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Cornell University, Ithaca, New York 14853-7801 USA

DEVELOPMENT OF ANGOLA'S AGRICULTURAL SECTOR

by

Steven C. Kyle

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ABSTRACT

This paper discusses the prospects for Angolan agricultural development in the 1990's. Given the recent history of civil war, dislocation, and widespread destruction of infrastructure, development of the nation's abundant resources will be a long process, but one which promises high returns in the long run. Angola has the potential for a strong smallholder sector producing both food and export crops.

INTRODUCTION

Prior to independence in 1975 Angola was self sufficient in food and exported numerous crops, of which coffee was the most important. During this period, agriculture had a dual structure, with a commercial sector of about 800,000 ha. managed by Portuguese settlers using modern technologies, and a traditional sector composed primarily of subsistence smallholders cultivating about 3.4 million ha. Agriculture was well supported by transportation and marketing infrastructure. More than 70 per cent of Angola's pre-independence population earned their living from agriculture, which accounts for approximately 20 per cent of GDP. With a relatively small population of approximately 10 million and population density of between 7 and 8 inhabitants per square kilometer, Angola is well endowed with agricultural resources and has the potential to grow a wide range of tropical and semi-tropical crops.

After 1975, many of the former commercial farms and plantations were converted into state farms, most of which have now been either leased to the private sector or taken over by their former managers. The ongoing civil war has resulted in a virtual collapse of marketed production as large numbers of rural inhabitants have fled or reverted to subsistence production. Infrastructure has suffered greatly with widespread destruction of roads, bridges and warehouses together with the presence of thousands of land mines in rural areas. Much of what marketed production there currently is comes from medium size private farms near urban areas.

At present, government policy is restricted in its effects to those areas which remain secure. In general, this means that only the coast and the southern regions can be considered as targets of short run development efforts. This fact has two important implications: First, since these zones are not the traditional "breadbasket" of the country, it will be impossible to achieve long run goals for food or export production until a peace agreement is reached. Specifically, the main staple grain producing areas are currently under UNITA control and so cannot be a target of government policy. Second, it will be important to avoid large investments in areas of low potential simply because they are the only options available at the moment. This is particularly true with respect to irrigation; the dry coastal and southern regions require irrigation to realize their full potential but to make large investments in this sector solely because of the constraints caused by the current hostilities may well be incompatible with the infrastructure needed to support the long run development of agriculture in the country as a whole.

After a peace agreement has paved the way for normal links with rural areas to be restored, the government will face numerous policy issues ranging from immediate problems of rehabilitation and reconstruction to issues of long run strategy and the proper balance between government and private sector activities. In many respects, the context for sector policy has changed drastically since independence in 1975. At the micro level, millions of inhabitants have been uprooted and much infrastructure has been destroyed. The marketing system, which virtually disappeared with the departure of the Portuguese, is now in the process of liberalization. In macroeconomic terms, the development of large sources of oil revenue has generated a whole new set of issues linked to Dutch Disease and real exchange rate alignment. Internationally, Angola now faces different market conditions from those it faced before 1975, and a world increasingly dominated by regional trading blocs. The remainder of this paper discusses the various policy options and issues which follow from consideration of Angola's potentials and the national and international context for development.

Agricultural Resource Base

In sharp contrast to many countries in Sub Saharan Africa, Angola is blessed with an excellent resource base for agricultural production. Prior to independence and the ensuing hostilities and dislocations, Angola was a net exporter of food and a major producer of coffee as well as other export crops. These facts are particularly impressive in light of the fact that these exportable surpluses were, for the most part, produced using traditional technologies and few modern inputs. So, not only is Angola a natural food and cash crop producer and exporter, but there is considerable potential for growth through modernization and technical change. (See Tables 1-4)

Agro-climactic conditions vary widely, from humid tropical lowlands in the north and northeast to desert on the southern coast bordering Namibia. The central highlands contain large areas with good rainfall (1500-2000 mm/year), relatively moderate temperatures, and adequate soils, and are also the region with the highest population density. The coastal and southern areas are far dryer, with average rainfall of less than 100 mm/year in southwestern desert areas and between 500 and 1000 mm/year in the four southern provinces of Namibe, Huila, Cunene and Cuando Cubango. Irrigation is essential to production in these zones, and fortunately there are abundant surface and subsurface sources, many of which have been developed to some degree.

While population is densest in the high potential areas of the central plateau (Bie, Huambo, Cuanza Norte, Malange, Uige and parts of Benguela and Cuanza Norte), there are large sparsely populated areas, especially in the east, which are capable of supporting much larger populations than at the present time. The current war situation has resulted in large refugee movements into cities and coastal areas. Though these movements can be expected to be at least partially reversed in the event of a peace agreement, in the meantime there is considerable population pressure in the relatively dry coastal areas.

Staple crops range from cassava in the humid north and northeast to maize in the central highlands and sorghum/millet in the dryer southern provinces. Potatoes are an important crop in the central plateau and rice is also grown over large areas in the north. Cattle are raised over broad areas in the central plateau but are particularly important in the southern provinces of Cunene, Huila, and Namibe where there are an estimated 3 million head of cattle.

The most important cash crop has historically been coffee, which grows well in the highlands from Uige and Malange through Cuanza Norte and as far south as Huambo and Bie. Exports are currently negligible due to the war, though Angola was once the world's fourth largest exporter. Cotton, sugar cane, sisal, bananas and wood are other important cash crops, though production is very low by historical standards at the present time.

AGRICULTURE AND THE MACROECONOMY

While it is perhaps a truism that sector strategy cannot be formulated independently of the overall macroeconomic strategy, this is doubly true in the Angolan case since the country's oil and mineral reserves pose several foreseeable and quite thorny problems. Oil production constituted 40 per cent of GDP in 1991, 90 per cent of exports and was the basis for 75 per cent of government revenue. Angola's per capita income amounted to about \$600 in 1992. This level of per capita income places Angola in the ranks of lower middle income countries, but masks the far lower level of development of the non-oil economy, particularly in rural areas. Since 1980 Angola's overall economic growth rate has remained relatively high as oil production increased, while the non-oil sectors have stagnated or even declined. (See Table 5)

Per capita oil revenues of \$300 per year mean that the oil sector's share in the overall economy is large even when compared to other oil exporting countries. For comparison purposes, Nigeria's oil exports per capita were approximately \$200 per year during the 1980's, while Indonesia's amounted to about \$60. Though other exporters (e.g. Algeria) show higher revenue per capita, they also have larger non-oil economies so that dependence on oil is less pronounced. (Gelb) This means that Angola has an even greater potential for Dutch Disease related problems than do these other oil countries.

