down by certain fields whose productivity was extremely poor. Meanwhile the Iranian Plan Organization which had provided the
capital for the project was facing financial difficulties. They proposed that the refinery should be sold to private investors and that the plantation, already cut from an original 10,000 hectare area to 6,000 hectares, should be further reduced to the 2500 already developed. Finally the Sugar Monopoly refused to purchase raw sugar from abroad to supply the factory, so that the refinery was operating considerably below full capacity. The Monopoly pointed out that it could import refined sugar at a lower cost than raw sugar plus Haft Tapeh's refining charge.

In the second year of commercial production, productivity increased and the acreage was slightly expanded (to 2421 hectares), and the quantity of refined sugar reached 17,000 metric tons. The increase was attributed to greater efficiency in harvesting, which was done almost completely by hand and with rebuilt cane carts for field transport, and to an improvement in the performance of the mill and refinery. Average yields remained disappointingly low.

By the 1963-64 crop, the fields with the lowest yields had been 'reconditioned' and errors in leveling, which had caused problems of waterlogging and salinization, were corrected. Unfortunately, the plantation suffered a heavy frost and production fell to 12,000 tons. Frost had been always a recognized danger because of the northern siting of the plantation, but the superior soil available at Haft Tapeh was considered worth the risk. Land development had proceeded and acreage had increased to approximately 4,000 hectares.
Fortunately for the future of cane sugar in Iran, Hawaiian Agronomics and the Plan Organization persevered. Yields and production markedly improved: the 1964-65, 1965-66 and 1966-67 seasons produced 25,847, 36,935 and 38,360 tons of refined sugar, respectively. By 1966 HAI was considering an equity participation in a 25,000 acre plantation near Haft Tapeh and the construction of a mill to provide raw sugar to the Haft Tapeh refinery. The Iranians assumed the management of Haft Tapeh in 1967 but retained HAI as a consultant. In 1971 the project's acreage was expanded to 14,000 hectares, and production grew to 100,000 metric tons per year, approximately 15% of Iranian demand. A paper plant has been constructed nearby to make use of the cane fiber.

B. IRAN

KHUZESTAN REGIONAL DEVELOPMENT PROJECT

In the mid-1950's, the Shah of Iran and head of his Plan Organization, Abdol Hassan Ebtehaj, decided that the development of the province of Khuzestan was of first importance, not only to the region's two million inhabitants, but to all of Iran. Khuzestan produced the oil and natural gas on which Iran's modern wealth is based, and the Shah and Ebtehaj felt that some of that wealth should be returned to the province in the form of development funds. The region was also the basin of five great rivers which flow from the Zagros Mountains into the Gulf. In the time of Darius, 2500 years ago, those rivers irrigated the province, and Khuzestan was the breadbasket of ancient Persian Empires. Those irrigation
works had long since fallen into disrepair, and erosion and
the percolation of water through the subsoil had dangerously
increased the salinity of the soil. Crops were poor and the
region had become depopulated. Iran's leaders sought a plan
for the integrated development of the entire region which
would restore Khuzestan to its ancient glories.

In September 1955, Ebtehaj contacted David Lilienthal
and Gordon Clapp, whose work with the Tennessee Valley Authority
presumably qualified them to devise a regional development
scheme which would include dams for power and irrigation and
projects of industrial and agricultural development. Ebtehaj
emphasized that the Iranians wanted them not only to formulate
a development plan, but also to undertake its execution. The
Iranians had already obtained advice, studies and surveys from
the Harvard Advisory Group, Point Four, the UN and various
engineering firms, but had had difficulty translating the plans
into tangible advances. Therefore they wanted Lilienthal and
Clapp and their newly formed Development and Resources Corpora-
tion to perform the quasi-governmental task of both formulating
and implementing a regional development plan.¹

Lilienthal presented his concepts of 'TVA' development
in Teheran in February 1956 and received approval to begin the
surveys for a unified plan. Over the next two years, D & R

