PN-ACA-024

Staff Paper

Transformation Versus Stagnation in the Oil Palm Industry: A Comparison Between Malaysia and Nigeria

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February 1997 Staff Paper No. 97-5

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Funding for this research was provided by the Food Security II Cooperative Agreement (AEP-5459-A-00-2041-00) between Michigan State University and the United States Agency for International Development, through the Africa Bureau's Office of Sustainable Development, Productivity Sector Growth and Environment Division, Technology Development and Transfer Unit (AFR/SD/PSGE/TDT).

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1. INTRODUCTION

The oil palm is a perennial crop that originated in the tropical rain forest of West Africa. It spread to South America in the 16th century, and to Asia in the 19th century.[1] During the 1970s, Asia overtook Africa as the principal oil palm producing region in the world. In recent decades, the domestic consumption of palm oil in West Africa has increased more rapidly than its production. After centuries as the lead producing and exporting region, West Africa has now become a net importer of palm oil.

The reversal in the production and trade status of these two regions can be explained by the underlying transformation and stagnation of the oil palm industries, respectively, in Malaysia and Nigeria. In 1961-65 world oil palm production averaged 1.5 million tons, with Nigeria accounting for 43% and Malaysia less than 10%. However, since then oil palm production in Malaysia has consistently increased while in Nigeria it has virtually stagnated. Today world oil palm production amounts to 14.4 million tons, with Malaysia accounting for more than 50% and Nigeria, which is one of the largest producers in West Africa, accounting for only 7%.

This paper contrasts the successful transformation of the oil palm sector in Malaysia with the stagnation of the oil palm sector in Nigeria, and examines the factors determining the different paths that the oil palm sectors took in these two countries with the aim of drawing lessons for future development and transfer strategy in Nigeria. Comparing two countries in different regions is not easy, especially when Nigeria has been in political chaos and the agro-climatic environments for oil-palm production differ greatly in these two countries. The purpose of this paper is, therefore, not to compare the **potential** technology frontiers these two countries can reach, but instead to highlight the technological and environmental factors that helped or hindered the countries in reaching these potential frontiers, however different they may have been.

We begin, first by outlining the conceptual framework and an overview of the oil palm sectors in Malaysia and Nigeria, followed by an assessment of the technological shifts and stagnation in Malaysia and Nigeria, respectively, in the context of the conceptual framework.

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[1] Today, oil palms are grown on a wide range of soils in a humid, tropical low land climate. The fruits grow in bunches, called fresh fruit bunches. Two types of oil can be extracted from the fruit: crude palm oil from the mesocarp, and kernel oil from the seed. Crude palm oil is chemically distinct from palm kernel oil, and does not compete in the same market.

2. CONCEPTUAL FRAMEWORK

The underlying premises of the analysis presented in this paper are that the process of agricultural transformation requires improvements in three areas: (1) **Technology,** which shifts the production function upward. This includes *process*es and *product*s of oil palm research and development (R&D), production, processing, storage, transportation and marketing. (2) **Environment**, which allows the realization of the potential gains from technological advancement, such as *institutions, organizations* and *infrastructure* that govern the movement of oil palm from researchers to farmers, processors, distributors, sellers and ultimately to consumers, and (3) **Coordination**, which reduces uncertainty and thus diminishes resource and transaction costs of achieving higher productivity. This includes *institutions, measures* and *mechanisms* that promote the flow of market information, the availability of complementary inputs, the enforcement of laws (e.g., contract laws, land tenure systems), and the product market development (Maredia et al. 1997, Boughton et al. 1995). The state of the art in these three areas constitute the **technology frontier**.

This paper argues that the differential performance of the oil palm sectors in Malaysia and Nigeria can be explained by the success and failure of these societies in shifting-out the technology frontier entailing improvements in all these three areas -- technology, environment and coordination. There is, however, no unique sequencing or **expansion/development path** for reaching higher technology frontiers, as there are many external factors unique to a given country's circumstances (such as agro-climatic factors, natural resources, demographic factors) that influence the development path. Nonetheless, there are characteristics, which are common in many successful expansionary strategies that can be emulated by countries to close the technology gap in a less developed sector.

The rapid development of the oil palm sector in Malaysia, for example, has been characterized by scientists, agricultural planners, farmers and the private sector breaking out of the traditional development path to initiate major changes in technology, the technology environment, or both, features which were largely absent in the case of Nigeria. The successful transformation of the oil palm sector in Nigeria will similarly require researchers, policy makers, farmers and other members of the private sector to break free of the current technology or environment "development path" to create a new, more efficient, less costly path. The catalyst for path-breaking is hypothesized to come from improvements in oil processing technology and from stronger smallholder farmer organizations.