Essentially, this implies two main problems for the agricultural sector. First is that of real exchange rate appreciation when nominal exchange rates fail to keep pace with domestic inflation. This problem is likely to arise to the extent that oil revenues are spent domestically (thus adding to domestic demand) rather than being saved or spent abroad, and is particularly important when considering non-oil traded sectors such as agriculture. To the extent that exchange rate overvaluation is allowed to occur, agricultural export prices are depressed, as are prices of competing imports. Those parts of the agricultural sector which produce traded goods or use traded inputs will be affected by this problem.

The current extent of this problem is demonstrated by the 300% gap between the official and parallel exchange rates. This gap is a major improvement over the nearly twenty-fold difference in these rates prior to the implementation of the new stabilization program beginning in February 1994. If government deficits continue and are monetized, this gap has the potential to grow again.

The second main category of problems relates to the input rather than the output side. Commonly known as the "resource pull" effect, the presence of a booming sector such as oil results in a drain of capital and labor out of non-oil sectors. The booming sector attracts capital due to the high returns available there, while non-oil sectors suffer by comparison, particularly if expected returns are depressed on the output side by real exchange rate effects.

From a macro perspective, therefore, there are two main issues confronting the government. The first relates to how much of the oil income is to be spent. Presently, there is little choice but to spend whatever is necessary on military requirements, leaving little scope for either saving or investment in non-oil sectors, but the fact that oil reserves will run out at some future date implies that some fraction of the income should be invested in alternative sectors in order to maintain permanent income after oil reserves have been exhausted. Angola's reserves will last for 18 more years at current production levels. This means that about 40% of oil income should be invested, if the return on investments is 5%. Gelb, in a major study of oil exporting countries concluded that as much as 2/3 should be saved (p. 140), the higher

figure arising in part from the lower efficiency of investment typical of large public projects which were a major use of oil windfalls in the countries studied.

It is important to note that the current situation, i.e. spending the money on imported military supplies, does not put pressure on the real exchange rate. While this certainly does not imply that the exchange rate is correctly valued, it does imply that oil revenues are a far lesser source of pressure toward appreciation than will be the case when the government can shift spending toward domestic investments.

In investing in activities which can sustain permanent income in the future there is a presumption that a primary goal of the investment program is to provide the economy with alternative traded goods production which will reduce dependence on oil revenues so that their eventual depletion will not result in an economic crash. There is an added advantage to this strategy: not only will non-oil exports provide income in the future when oil is exhausted but they will also provide diversification in the present, to help smooth revenue fluctuations arising from dependence on a single commodity. Agriculture, with its strong resource base and history as the country's leading export sector prior to the oil boom, is the prime candidate for such diversification and investment. Over the course of the 1980's the share of government expenditure in support of agriculture fell precipitously, from 10 per cent of the budget to less than 2 per cent, well under the 6.8 per cent average for Sub-Saharan Africa as a whole. While central government budget trends during this period were largely driven by military considerations, it is clear that a major reallocation will be necessary after hostilities end.

Of key importance when considering public investment in agriculture, as in any sector, is the proper balance of government and private investment and involvement. While the exact nature of this balance will remain an important issue to be resolved, it is quite clear that there are numerous public goods such as roads and ports which can only be dealt with by the government. There are also important roles for the government in research and extension. While there will inevitably be government involvement in the regulation and function of agricultural markets, it is clear that the government has a firm intention to pursue a strategy involving distinctly more liberalization than has been the case in the past. Equally important is the possibility of orienting a domestic investment program toward alleviating undesired income distribution effects of oil production and revenue. A strong agricultural bias in the investment program, coupled with an emphasis on transport and education, would help rural areas keep pace with cities, which typically gain in relative terms in oil boom economies. Since more than 70 per cent of Angolans lived in rural areas prior to the onset of hostilities, most of them in poorer income groups, investment in agriculture can have a major impact on income equality.

As noted above, there is a potential risk for real exchange rate effects to depress prices of traded crops and create an incentive to import food to supply urban areas. Accordingly, appropriate and consistently maintained macroeconomic and price policies are essential for productive private investment. Existing measures of Domestic Resource Costs for various crops indicate that Angola has a strong advantage in several agricultural commodities, enabling a reasonable potential profit margin for producers even if exchange rate misalignment imposes a tax on farm output. Avoidance of exchange rate overvaluation will be the most important aspect of macro-economic policy relating to the agricultural sector.

Investment in infrastructure, particularly transportation, can help alleviate some of these effects, but ultimately there must be a strong emphasis on technological improvement in agriculture. This implies a sector strategy which emphasizes cost reduction through infrastructure development, research and

extension in mechanization, improved seeds or other technologies, and support for both primary and advanced studies in agriculture related areas.

Another related but distinct issue is that of access to foreign exchange. The government's current system of allocation (since April 1994) is based on a daily fixing of the exchange rate to commercial banks with a foreign exchange portfolio. The banks then sell foreign exchange to the private sector at market determined rates. Clearly, this is an important improvement over the former situation. However, even exchange houses are required to go through the banking system to obtain foreign exchange. Given the relatively time consuming and bureaucratic nature of bank transactions compared to those at exchange houses, the "openness" of the foreign exchange fixings and sales could have a major effect on the de facto availability of foreign exchange on a timely basis. This issue affects agriculture in several ways. First, foreign exchange availability is key to the supply of imported agricultural inputs. Much of the supply of farm equipment and all of the supply of fertilizer and pesticides are imported. If parastatal organizations importing these items no longer receive foreign exchange allocations, then the private sector agents who replace them must be able to freely access the market for foreign currency as needed. Second, many agricultural processing industries are in need of retooling and raw materials, much of which must be purchased from abroad. These firms must have easy access if they are to function efficiently and so generate foreign exchange themselves.

The contrasting experiences of two other oil exporters, Nigeria and Indonesia, provide strong support for an emphasis on agricultural investment coupled with an exchange rate policy designed to avoid over-appreciation. Indonesia is a positive example of the use of appropriate policies to encourage agricultural development in an oil rich country while Nigeria is a negative example illustrating some of the pitfalls inherent in management of oil export proceeds.