¹The independence granted D & R is unusual but not
unique in Iran. The Iranian Government asked Tahal, the
Israeli water agency, to plan and implement the development
of the Ghazvin area. See Maxwell I. Klayman, The Moshav in
investigated the rivers for irrigation and power potential; located dam sites; analyzed soil for types and fertility, salinity and drainage, and potential for the growth of food crops; explored the use of natural gas as a raw material for a petro-chemical industry; and searched for other minerals in Khuzestan. Meanwhile the government authorized the construction of a high voltage transmission line from Abadan, the site of the oil refineries and a main power source, and the provincial capital of Ahwaz; the establishment of a sugar plantation at Haft Tapeh; a series of trials and demonstrations of chemical fertilizers on Khuzestan soil; the drafting of plans for a fertilizer plant based on natural gas; and preliminary work on the Dez dam. The Dez dam was to be the central core of the regional project, providing power for the industrial development, irrigation water and flood control. D & R presented a report to the Plan Organization on the "Unified Development of the Natural Resources of the Khuzestan Region" in March 1959, detailing the advances which had been made, the work in progress, and their goals for the area. These goals included a system of fourteen dams, the construction of a polyvinyl chloride plant based on natural gas, and a general re-shaping of tenant-landlord relations.

The major difficulty faced by the regional plan was financing. Although Iran was receiving a sizable income from her oil exports, these funds were not enough to finance a project of the magnitude of the Dez Dam and irrigation works, approximately $105 million. Iran looked instead to the World Bank for a loan, and unfortunately the Bank's attitude fluctuated
from enthusiasm to rejection. Initially the Bank was very positive about the project and D & R's involvement in it. In April 1957 the World Bank approved the Khuzestan program and agreed to finance its foreign exchange requirements, but expressed concern that rapid development, with foreign exchange from oil and the Bank loan converted into rials, could produce uncontrollable inflationary pressures. By October 1958 the Bank's support had become more tentative. The Bank's economists did not doubt that the project was technically sound, but preferred a more gradual start, small diesel power stations and demonstration irrigation projects, to the Dez dam. The Shah meanwhile remained committed to D & R's approach, and since development involved Iranian as well as Bank funds, negotiations reached something of an impasse.

The D & R project was also under attack within Iran, with other regions feeling that Khuzestan had been unfairly singled out for development. Lilienthal was criticized for excessive spending, explained in part by the rapidity of the schedules which had been adopted. Finally the Plan Organization itself was attacked for spending above its income, a charge which was certainly accurate after the Government cut that income from a promised 80% of oil revenues to 54%. In February 1959, Ebtehaj resigned and under Prime Minister Egbal the Khuzestan program was cut back to the essentials: the Dez dam, the power and irrigation related to it and the sugar cane project.

Public financing for the polyvinyl chloride plant and fertilizer plants was eliminated, and the construction of the remaining dams was postponed.

A low point in Iranian-Bank relations was reached in May 1959 when the World Bank not only announced that it would not finance the Dez dam, but stipulated that Iran would have to guarantee reforms in tax collection and a commitment of oil revenues to development before the Bank would complete their $72 million loan for highways. Iran however, had already spent $11 million on the preliminaries of construction, 20% of the projected costs of the dam itself. The Shah decided that the necessary funds would be found elsewhere, probably by eliminating or finding alternative funding for other projects. Stubbornness finally won Iran's point with the Bank, and in September 1959 Iran and the World Bank agreed in principle to the terms of the loan. Iran agreed to the budgetary reforms proposed by the Bank and D & R agreed that agricultural development would be limited initially to a pilot project of 20,000 hectares, rather than a program for the entire 125,000 hectares below the dam. This approach was to allow completion of fertilizer trials, demonstration of irrigation and cultivation techniques and an accommodation with local landlords before large scale development began.

The Dez dam was completed on schedule in March 1963 and was inaugurated as the Mohammed Reza Shah Pahlavi Dam. The Khuzestan Development Service was established by D & R to manage the agricultural development projects. These included the 20,000 hectare pilot project, a series of fertilizer trials
which ran from 1957 to 1961 and extensive public health work. The latter two projects were seen as a way of extending the benefits of the pilot project beyond its immediate area.

The pilot project involved the construction of irrigation canals and related works to distribute the water impounded by the Pahlavi Dam; land leveling and access roads; and arrangements for sharing with landowners the work and expense of land preparation and operating costs of the irrigation system. Meanwhile KDS began the process of educating and motivating the local farmers in the use of modern agricultural methods, including irrigation, commercial fertilizer and the cultivation of new crops. D & R trained and supervised Iranian teams who worked directly with farmers. The company also coordinated and made available to local farmers a package of government services including agricultural credit, mechanization, the results of field trials and research, water regulation and irrigation, and marketing arrangements.