3. OIL PALM SECTOR PERFORMANCE IN MALAYSIA AND NIGERIA: A COMPARATIVE OVERVIEW

Based on the conceptual framework outlined in the previous section, Table 1 highlights (1) the key **technologies** that characterize the oil palm industry in Nigeria and Malaysia; (2) the characteristics of the **environment** for technology development and adoption, including policies,

Table 1: Characteristics of the Oil Palm Sector in Malaysia and Nigeria

Characteristics	NIGERIA **Dominant technology: Smallholder Production with Traditional Processing**	MALAYSIA **Dominant technology: Large-scale Plantations with Modern Mills**
TECHNOLOGY		
Farm-Level	Oil palm inter-cropped with other food crops; semi-wild varieties with little or no modern inputs	Intensive monoculture; high degree of specialization; HYVs and modern inputs, mechanization
Processing	Manual; low volume; low extraction rate (20-50%)	Well-integrated; capital intensive; high volume; high extraction rate (90%)
Management Structure	Decentralized management, processing and marketing	Single management control
ENVIRONMENT		
Production structure	80% of national production from smallholders	Over 90% of production from large-scale plantations
Research	Public research (NIFOR) only	Collaboration between public (PORIM) and private research
Institutions	Separate land and tree tenure system, Land Use Decree of 1978	Consolidated land holdings; vertical integration; quality control standards
Supporting infrastructure	Negligible; some government mills or plantation	Nurseries, credits, refinery mills, established trading system
COORDINATION		
Inputs	Little use of modern inputs and extension service	Provided internally (e.g., seedlings from own nursery) or from markets
Output market	Previously controlled by monopoly marketing board; market liberalization in 1986	Vertical integration; contracts; markets; PORLA provides market information, standards and quality control
PERFORMANCE		
Productivity	Low	High
Quality of oil	high fatty acids; for local use only	export quality
Adoption of modern inputs	low	high
Access to information	slow	fast (partial internal flow)
Impact on environment	low	high

marketing organizations, and infrastructure in each country; and (3) the **coordination** mechanisms used in each country that contributed to the productivity differences that we see today between Nigeria and Malaysia. Malaysia's success is built on plantation management together with processing in large modern mills. Almost 100% of the area cultivated under oil palm is planted to *Tenera*, a high yielding variety (HYV)[2]. Over 90% of Malaysia's oil palm is grown on plantations and processed into crude palm oil at large modern mills. Plantations and mills are vertically integrated, with the largest plantations engaged in oil refining and trading activities. The plantation mode of production is characterized by large-scale monoculture under unified management. Sixty five per cent of plantations are larger than 1200 ha, enabling an individual plantation to supply sufficient fruit to operate modern large-scale mills profitably.[3] Modern mills achieve high extraction rate (in excess of 90%), and export-quality oil (Moll, 1987).

In Nigeria, by contrast, 80% of production comes from dispersed smallholders who harvest semi-wild palms and use manual processing techniques. Several million smallholders are spread over an estimated area of 1.65 million hectares in the southern part of Nigeria. Oil palm is inter-cropped with food crops such as cassava, yam, and maize. As a consequence of these factors and because Nigeria has a less favorable climate for oil palm cultivation, fruit yield in Nigeria is less than one sixth of that in Malaysia.[4]

There are also large differences in the extraction rate and the quality of oil between Malaysia and Nigeria. For example, the capacity of traditional presses is very low, ranging from 0.10 to 0.75 tons of fruit per hour. The efficiency of these methods is lower than modern mills and oil extraction rates range from 20% to 50%, compared with 90% in Malaysia. The quality of oil is low by export standards, but adequate for the domestic market (Moll, 1987).

In addition to the agro-climatic and structural (size and scale of production and processing sectors) differences discussed above, there are other environmental and coordination (political, institutional, organizational) factors highlighted in Table 1, which have hindered or promoted the achievement of potential frontiers in Nigeria and Malaysia. In the next section, we examine these factors in greater detail, beginning with the story of stagnation in Nigeria.

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[2] *Tenera* was first used for commercial production in Zaire (formerly, Belgian Congo) during the early 1920's (Hartley, 1988).

[3] Modern large-scale mills can process between 6 and 60 tons of fruits per hour, at least double the throughput of small-scale mills and eight times as manual processing. A modern mill requires a large supply of fruits (at least a 1000 ha of oil palm production) to operate profitably.

[4] The pronounced seasonal distribution of rainfall in West African countries, with dry periods from 2 to 5 months, results in average estate yields of 8-13.5 tons/ha of fruits compared to average yields of 15-22 tons/ha on estates in South-East Asia where rainfall is distributed more evenly (Moll, 1987).