Indonesia followed a policy of emphasis on agricultural infrastructure and technological improvement with modern high yielding varieties, as part of an overall economic policy program which resulted in high non-oil growth rates over sustained periods. Price policies encouraged fertilizer use, supplied from domestic production using petrochemical feedstocks. Indonesia also avoided extreme exchange rate overvaluation, though there were periods in which it appeared to be overvalued to some extent. Agriculture received a large share of public investment, more than 20 per cent in the initial years of the oil boom. An important aspect of government policy was its long run nature. Successful sector development has been a matter of decades with an early and sustained emphasis on an agricultural investment program. An added benefit is the beneficial effect on income distribution, since the majority of the poorest in Indonesia (as in Angola) were rural. While Indonesia's emphasis was on its staple crop, rice, a similar strategy has considerable appeal with a focus on the important staple crops in Angola. Maize in particular has potential for large yield increases using existing technologies. (See below)

Nigeria's example is in many ways the opposite of Indonesia's in that the exchange rate became progressively more and more overvalued as time went on. Urban bias was pronounced, with a consequent flow of resources away from rural areas and toward large cities. In the agricultural sector no progress was made in smallholder production technology during the oil boom years while government investments in the sector were concentrated in large projects with disappointing results. A large portion of government expenditures on agriculture were devoted to fertilizer subsidies rather than investments in infrastructure or agricultural services such as research, extension and education. Consequently, Nigeria is now a major importer of agricultural products which it exported prior to the oil boom.

SECTOR STRATEGY

Consideration of near-term strategy must of necessity be conducted in the context not only of overall macroeconomic strategy as discussed above, but also in light of long-run goals for the sector itself. This is especially true in the Angolan case since the current situation (as well as any feasible scenario for the short to medium term) is obscured by war and distorted by government policy.

Of particular importance is the fact that the government currently controls approximately 30 per cent of the national territory; its short run sector development plans must therefore be confined to the coast and southern provinces, and cannot do much to affect conditions on the central plateau which traditionally has provided the bulk of agricultural production in the country. It is important to avoid the notion that because there is a war going on, all long run development plans must be held in abeyance. War or no war, there are still opportunities and options for sector policy and development but it is imperative that any initiatives taken in the current distorted situation be ones which make sense both in the short run and in terms of a long run strategy based on peace. Accordingly, long run strategy must be discussed first in order to enable an evaluation of which short run options fit into this overall picture.

Food Crops vs. Export Crops and the International Market

Perhaps one of the most basic and often debated issues in long term strategy for agriculture is the relative emphasis to be given to food crops as opposed to export crops. Angola is fortunate in the sense that its second biggest agricultural export prior to independence was in fact a food crop: maize. Maize is not only a major potential export crop, but together with cassava is the major staple food crop as well. Currently, the vast majority of marketed maize is imported, making rehabilitation of marketed maize production the quickest way for agriculture to provide a contribution to the non-oil trade balance in the short run while at the same time remaining in line with long run comparative advantage.

However, there is a major caveat to this conclusion: Those areas which are most favorable for grain production are currently inaccessible due to ongoing hostilities. The grain surpluses which were exported prior to independence were produced by the family sector using traditional technology in the central highlands and not on the coast.

Encouraging smallholder production and implementing a plan for the long term development and technological improvement of this sector has clear benefits in terms of both building on revealed comparative advantage and in terms of equity and poverty alleviation. However, large scale grain production in areas currently under government control would be possible only with substantial investments in irrigation which would not be made for this purpose in a less distorted situation. Accordingly, a major investment program for smallholder maize production must be conditioned on peace. Having said that, it is likely that increases in marketed production of maize, an annual crop, will be the quickest way to reduce the national food import requirement in the period immediately following a peace agreement.

In the longer term, it will be important to gear sector strategy in terms of crop emphasis both to market conditions and to input, research and extension strategy. Some examples are the relative importance of extension and timely input supply for cotton production as opposed to the relatively pest

and maintenance free production of coffee (While this is true of the robusta varieties grown in Angola, cultivation of arabica is far more input and extension intensive. See Carr, WB Technical Paper 216) On the other hand, cotton is an annual crop amenable to rapid shifts in acreage in response to market changes, and can be readily linked to downstream industries.

Angola's most important agricultural export prior to 1975 was coffee. Approximately 240,000 MT were exported in 1972, the peak year for coffee production, while at the present time the amounts marketed are negligible, amounting to only 1,500 MT in 1993. It is clear that rehabilitation of coffee production will only happen after a considerable lag. First of all, no new coffee plantings have occurred since before independence, making the age of current plants well beyond the period of peak production. New plantings will only yield a crop after several years and will not reach peak production for almost a decade.

It is also clear that coffee is unlikely to return to its former status as a major export, for reasons related both to internal conditions and to the world market. Internally, coffee is no longer the mainstay of the rural economy in areas where it was formerly dominant. Peasant producers do not farm large monocropped areas of coffee as was done on Portuguese plantations prior to 1975, and the large labor requirements of such plantings, as well as the managerial capacity required to run large plantations make rehabilitation along pre-independence lines a non-option. Rather, coffee is likely to be one of several crops for any particular farmer, grown either in small plots or in association with other crops. This is likely to remain the case for the foreseeable future.

In terms of the international market, there are now several countries in Africa and Asia which have recently begun substantial coffee exports, filling the gap left by Angola's disappearance from the market. Consequently, prices have declined since the mid-1970's though there are still opportunities for export of high quality coffee which could be grown in Angola. Real international coffee prices remain at less than half the levels of the 1970's and early 1980's, even after recent increases from historically low levels.

Table 6 shows maize yields for Angola and other countries in central Africa. It is clear that there is substantial room for improvement; a doubling of yields is not unreasonable to expect using existing technologies and varieties already proven in neighboring countries. A recent study of this issue (World Bank 1991a) concluded that " ... all available evidence indicates that local and traditional varieties have considerable untapped yield potential ... There is no reason to believe yield improvements will have to wait for new varieties ... " (p. 81).

It is likely that for the near term, it makes sense to restore some export production where that can easily be achieved, and to restore production of staple grains for domestic consumption, since output in both categories is on the order of 10 per cent of pre-independence levels for most crops. This indicates that there is a large unused capacity that can be relatively easily tapped in the short term.