In the early stages of the project, the planners did not make special arrangements to assure that the distribution of benefits would be on an equitable basis. They assumed that increased production would benefit both tenants and landlords in proportion to their traditional share of the harvest. The land reform of 1962 changed this social context of the project, as it limited landowners to one village or 500 acres: the project then dealt with peasant farmers, rather than large, often absentee, landowners, and benefits were skewed towards lower income farmers. Through its intensive work with the peasants, KDS was able to triple the production of the farmers
in the pilot area, and its agricultural work has generally been considered a success.

The Plan Organization established the Khuzestan Water and Power Authority in 1960, and between 1962 and 1966, D & R gradually transferred its managerial functions to the Iranians of KWPA. Since the departure of D & R, KWPA has concentrated on merely selling water and power rather than carrying forward the developmental initiative, and has generally lost interest in agriculture.\(^3\) It maintained the crop trial station for several years, but has now transferred it to the Ministry of Agriculture.

One of the problems of the Dez project is that now that the dam and the irrigation works have been completed, the Iranians have not been able to decide how the remaining 100,000 hectares below the Dam can best be developed agriculturally. The pilot project increased yields and improved the social welfare and incomes of the peasant farmers, but it was very expensive. The Iranians could not see extending the same network of village extension work, machinery, credit and public health throughout the whole area. Approximately 65,000 hectares were leased to private corporations, but of the four largest projects, two have withdrawn after heavy losses. A third alternative has been the establishment of 'farm corporations', cooperatives in which farmers exchange individual plots for shares in a larger unit. These corporations are not a solution

\(^3\) Interview with Thomas Mead, Development and Resources Corporation of New York, 26 November 1975.
to the problem of providing proper management, credit, machinery and technological expertise to village agriculture, but only a new form of the problem itself.

C. KENYA

MUMIAS SUGAR PROJECT

The Mumias Sugar Project in Kenya was initiated in 1967 when the Kenyan Government chose Bookers Agricultural and Technical Services (BATS), a subsidiary of Bookers McConnell, to carry out a feasibility study and pilot project to determine the viability of a sugar project at Mumias. The township of Mumias, approximately 200 miles northwest of Nairobi, was chosen by the government because it was a fairly densely populated area where labor was either underemployed or tended to migrate to urban centers. The land was flat, suitable for either irrigation or drainage, and rainfall was plentiful. The soil structure was good and the soil was fertile, but about half was left uncultivated. Some sugar was already produced in the district, but its only market was the jaggery factories where it is converted into alcoholic beverages. The government considered rural alcoholism a serious local problem and hoped it could be mitigated by the provision of a more profitable market for sugar production.

The Kenyan Government chose Bookers primarily because of its generally good international reputation. Bookers has been producing sugar for 150 years, predominantly in the West Indies. BATS provides technical and management services to third parties outside the Booker Group, but is able to base
its expertise on the practical experience of the various subsidiaries of the Booker Group. Bookers also had the advantage of being already involved at the nearby Chemelil estate where BATS was evaluating the operations of that project to determine whether and under what circumstances BATS would be willing to assume its management. Finally, the ownership of the Mumias scheme was expected to be shared by the Kenyan Government and the managing company: since government funds were to be provided from a loan from the Commonwealth Development Corporation, there was some appeal in retaining a British firm to act as manager.

After three years of study and an extensive pilot project, BATS submitted a favorable report on the project. They proposed a nucleus estate of 8000 acres and construction of a plant which could process 50,000 tons of sugar annually, expandable to 80,000 tons. Farmers within an eight mile radius ('outgrowers') would be encouraged to plant approximately 18,500 acres for the factory. The factory and estate would employ about 2000 Kenyans and an additional four to five thousand would be able to earn an average cash income of £130 from the scheme. Local farmers seemed enthusiastic and the division of the proceeds from the sale of cane appeared attractive to both the outgrowers and project managers. The study had determined that irrigation would not be economic: rainfall was plentiful and cane grown on the lower colluvial soil would have access to some ground water. It proved possible to drain these previously uncultivated, waterlogged colluvial soils and grow economic crops of cane. Land clearing and soil preparation
costs were relatively low, rain transport could be provided by a ten mile spur from the main line. The climate allowed cane to be grown all year, and the factory was planned to run ten months with two months for overhaul.

On July 1, 1971, the Mumias Sugar Company was formed under the chairmanship of J. G. Kibe, Permanent Secretary in the Ministry of Agriculture. Project investors included the Kenyan Government, CDC, Bookers, the Kenyan Commercial Bank and the East African Development Bank. The British Overseas Development Administration provided a loan to finance the construction of the factory. BATS was contracted to provide technical advice and management.