It is important to emphasize that although food self-sufficiency is not a prerequisite for food security and so is not necessarily a goal to be achieved for its own sake, the apparent Angolan comparative advantage in food production makes it likely that it can and should be achieved. This follows from a strategy of investing in activities with low DRC's since maize (among other food crops) appears to score well by this and other measures of comparative advantage.

Other major export crops include bananas, cotton and wood, as well as others. Efforts to reactivate production in particular crops should be preceded by an evaluation of Angola's relative advantages compared to world market conditions. World markets for other crops have changed dramatically since Angola was last a major exporter. This is particularly true in the case of palm oil, which has seen large production increases from Southeast Asia. Sisal may well be easier to rehabilitate than other crops due to coastal production areas close to ports, while the extent to which wood production is restored to former levels depends on overall government policy toward forestry. This is closely linked to environmental aspects of forest policy discussed below, but must be recognized as a large potential source of foreign exchange.

Overall, export opportunities may well extend beyond those crops historically grown in Angola. These possibilities naturally depend on Angola's agro-climatic characteristics, but will in the end depend crucially on world market conditions and opportunities. Of critical importance in the years to come will be the effects of regional trading blocs such as the European Community and NAFTA.

Europe was the destination of as much as 40 per cent of Angola's exports and the source of almost 60 per cent of its imports in recent years. See Table 7. (Amelung and Langhammer 1989, Ferreira 1993) Angola is a signatory to the Fourth Lomé Convention and its position as an ACP (African, Caribbean, Pacific) country gives it a privileged position (along with 67 other countries - See Figure 1) for imports into the EC. ACP countries are allowed a variety of preferences ranging from duty free import of commodities to the EC to concessions on some crops which reduce the amount of the EC's variable levy. Some commodities, notably bananas, rum, beef, and sugar, are subject to quotas designed to protect "traditional suppliers" to former colonial powers. Significant increases in these quotas seem unlikely. While EC preferences provide some opportunities, there is now much more competition in supplying the Portuguese market than previously. Accordingly, the significance of Portugal's entry into the EC may well be negative rather than positive for Angola.

To summarize, the most immediate impact on both food security and the non-oil trade balance will come from production of staple grains, especially maize. Accordingly, infrastructure development should in the first instance be geared toward providing transport and marketing needs for the main producing areas on the central plateau. Over the longer term, coffee production in the highlands and fruit production on the coast will be priority areas for infrastructure development.

Technology and the Role of Smallholders vs. Commercial Farming

While Angola is a relatively sparsely populated country, with between 7 and 8 inhabitants per square kilometer and little overall pressure on arable land, there may be some areas where population pressure is a problem. Given this fact, the government has considerable leeway in favoring smallholder production and large scale commercial operations without facing serious trade-offs. The smallholder sector contains the majority of the Angolan population, which means that it must play a key role in any sector development strategy.

An important corollary of Angola's abundance of arable land as compared to its population is that land using technologies (e.g. mechanization) will play a far more important role here than in other African countries with substantial land pressure. In the central highlands provinces with high population density (e.g. Huambo and surrounding areas) there is likely to be a role for technologies promoting intensification such as increased application of fertilizers, soil conservation, etc. However, given the

existence of large unused areas suitable for agricultural production, extensive technologies will be important. Even so, irrigation, adoption of which is usually considered to be a move in the direction of intensification, will be important in many of these areas since water availability is in many cases the most important constraint to increased production.

While Angola's land abundance would allow a greater reliance on extensive technological change and greater reliance on mechanization than is typical in Africa, there is nevertheless a role for improved varieties of major crops. This is true for several reasons: First, improved varieties can result in greatly increased yields in areas with dense populations such as the central plateau. Second, improved varieties are a technological change which is both easily divisible and easily transportable. These two characteristics are key factors for ease of transfer and extension to the smallholder sector, where large investments are difficult or impossible and where farmers are typically risk averse.

Historically, staple food crops such as maize, cassava, millet and sorghum have been grown on small farms, while crops such as coffee and bananas have been produced on large plantations. Intermediate size commercially oriented units have been important in fruit and vegetable production, particularly in irrigated areas on the coast, in the southern provinces and around large cities. Production of staple grains is likely to remain a predominantly smallholder activity, but the breakup of large Portuguese-owned plantations following independence is unlikely to be fully reversed. Consequently, though medium-size commercial units remain important, a revival of large-scale plantation agriculture along pre-1975 lines cannot provide a basis for future sector development. This implies that re-establishment of crops such as coffee will be much more smallholder oriented in the future.

Access to modern inputs is an important factor but it must be recognized that in the case of Angola, smallholders will often find it difficult or impossible to obtain modern inputs in the current situation. FAO studies of maize fertilizer response indicate that it can be extremely profitable, with benefit/cost ratios ranging from 6:1 in Madagascar to 21:1 in Rwanda. While these experimental results must be treated with caution, it is clear that there is considerable scope for efficient yield increases from use of purchased inputs such as fertilizer. (See World Bank 1991a) Since there are no economies of scale in production apart from sugar cane and bananas, a policy to support smallholders through provision of inputs and credit will not result in a loss of productivity and will have substantial benefits in terms of income distribution.

Generally speaking, a smallholder-oriented strategy has considerable appeal in terms of equity and social aspects, but involves much longer periods of time than would reliance on commercial production. Given the speed with which the commercial sector can produce needed supply response in the short run, it could become an important element in a near term strategy, particularly in development of irrigated peri-urban areas. At present, the commercial sector is concentrated on mid-sized farms producing mainly horticultural crops in these zones. However, this development should take place in an overall context which emphasizes smallholder development and the eventual transformation of small farmers into commercial producers themselves. There are several major elements which are key to a thriving smallholder sector. Among them are an adequate marketing structure, appropriate infrastructure development, and availability of extension assistance and credit.

INSTITUTIONAL ASPECTS AND SUPPORT SERVICES

The Changing Role of the State and the Private Sector

In agriculture, as in the rest of the economy, Angola is currently undergoing a marked shift in the relationship between the state and the economy. Previously, the role has been that which is typical in a command economy, where all activity has been controlled and carried out directly by the government. In shifting away from this model of development, it has become necessary to redefine the role of the government as it relinquishes its hold on activities which it used to dominate and direct. It is clear that while the government intends to retreat from direct control in many areas there are nevertheless several key roles which the government must perform in order to ensure a healthy and efficient economy. In general this implies a government role directed mainly at provision of essential public goods which the private sector is unable to provide for itself together with a stable institutional, legal and policy environment.

One of the most pressing needs is for the government to rebuild and expand infrastructure, especially now that the ongoing hostilities have resulted in the destruction of so many roads, bridges, buildings, irrigation systems, etc. Equally important is the role of the government in promoting and maintaining a stable policy environment conducive to development and growth. Management of such policy tools as the exchange rate are key as is the protection of the basic institutional requirements of a market economy: a well functioning legal framework, stable financial system, clear rules of the game, and the power and will to enforce these. Education and health are also areas which require government presence and action, since the private sector cannot be expected to provide these services.

Privatization or "redimensioning" of parastatal enterprises constitutes an important element of sector strategy both to clear the way for private sector development and to eliminate the large drains on public resources stemming from money losing state enterprises. There are at least four major state enterprises in the agricultural sector which merit attention. Privatization and/or elimination will not only decrease claims on public resources, but will also foreclose opportunities for graft and corruption, which are reputed to be widespread.

It is important to note that the private sector will play an important role in other parts of the food and agricultural system as well. Most important will be the marketing and distribution of both inputs and outputs (see below), areas where the private sector was active before 1975 but where the government has been dominant since. While re-establishment of a rural marketing network must await a cessation of hostilities in many areas, it is apparent from the high level of activity in parallel markets in cities that the entrepreneurial talent needed to replace the departed Portuguese traders exists and can in time fill the gap in rural zones if given appropriate incentives. Key aspects after a peace agreement will be: 1. Removal of controls on wholesale and retail margins; 2. Re-establishment of marketing and transport infrastructure; 3. Provision of credit for marketing activities. This last item is likely to require government intervention due to the current weakness of the private financial sector but is important in promoting private sector development in agriculture due to the role of small traders and marketers in providing finance and credit for their customers.

Extension, Research, and Education

The current extension system, run by the Instituto de Desenvolvimento Agrario (IDA) in the MINADER, operates in the field via Estações de Desenvolvimento Agrario (EDA's) which have provincial and municipio level representation from the central government. At the moment, this system is almost entirely theoretical: there is little or no actual field presence in the countryside apart from areas in the south where foreign assistance has had some positive effects.

Building a viable national extension system will take time; nevertheless the process can start in the short term where possible, with an eye toward eventual expansion of the system to the remaining provinces once peace has been achieved. Given the historical importance of politics in the relations of the government to rural areas, it will be important to firmly establish the role of the extension system as a non-political agency devoted to improving the welfare of farmers and increasing productivity. Of great importance to the system is the availability of appropriately trained staff to operate it. In the short term, it would be useful for members of the extension system to visit countries with relatively strong extension services of their own. One possibility would be Zimbabwe, which faces many of the same issues confronting Angola, but which has what is perhaps the best extension service in Sub Saharan Africa.

Strengthening of research and higher education is an extremely important goal, but must be postponed until peace due to the occupation of Huambo by UNITA forces. While the Faculty in Huambo and the Instituto de Investigação Agronomica (IIA) are intact (though inaccessible and unused), the Instituto de Investigação Veterinaria (IIV) has been totally destroyed, raising the possibility of rebuilding at a new location in the southern provinces which are the main centers of livestock production. Given the existence of a regional laboratory in Huila, this is certainly a viable possibility and one which could be pursued in the short run. However, it is imperative that an assessment of the previous links between the IIV and the University in Huambo be conducted prior to investing in a major facility so far away. In general, it is clear that education at the university and lower levels is an appropriate area for government involvement.

Credit

In 1991 the government created the Caixa de Credito Agropecuario e Pescas (CAP), designed to provide credit to the agricultural sector, but it has been restricted in its ability to operate since hostilities recommenced. Its stated objective is to promote the development of the agricultural sector through loans to small enterprises and farmers. The government plans to restructure the CAP as a professionally managed fund; the status and nature of this reorganization will be an important issue. In general, credit is an area where the private sector is typically more efficient than government entities. However, in the short term, Angolan conditions are such that substantial private sector involvement is unlikely. Therefore, government involvement is best restricted to those areas where credit is clearly the most important constraint, leaving areas of secondary importance for future private sector involvement.

After peace is achieved, credit, and the conditions of access to it will be major determinants of the ability of different parts of the agricultural sector to grow. In particular, smallholder credit is an important area for government policy, since it is the sector least likely to attract adequate financial support from private sources. However, it is the commercial sector that is able to provide the quickest supply response and is also the most intensive user of purchased inputs, making it the top priority for direct credit in the short run. Oil revenues can provide a source for these funds. There is no history of

direct provision of credit to the peasant sector; rather, informal credit has been available through the rural marketing system. Accordingly, credit for the marketing system will be a key area for the CAP, as will credit for rehabilitation and operation of agricultural processing industries.

It is important to note that there is a long history of directed credit programs to the agricultural sector in developing countries, and that this history demonstrates the difficulty of providing credit in an efficient non-distortionary manner. If the basic problem is that there are high fixed costs for establishing intermediaries (which is likely to be true in Angola) then there is a good case for government support programs. If, however, the problem is asymmetric information (as is also likely to be true in Angola), the government may be in no better position than the private sector. In this situation there is a strong case to be made for government promotion of the type of informal lending which is traditional in rural areas, since farmers and small shopkeepers have the needed information, ability to screen for credit risk, and ability to exert peer group pressure to ensure repayment. Angola's peasant associations are a possible vehicle for emulation of such institutions as Thailand's Bank of Agriculture and Agricultural Cooperatives, and Bangladesh's Grameen Bank. Though these are not examples of informal finance their success in reaching target populations has been considerable.

In any of these cases, experience points to several important aspects of successful programs. First, they must be concentrated in the hands of those who most need them, i.e. productive, credit constrained farmers. Second, there must be effective mechanisms to ensure repayment or penalties in the event of default; Use of local groups such as peasant associations can help to provide this, but the government must make sure that credit programs do not become transfer or welfare schemes through lax enforcement or forgiveness of defaults. (See Calomiris and Himmelberg 1993)

Peasant associations have been promoted in Angola since independence in 1975. They have gone through several phases during this time, and were used as a political instrument during their early years. Currently, political goals are disavowed by the government and it appears that membership is entirely voluntary. However, use of these associations as distribution mechanisms for credit or inputs will create a powerful incentive to join and so will also present opportunities to influence peasants who are members.