Despite the years of experimentation and apparent local enthusiasm, the project began slowly. The major delay was in the acquisition of land for the nucleus estate, which in turn postponed land preparation until after the dry season. The work then had to be done under poor conditions and in a shorter period of time than envisaged. The project managed to get back on schedule, partly because of its relatively small size and partly because the Kenyan Government finally enforced its right of eminent domain and completed the land acquisition program.

Another delay was the construction of roads within the nucleus estate, a company responsibility. The company had considerable difficulty obtaining the proper kinds of equipment. This was one activity which was not tested in the pilot project and experimentation with different types of machinery was required before an adequate road program was developed.
The designers of the Mumias project carefully delineated the government and company responsibilities. The company is responsible for the development, including roads, and subsequent operations on the nucleus estate. Although the company has provided a few field workers for outgrower development, the government is primarily responsible for agricultural extension work among the outgrowers and encourages local farmers to attach themselves to the project. The company then enters into agreements with local farmers for additional (extra-estate) cane production: the farmers clear a plot, and a company cultivation unit ploughs, harrows and furrows it. The company provides disease treated planting material and fertilizer, but the farmer is responsible for planting, fertilizing and weeding according to the precepts taught by the extension workers. The company harvests and transports the cane, but gives hiring priority in the harvesting groups to the local farmers. The company takes total responsibility for training the personnel for the factory.

Responsibility for social benefits is also divided between the company and the government. Thus while the company provides housing on the estate for the managerial staff and has expanded housing in the four townships around Mumias to accommodate the estate labor, the outgrowers continue to live in their own housing. The company provides some medical, educational and social facilities on the estate, but schools and clinics had already been established by the government in the area. The company has built roads in the outgrower region, but the government has paid for the construction. Social and
legal problems which arise are settled by the company with the assistance of the provincial government and local chiefs.

Both government and company officials consider the project a success and are planning an expansion to a second plant. Since the project was partly motivated by social/employment considerations, and secondarily by a desire to substitute local production for a major import, the variations in the world price of sugar are not expected to influence the future of the project.

D. SENEGAL

GROUNDNUT PRODUCTIVITY SCHEME

When Senegal became independent, the French price supports she had enjoyed for her groundnuts, 80% of her export earnings, were phased out. Under the rules of the European Common Market, by 1968 Senegalese groundnuts could be sold in Europe only at the world market price, approximately 25% less than the prices of the protected French market. This price adjustment posed a serious threat to the Senegalese economy whose GDP could fall as much as 10%, and to the Senegalese cash crop farmers whose incomes would suffer a substantial reduction unless they were able to increase production. Since the land in the "groundnut basin" was already fairly densely populated, it was thought that the necessary increase in production could be achieved only by raising yields, rather than clearing new areas.

The technology to increase yields by 25% had been developed by two French research institutes: the Institut de
Recherche d’Agronomie Tropicale (IRAT) and the Institut de Recherche sur les Huiles et Oléagineux Tropicaux (IRHO). The two Institutes made recommendations for the introduction of a series of measures to improve yields, including variety selection, disinfection of seeds, sowing densities, fertilization and husbandry techniques, and three small items of equipment which could be purchased and used by most small farmers. Their recommendations had been developed over years of research and trials in Senegal, and had been proven at pilot-extension projects carried out by IRHO since 1955.

Rather than communicating the technology through the channels of the Senegalese Ministry of Rural Development, the project was put out to tender and the contract was awarded to the Société d’Aide Technique et de Coopération (SATEC). Funding was provided through two loans, one from the French Fond d’Aide et de Coopération (FAC) of Fr CFA 190 million over the period 1 March 1964 - 31 December 1964, and the other from the European Development Fund (FED) of Frs CFA 1,448 million from 1 January 1965 to 30 June 1968. While SATEC itself is based on French state capital, many of its competitors in the bidding were wholly private firms. SATEC in turn retained the services of specialists in two private firms, the German AGAR und HYDROTECHNIK and the Italian TECHITALIA. SATEC's function was to supply advice and technology, and coordinate existing organizations. Credit and marketing continued to flow through the 1500 cooperative societies, supply of improved agricultural implements continued to be manufactured and supplied by the commercial enterprise CISCOMA, and research on groundnuts
remained the responsibility of the National Agricultural Research Center.