Irrigation

Irrigation investments, if undertaken at all, should be made only after careful study, taking into account Angola's ample potential in the long term for rainfed agriculture. Rehabilitation of irrigation systems and small water projects will be important issues for sector strategy regardless of whether a peace accord is reached soon. This is particularly true in the southern provinces and coastal areas currently controlled by the government, where investments in water supply can help alleviate the most important constraint to increased production. While small water projects are more appropriately left to the private sector, larger projects (if found to be attractive investments) are more likely to be undertaken under the auspices of the government where the responsible unit in MINADER is the Direcao Nacional de Hidraulica e Engenharia Rural (DNHER). Rehabilitation of previously existing systems will aid primarily the commercial sector. Priority should be given to green belts surrounding major cities where small investments in existing systems can result in short run increases in production of high value crops such as fruits and vegetables. Irrigation for grain production in such areas makes little sense in either the short run or the long run, however, since other areas are clearly better suited and offer conditions for rainfed agriculture.

One interesting possibility for aiding the family sector is the promotion of manual pumps which are manufactured locally. These are cheap, simple, and easy to transport and fix. The company which makes them needs help, and might benefit from an upgrade in capital equipment and access to credit as might numerous other private companies which transform or process agricultural products. There are many such small companies in provincial cities as well as in Luanda and in many cases their main constraint is financing for replacing ancient equipment. Demand for their products is in many cases far greater than their capacity.

Land Law and Tenancy

Also important will be government policy toward land tenancy, which must be settled before large investments by farmers can be expected. Security of tenure, and legal or official recognition of it allows farmers to make investments with longer gestation periods. Evidence from other countries demonstrates the importance of secure tenure in obtaining credit. An important issue for the government is the status of the new land law that is under consideration, and the extent to which it will give farmers the needed security of tenure to land and the right to bequeath land or sell it.

The new land law was passed and has technically been in force for two years. However, the implementing regulations have yet to be approved so that the de facto land law remains the one left over from the colonial era. The new law is problematical for many reasons, not the least of which is that it allows only for use rights, so that land cannot be mortgaged. Other problems are the vagueness of the law with respect to how it is to be decided how large holdings should be, how title can be obtained, what happens when land changes hands or when time limits on use rights are reached. It is also unclear how shifting cultivation or pastoral transhumance will be treated under the law. The law was passed by the Comissão Permanente da Assembleia do Povo during the runup to the 1992 elections, but was never passed by any legislative body and has received virtually no public scrutiny or debate. A clarification of these issues, and establishment of clear security of tenure (via titling or some other means) which is consistent with a well functioning land market is essential if the government wishes to implement its stated goal of allowing the private sector to take the lead in investment and allocation decisions. In particular, time limits on tenure and inability to mortgage land or use it as collateral constitute major problems.

Another important area for the government to clarify is its attitude toward foreign investment in the agricultural sector. This is linked to the land law in that the status of foreigners and/or corporations as landowners will be an important consideration. Foreign investment can be a major source of capital and new technology for agricultural production but the terms under which it will be allowed must be clearly understood by all and not subject to frequent change. It should be recognized that security of tenure which is adequate for domestic family agriculture (e.g. along customary or traditional lines) may be inadequate to attract foreign capital. While special treatment for foreigners is clearly something to be avoided, it should be understood that such investors may well require clear title before being willing to risk large sums of capital. Past experience in other countries indicates that while foreign investors often choose large scale plantation agriculture, they may also prove to be an important factor in the direction of smallholder development as well. For example, a foreign multinational corporation has invested heavily in smallholder cotton production in northern Mozambique, with contracts under which inputs are supplied in return for cotton at prices fixed in advance. While smallholders are guaranteed a viable profit margin under such schemes, they are not guaranteed a price related to world market levels.

IMPLICATIONS FOR GOVERNMENT POLICY

Currently, most of the government's investment program in the agricultural sector is paralyzed due to ongoing hostilities. The most important exceptions to this are dam and irrigation rehabilitation projects in the southern provinces and in the green belts around coastal cities. In considering extension of government activity beyond the current low level, it is useful to distinguish between those actions which can take place immediately, and those which require more time and/or a peace agreement before they can be implemented.

In the very short run the government is constrained in its ability to reactivate agricultural production and, as discussed above, must be careful to make short run investments that are consistent with a long run view of the development of the sector. For political and military reasons, very short run policy must focus on the coast (without prejudice to long term comparative advantage in agriculture, which originates mainly from the country's interior), peri-urban areas, and the development of production in the southern provinces under government control. While rehabilitation of irrigation systems and development of vegetable and fruit production can take time, there is little reason to delay in areas surrounding major coastal cities since these are investments which make sense both under peaceful conditions and at the present time. Another major area which merits attention in the very short run is a continuation of the institutional changes which are already underway. Redimensioning and privatization of the remaining parastatals can do much to reduce obstacles facing reactivation of production where that is possible. As discussed above, import marketing at preferential exchange rates can have a strong disincentive effect on local production as well as providing opportunities for corruption and theft. Given the fact that most of the population, including the poorer segments, already faces parallel market prices, there are no strong social grounds to delay these actions.

One of the greatest constraints at the present time and in the immediate future is the almost total absence of a rural marketing system for agricultural inputs, outputs, or consumer goods for rural areas. Previously monopolized by the now departed Portuguese, rural marketing is the key element of the food system connecting farmers to the rest of the economy. Without rehabilitation of marketing, government policy can have little effect as it will be transmitted to farmers only imperfectly or not at all. As discussed above, government marketing parastatals have been inadequate to serve rural needs and have proved to be an obstacle to private sector activity in this area. While investment in marketing infrastructure will be important in the medium to long run, institutional changes can begin much sooner. Privatization and/or elimination of all or parts of the existing parastatals can provide some near term benefits as the regulatory framework for the private sector is clearly established.