The project covered approximately 38,000 square kilometers, comprising three administrative regions. The population is about one million. All are Wolof tribesmen and all conform to similar primitive techniques for farming groundnuts. Their principle crops, which are both cash and subsistence crops, are groundnuts and millet.

The administrative organization was composed of a head office in Dakar, which employed several agronomists and specialists in communications and information, and three regional offices, each under the supervision of an experienced director and two assistants, one of whom specialized in training extension workers. The regions were sub-divided in 39 arrondissements (districts) each headed by a district supervisor with technical agricultural qualifications and staffed by 15 to 20 locally recruited extension workers. These field workers, 700 in all, were chosen from among local peasants after passing a series of practical tests, and were given a short course in communicating the package of techniques developed by the research institutes. Each was in charge of eight or nine villages within a fifty square kilometer area. At the beginning of the project all employees above the lowest level were European; however, as the project progressed a significant Africanisation was affected. The replacement of Europeans by Senegalese helped close a communications gap between the district supervisors and the extension workers whose imperfect French and lack of technical training raised barriers in the
early years to the free flow of information between the village level and the Dakar headquarters.

The extension force had four functions. It was to inventory the equipment available to each farm and compare that equipment to standard schedules of equipment recommended by the Headquarter's staff. The schedules became a target of level of mechanization to be reached by each farm and a maximum not to be exceeded. The data was recorded in an 'extension log-book' and annually updated, providing a continually current appraisal of the progress of the equipment program. The equipment was purchased on the advice of the extension agent and with credit provided by the local cooperative.

The communication of techniques followed 'themes' corresponding to the stages of the growing cycle: disinfection of seeds, drill sowing, fertilizer spreading and hoeing. Each theme was introduced by a training session for the extension workers who then communicated the techniques to farmers following a schedule of weekly work programs drawn up by the district supervisor. The supervisor accompanied each extension worker in turn, making whatever corrections were necessary and himself keeping in touch with the realities of the village level. The techniques offered were divided into two types: a 'heavy' program for larger farmers who had draught animals, and who were expected to make the largest contribution to the production targets, and a 'light' program for everyone else.

The third function of the extension force was the massive training program for Senegalese extension workers. Each extension worker received an induction course designed to
verify that he was capable of learning and demonstrating new techniques. They then received training at the beginning of each cycle and further sessions to encourage them to examine their field experience and consolidate their knowledge. During the periods of the growing season when extension workers had some free time, group working sessions were organized with the district supervisors and the regional extension officers under the leadership of training specialists. The training activities became increasingly important as the European staff was replaced by Senegalese.

Finally the extension force coordinated the services of other organizations which were responsible for collecting the harvest and supplying and financing equipment and fertilizers. The extension workers identified equipment needs, assured prompt delivery and arranged for repair services required by farmers.

The SATEC scheme began well: the extension network was quickly established and total output rose significantly for the first two years (1964–65 and 1965–66). Equipment sales and fertilizer consumption rose significantly, the demand for credit and equipment was satisfied on a more organized basis. Plant husbandry markedly improved among peasants and a network of trained Senegalese extension workers was established.

Unfortunately, the primary aim of the project, as seen by its sponsors, the Senegalese and French Governments and the EEC, was the increase in groundnut production, and the average sales of groundnuts actually declined during the period of the project. The major problem seemed to be that the goals of the scheme, intensive cultivation to increase production,
did not coincide with those of the farmers. The farmers, quite rationally, did not see the attraction of increasing their production of a crop whose price was obviously falling. In addition, even before the disastrous Sahelian drought, rainy seasons in 1966, 1968 and 1970 were poor, and the peasant reaction was to shift to food crops: a food surplus in a poor year will always find a market and the farmer will at least be assured that he can feed his family. Those farmers who obtained draught animals used them to extend their holdings, rather than cultivate intensively. While the government had to be concerned with soil exhaustion and a future when land would be scarce, the individual farmer could see that extensive farming over wider areas returned a higher yield per man-day than intensive farming over smaller areas. Further, it was to his advantage, looking toward that same future of land scarcity, to acquire cultivation rights over as large an area as possible. Finally, cost projections were based on the assumption that one year in four, the rains would be poor. In recent years the rains have been sufficient only one year in two, and farmers could not risk further indebting themselves for groundnut fertilizer in hopes of a harvest that would cover their costs and pay their debts. On an individual basis, they were wiser to increase their production of millet, and this the peasants did in large numbers.

The project officially ended in 1968 and SATEC was transformed into a permanent national extension service under the name of the Société de Développement et de Vularisation Agricole. SODEVA continues to receive technical assistance
from the three private companies under the general leadership of SATEC.

E. SUDAN

BLUE NILE REGIONAL DEVELOPMENT PROJECT

The Republic of the Sudan is currently viewed as a nation of considerable agricultural potential. Its undeveloped resources include 80 million acres of range land and 120 million acres of cultivable land. While irrigation possibilities are limited by the 1959 Nile Water Agreement with Egypt and the potentialities of conservation projects to only five million additional acres, the remainder receives between 500 mm and 1000 mm of rainfall, adequate for a large variety of crops. The Sudan is famous for her long staple cotton, but also produces wheat and groundnuts in the irrigated areas and sorghum, millet, sesame, groundnuts, oil seeds, cereals and short staple cotton in the rainfed regions. Success in combating animal diseases has resulted in the growth of livestock, and the Sudan exports both cattle and sheep.

The government has recently oriented its economic planning towards the development of agriculture. Traditional developmental policies of attaining self-sufficiency in foodstuffs and then diverting resources to industry, have been revised. Rather the Sudan government now aims at surplus agricultural production and export, and sees industry as a complementary sector to agriculture, where agricultural products can be processed and inputs produced. With their long experience in foreign investment in agriculture, planners have had little
reluctance to accept financing and project planning from abroad in their agricultural development.

Both regional financiers, public and private, and western businessmen have been attracted by the agricultural potentialities of the Sudan. The oil rich Arab governments are aware that their dependence on food imports makes them vulnerable to retaliation for increased petroleum prices by the 'agro-powers'. Development of Sudanese agriculture is not only a profitable investment, but could make the region self-sufficient in foodstuffs as well. Thus the Kuwait-based Arab Fund for Economic and Social Development has proposed a ten year plan costing some $5 billion which would double the Sudan's output of cereal, raise meat production from 350,000 to 850,000 tons, and increase sugar production from 110,000 to 810,000 tons.4 Western corporations have found that the Sudan's development aspirations offer good opportunities for sales of goods and services. U.S. exports, for example, jumped from $6 million in 1972 (when the U.S. and the Sudan resumed diplomatic relations) to over $100 million by 1977.5 The growth has been primarily in heavy equipment for construction, agriculture and transport. Demand for engineering and construction services is also high and many of the proposals for Arab


Arab investment in Sudanese agriculture assume the availability of western, especially American, technology and management.

One of the numerous companies which has attempted to capitalize on the agricultural possibilities in the Sudan is the Arizona-Colorado Land and Cattle Company. AZL participated in the formation of AZL International, a company financed by a Saudi Arabian investment company named TRIAD and the author of several agribusiness proposals in the Middle East. In 1975, AZL International submitted the Blue Nile Regional Development Project to the Sudan Government for the establishment of a modernized cash crop and livestock (sheep and cattle) industry in the Blue Nile Region.

The project included a commercial company, the expansion into livestock of the role of the Agricultural Bank of the Sudan, and a program for the development of the social, technical and physical infrastructure of the area. AZL was designated the General Manager of the Commercial Company, but the development of social infrastructure and the modernization of the traditional agricultural sector remained the responsibility of the relevant ministries. It was envisioned that overall responsibility for the project would be vested in a Project Coordinating Committee chaired by the Minister of Agriculture and composed of the Chief Executive of the Animal Production Public Corporation, the Blue Nile Provincial Commissioner and representatives of the other government agencies involved. In the Blue Nile Region itself, the Blue Nile Provincial Commissioner was expected to appoint a Project Coordinator who would be assisted by a Regional Coordinating Committee. The latter
would be composed of local traditional leaders and the chief field officers of the participating ministries.

The commercial company was to consist of four operating divisions. The Er Roseires Ranch would be established on one million acres of improved pasture on which sheep and cattle would be raised. A 30,000 acre irrigated crop farm would produce cash crops for export, cattle fodder and grains for livestock, and fruits and vegetables for canning. A livestock finishing complex consisting of feedlot and feed milling operations, was expected to serve both the company and local producers, and would distribute specialized feed mixtures. Finally the slaughterhouse and cannery complex would process the meat, fruit and vegetables produced by the company.