The massive amounts of food aid currently being imported into Angola pose a significant problem of coordination and transition as domestic production is reactivated after peace is reached. In fact, food aid deliveries in the province of Huila are already said to be causing some disincentive effects in terms of replacing potential local production. It is clear that a relatively short term goal after peace is achieved (1 - 3 years) is the cessation of food aid imports of grain since domestic production can be rapidly and efficiently reactivated to levels which can meet needs. However, there is a short run coordination problem since an immediate end to food aid could cause widespread hunger and starvation before crops can be brought to market.

A related issue regarding the transition to peace is that of (re)migration and resettlement. Many (though not necessarily most; younger refugees in particular are more likely to remain in urban areas) refugees in coastal cities will want to return to their farms as soon as possible. Restoration of transport infrastructure is a prerequisite for efficient marketing from the main agricultural regions, while input provision and marketing systems will be equally important in promoting marketed surplus. The clearing of land mines, thousands of which were scattered around villages and paths in rural areas, must be acknowledged as an important prerequisite for restoration of normal production in many areas. One important issue is the number of displaced farm families who will actually return to rural areas. Evidence from Mozambique indicates that return migration can commence quite quickly following a peace agreement, and that families often return to the same land they had farmed years previously, under customary systems of land tenure. Nevertheless, it is likely that the process will take some time to equilibrate and that many who sought safety in urban areas will not return.

As noted in the previous section, lifting of controls on marketing margins is a major step toward reactivation of the rural network but is only a first step. It is clear that a return to the old system of government procurement and distribution is neither feasible nor desirable, but there are several areas in which government action can promote progress in the medium term. One is construction of rural infrastructure: secondary roads, warehouses, and rural stores. Much of the existing structures and roads have been destroyed, mined, or are in a state of extreme disrepair. Reconstruction and rehabilitation can do much to reduce costs and allow the private sector to begin operations. Also important will be reactivation of agricultural credit, something that is nonexistent at the present time.

As noted above, there is little question that Angola has a large potential for production and export of food, particularly maize. Accordingly, the common concern over balancing export vs. food crops is far less apparent than in many other developing countries. Even in the short run, food production to replace imports efficiently will have the quickest impact on both hunger and the balance of payments. It is likely that food production can pass through self sufficiency to become a major export within a few years of a peace agreement. Other important export crops such as coffee or wood will take longer to achieve their potential than will annual food crops such as maize.

Since Angola is a relatively sparsely populated country, the government has considerable leeway in favoring both smallholder production and large scale commercial operations. The smallholder sector contains the majority of the Angolan population, which means that it must play a key role in any sector development strategy. As noted above, both distributional and efficiency concerns suggest a long run strategy which places a considerable emphasis on the smallholder sector, transforming it into modern commercially oriented farms such as are found in the commercial sector today. This will require strong extension, research and educational systems, none of which are now in existence. Though these may be long run goals, it is important to realize that their development must begin in the short run since the history of such organizations in other countries demonstrates that long periods (on the order of decades) are needed to build them.

BIBLIOGRAPHY

Africa Watch Land Mines in Angola, Human Rights Watch, 1993.

Amelung, T. & R. Langhammer "ACP Exports and EC Trade Preferences Revisited" Kiel Institute of World Economics Working Paper No.373, May 1989.

Calomiris, C. and C. Himmelberg, "Directed Credit Programs for Agriculture and Industry: Arguments from Theory and Fact" Proceedings of the World Bank Annual Conference on Development Economics 1993, pp.113-154.

Carr, S. "Improving Cash Crops in Africa - Factors Influencing the Productivity of Cotton, Coffee and Tea Grown by Smallholders" World Bank Technical Paper No. 216, IBRD 1993.

Ferreira, Manuel Ennes, Da Política Económica ás Relações Económicas Com Portugal Caderno Economico Portugal-Angola No. 7, Camara de Comércio e Indústria Portugal-Angola, 1993.

Gelb, A. and Associates Oil Windfalls Blessing or Curse? Oxford University Press, 1988.

Government of Angola "Relatorio Nacional à Conferência das Nações Unidas sobre Ambiente e Desenvolvimento", Rio de Janeiro, June 1992.

Koester, U. & R. Herrmann "The EC-ACP Convention of Lomé" Forum No. 13, Wissenschaftsverlag Vauk Kiel, 1987.

Lele, U., R. Christiansen & K. Kadiresan "Fertilizer Policy in Africa: Lessons from Development Programs and Adjustment Lending 1970-1987" MADIA Discussion Paper No. 5, IBRD 1989a.

Lele, U. & M. Agarwal "Smallholder and Large Scale Agriculture in Africa: Are There Tradeoffs Between Growth and Equity?" MADIA Discussion Paper No. 6, IBRD, 1989.

World Bank "Agricultural Technology in Sub Saharan Africa" World Bank Discussion Paper No. 126 1991a.

World Bank "Angola: An Introductory Economic Review" World Bank 1991b.

Table 1. Evolution of Productive Base.

Indicators	1973	Average 1977/80	Average 1981/85	Average 1986/90	1991
Total Area (ha)*	4,469,197	2,050,093	2,126,125	2,238,136	2,472,780
Total Production (MT)	1,884,343	943,696	971,287	1,002,336	1,164,024
Yield (kg/ha)	422	460	457	448	471
Cattle (heads)**	3,808,542	3,031,830	3,150,000	2,694,240	
Meat Production (MT)	31,500	12,458	3,651	6,576	1,486

Source: MINADER, Caracterização da Agricultura no Período Colonial - draft 1994.

* Only annual crops.

** In 1990 drought approximately 500,000 head died.

Table 2. Angola: Production of Selected Agricultural, Livestock, Forestry, and Fishing Products, 1988-93.

Crops	1988	1989	1990	1991	1992	1993
	-----In thousand of metric tons, unless otherwise stated-----					
Wheat	2.4	2.4	2.5	3	2.4	2.1
Rice	2.4	2.8	3	4	3.2	2.8
Maize	270	240	18	299	239	209
Sorghum	60	63	63	66	53	46
Beans	36	36	33	36		
Potatoes	40	35	34	36	53	46
Sweet Potatoes	56	56	54	56	45	39
Cassava	1460	1504	1600	1640	512	448
Cotton	2	3	0.1	3	2	2
Coffee	8.1	5	6	5	4	3.5
Sisal	1	1	1	1	0.8	0.7
Bananas	114	114	113	114	91	80
Sugar Cane	110	110	110	110	88	76
Beef	4	4	3	3	2	2
Logs (in thousands of cubic meters)	20	20	21	18	14	12
Fresh Fish	201	189	148	118	94	82

Source: Ministerio da Agriculture e do Desenvolvimento Rural Gabinete do Planeamento.