In addition to the large scale operations of the commercial company, the project also promoted the development of the traditional sector. Designers advocated an expanded system of Agricultural Bank of Sudan loans for livestock development, to be supported by increased government extension programs and the supply of inputs and marketing services by the commercial company. It was envisioned that a Livestock Development Division would be established which would administer both the development funds provided by ABS and the short term loans provided by the commercial company. The loan program was expected to cover about 1000 farmers for mixed farming and livestock fattening, plus 150 individuals, families and cooperatives who would create small ranches in the vicinity of the Er Roseires ranch. Funds would be available for development of forage crops, range improvement, provision of breeding
stock and the introduction of improved herd and flock management practices.

The third aspect of the project was the development of the regional infrastructure. These included the development of medical centers and education; an increased number of veterinarians on the provincial staff; the establishment of local livestock markets, the improvement of 250 miles of stock routes, the construction of two quarantine stations and the establishment of three grazing reserves for nomadic herdsmen by the Animal Production Public Corporation; and the construction of the irrigation works for range development and cash crops by the Ministry of Irrigation.

The Blue Nile Regional Development Project is interesting in that it attempts to integrate a large scale agricultural project into a regional development plan. It is somewhat unusual however, that such a plan was developed by a private company (AZL International) rather than by the provincial government within the context of the national development plan. The project presupposes the cooperation of the Agricultural Bank, the APPC, the Provincial Government and the Ministries of Education, Health and Irrigation. The role of AZL (the American participant in AZL International) is limited to the management of the commercial company. It is also clear that AZL was not proposing to commit funds of its own to the project. The commercial company itself was expected to concentrate on production, development and management. Construction of facilities (including the canning plant and slaughterhouse) and infrastructure, and the provision of loan capital, were
the responsibility of the government. The capital for the commercial company was to be supplied by the equity participation of local investors, cooperatives and banks and government agencies. Presumably AZL International would be one of the local investors, and AZL, the American company, would invest in AZL International.

There are a number of specific areas where problems could arise for the scheme. The project places heavy demand on skilled workers and professionals with little regard to their availability. Like all developing countries, medical staff, teachers, extension workers, veterinarians and mechanically skilled workers are in short supply in the Sudan. A large number of local farmers are West African immigrants, and the project's managers will have to choose between the more highly motivated foreigners and less skilled Sudanese for the project. The project also assumes that there will be little difficulty in settling the Blue Nile nomadic population and incorporating them and their traditional rangeland into a large scale project. There is little evidence in the project proposal to support that assumption. Finally, the project is very complex, creating an entire livestock industry from range management and the production of feed, through a breeding program and raising of livestock, to the slaughterhouse and canning factory. It seems unlikely that the entire project will dovetail as neatly in reality as on paper.

AZL withdrew from the Blue Nile Project in 1976 by declining to exercise its option to acquire 40% of AZL International. The rationale seems to have been less attributable
to problems in the project and more aligned to a general change in company policy. AZL's founding concept is the acquisition of ranch land in growing states in the U.S.; the establishment of cattle and agricultural operations to provide the necessary cash flow while the land appreciates; and finally the sale of selected segments as they reach their optimum market value. Reverses in the cattle industry led to losses in AZL's Ranching Division and its inability to provide the company with the necessary cash flow. The company directors decided to cut back its operations and "divest any peripheral holdings which do not fit our long term strategy or complement our basic business." Participation in AZL International was among those peripheral holdings. Such overseas operations were prime candidates for the cutback: even if the projects were thoroughly successful, AZL could not have expected to earn substantial profits from them without an equity investment the company was in no position to make. In addition, relations between TRIAD and AZL had become increasingly strained. TRIAD had developed serious doubts that AZL's American experience would be adequate to enable it to manage a project as complex as the Blue Nile project. AZL found that its connection with TRIAD, which is backed by the Saudi financier Adnan Khoshoggi, was creating political problems for both companies in the U.S. Khoshoggi's attempts to purchase U.S. banks have been generally unpopular.

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7Ibid., p. 2.
and he is currently refusing to testify before an ongoing SEC investigation into Lockheed's attempt to bribe Saudi generals. AZL probably preferred that his connection with AZL (14% ownership) would not become widely known.

TRIAD has now contracted Tate and Lyle, a well known British sugar company with considerable Third World experience, to manage the Blue Nile Regional Development Project. The project has been included in the current Sudanese six year development plan with substantial funding provided through the Arab League.