Table 3. Cultivated Area and Expected Production for 1993-1994.

Province	Maize		Fresh Cassava		Sorghum and Millet		Wheat and Rice		Total Grain Equivalent 1000t
	Area 1000h	Yield kg/ha	Area 1000h	Yield kg/ha	Area 1000h	Yield kg/ha	Area 1000h	Yield kg/ha	
Benguela	180	300	6	3,600	79	400	0	700	93
Bie	60	200	9	3,500	18	400	2	800	31
Huambo	90	200	11	3,500	1	400	2	800	32
Huila	175	400	8	2,700	246	400	1	700	175
Kwanza Sul	79	400	38	3,600	2	450	0	700	74
Malange	35	300	41	4,900	1	950	1	950	73
Other Provinces	83	300	161	4,400	52	390	1	800	258
TOTAL	702	315	274	4,231	399	399	7	808	735

Source: Department of Statistics, Ministry of Planning, IDA and MINADER, Angola, 1993. Forecast as of September 1993.

Table 4. Agricultural Exports (Imports), 1962-1986.

Product	1962	1973	1980	1985	1986
	-----('000 Tons)-----				
Coffee	156.9	218.7	47.2	18.7	15.8 ^a
Cotton	5.7	23.3	-	-	-
Sisal	68.8	53.0	-	-	-
Bananas	2.0	77.0	-	-	-
Wood	51.2	182.0	1.2	24.9	-
Maize ^b	116.7	112.0	(142.7)	(79.6)	-
Tobacco	0.8	6.8	-	-	-
Beans	10.1	28.6	(31.6)	(59.2)	-
Sugar	36.5	9.7	(73.4)	(59.2)	-
Palm Oil	12.6	2.6	(1.2)	(0.7)	
Rice	2.5	4.5	(55.1)	(35.8)	

^a Does not include exports via VIGIMEX.

^b Total imports of cereals in 1988/87 were 152.5 thousand tons (Commercial imports plus food aid).

Source: Relatório e Contas do Banco de Angola and Customs Data.

Table 5. Angola: Gross Domestic Production by Sector (constant 1987 prices).

	1985	1986	1987	1988	1989	1990
AGRICULTURE	27985	27580	28402	27606	28649	28554
Agriculture	26736	26591	27283	26415	27445	27417
Forestry	595	574	545	535	517	499
Fish	554	415	574	656	687	638
EXTRACTIVE INDUSTRY	44298	44625	63067	75371	79186	81019
Crude Oil	41978	43700	60283	72130	75249	77639
Diamonds	2190	801	2641	3085	3776	3230
Others	130	124	143	156	161	150
MANUFACTURING	22663	21643	16152	17953	14740	12302
Food Beverages & Tobacco	8777	7468	6643	6126	5033	4749
Textiles, Clothes & Leather	5220	4555	2792	2648	2199	2411
Chemicals, Rubber & Plastics	1944	1557	1062	1143	1216	1165
Petroleum Derivatives	2623	4054	1956	4524	2341	868
Metals, Machinery, & Equipment	2261	2206	1969	1821	1812	1145
Others	1838	1803	1730	1691	2139	1964
ELECTRICITY & WATER	474	474	530	483	437	370
CONSTRUCTION	12204	9549	11449	8567	7271	7169
COMMERCE	29313	25975	25926	25298	27674	27335
TRANSPORT & COMMUNICATIONS	9969	10002	8768	8217	7537	8098
BANKS & INSURANCE	3461	2614	619	1113	1396	165
OTHER MERCANTILE SERVICES	6485	8421	9087	9506	8173	8896
NON-MERCANTILE SERVICES	41413	52534	53881	57436	56998	58214
GDP at PRODUCER PRICES	198265	203417	217881	231550	232061	232122

Source: INE - Departamento de Contas Nacionais, 1993.

Table 6. Maize Area, Production and Yield in mid-Africa, 1987.

Country	Area Harvested (1000 ha)	Yield (kg/ha)	Production (1000 mt)
Angola	850	353	300
Burundi	135	1222	165
Cameroon	450	844	380
CAR	80	800	64
Congo	11	727	8
Gabon	7	1429	10
Kenya	1600	1188	1900
Nigeria	700	2000	1400
Rwanda	86	1191	102
Tanzania	1948	1211	2359
Uganda	280	1275	375
Zaire	860	903	777
Zimbabwe	1211	769	931

Source: FAO Production Yearbook 1987.

Table 7. Angola: Geographic Structure of External Trade.

Principal Client	Export (%)		Principal Suppliers	Import (%)	
	1989	1990		1989	1990
U.S.A.	64.6	51.7	Portugal	23.4	26.2
France	1.4	12.9	France	11.5	11.1
Belgium/Luxembourg	8.7	7.9	U.S.A.	7.3	9.6
Germany	1.3	6.1	Brasil	8.7	7.6
Yugoslavia	6.7	5.7	Spain	5.1	6.8
Holland	5.3	4.5	Holland	6.7	6.2
Brazil	1.9	2.8	Germany	6.7	5.4
Portugal	1.7	2.1	Italy	5.7	5.1
Spain	0.5	1.6	Belgium/Luxembourg	3.4	4.5
Italy	1.9	1.4	United Kingdom	3.1	3.4
EEC	19.2	35.5	EEC	68.2	68.7
TOTAL (million U.S.\$)	2,989	3,940	TOTAL (million U.S.\$)	1,338	1,578

Source: International Monetary Fund. Direction of Trade Statistics Yearbook 1991.

Table 8. Fixed and Controlled Margin Pricing Regime (1993).

Fixed Prices

Electricity, Telecommunications, Water,
Postages, Public Transportation, Domestic,
Flights, Oil Products

Controlled Margins

Agriculture Inputs, Tools, Tires, Cement,
Plastic Bags, Wheat and Corn Flour, Beef,
Chicken, Matches, Rice, Cooking Oil, Sugar,
Soap, Milk, Construction Materials

Source: Decree No. 7/93 (4/14/93), in Diario da Republica.

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