4. FACTORS BEHIND NIGERIA'S STAGNATION

Since independence in 1960, Nigeria's agricultural sector has experienced slow output growth that has not kept pace with population increases. This has resulted in declining agricultural exports and domestic food supplies, and a growing reliance on imported food. Nigeria has been particularly fortunate in having vast oil reserves, but it has also been plagued by economic chaos and political instability over the past three decades. While the decline in the agricultural sector can be partly explained by drought and serious pest and disease infestations, there are other prominent reasons for its decline, including the neglect of the agricultural sector after the oil boom, and unfavorable government policies, which are highlighted in Box 1. In what follows, we discuss how these overall policies affected the technology generation capacity and technology environment, farm-level production and marketing environment, and coordination mechanisms between different stages of the oil palm sector in Nigeria.

4.1. The Role of Technology

During the colonial era, Nigeria's public oil palm research institute was an effective producer of new technology (Eicher, 1989; Anthony et al., 1979). The first oil palm research station was established in 1939, and in 1951 it became the West African Institute for Oil Palm Research (WAIFOR), with a mandate to serve the British West African territories of Nigeria, Ghana, Sierra Leone, and Cameroon. Following independence (1960), WAIFOR was nationalized in 1964 and became the Nigerian Institute for Oil Palm Research (NIFOR). Nigeria's oil palm research benefitted from the regional spillover effects from national agricultural research systems (NARS) in Zaire where the hybrid nature of *tenera* was discovered. By 1959 NIFOR had completely shifted its seed production from traditional varieties to higher yielding hybrid *tenera* palms. The polyethylene bag method for nursery seedlings developed in Malaysia was also successfully modified to suit Nigerian conditions (Udom, 1986). These successes in developing technology for the oil palm sector in Nigeria were achieved when WAIFOR was staffed by only 16 senior research officers.

During these years the research team was financially supported from the trading surplus collected through the marketing board. In the late 1940's, 70 % of marketing board profits was allocated to research activities (Lambo, 1987). When the marketing boards were decentralized to the states in 1954, the board profits also provided an important source of capital funds for regional development. Nevertheless, part of the Eastern Regional Marketing Board's surplus was allocated to WAIFOR and later to NIFOR (Udom, 1986).

During the 1970s NIFOR's financial base changed from the industry's surplus to annual federal government grants or subvention, as well as from its own internally generated income. The windfall gains in government revenues from the oil boom also led to an increase in NIFOR's senior staff from 16 in 1970 to 283 in 1985. Correspondingly, its research mandate was broadened beyond oil palm to include date palm, raffia, coconut, and other palms. The number of research facilities during this period also increased.

Box 1. Agricultural Policy in Nigeria: An Overview

The stagnation in the oil palm sector in Nigeria has been influenced by the overall agricultural policies of the Nigerian government. These are examined below by three time periods, roughly corresponding to the period following independence (1960-1970), the period of oil export-boom (1970-85) and the period of structural adjustment (1985-present).

1960-1970: At the time of independence in 1960, Nigeria's economy was largely dominated by its agricultural sector which contributed about 70% of national income and employed 80% of the labor force. Agricultural exports were the greatest source of foreign exchange earnings. After independence, the Nigerian government followed an industrialization strategy aimed at replacing imports with goods produced in Nigeria. This industrialization was financed by export taxes levied through Commodity Marketing Boards, which monopolized the export trade and set the official producer prices well below world market levels for major agricultural commodities such as cocoa, groundnut, palm oil, cotton and rubber. The resulting producer price had a damaging effect on the production of export crops. In addition, the civil war from 1967 to 1970 had devastating effects on the economy. Agricultural activities in all parts of the country were adversely affected, but the eastern region, which was the major source of supply for root crops and palm oil to the economy was hardest hit (Lambo, 1987). This period was also characterized by a decentralized approach to agricultural development, with the states constituting the main centers of development activities, while the federal government merely played a supporting role (CBN/NISER, 1992). The old national marketing boards were replaced by regional marketing boards, each of which was made responsible for the major commodities produced within its territory. Even the research system was decentralized whereby federal departments were mandated to conduct basic research while the state departments were mandated to conduct applied research (Idachaba, 1987).

1970 - 85: During this period two major factors adversely affected the agricultural sector, the oil boom and direct intervention by the Federal Government. With OPEC's intervention oil prices in early 1970s increased fourfold and oil became the dominant export commodity and source of government revenue. The employment opportunities provided by the oil industry and the massive increase in public expenditures, which were biased toward the urban sector, drew labor away from rural to urban areas, leaving agriculture short of labor during the peak season. At the same time, the appreciation of the Naira and the reduction of duties on food imports made food imports cheaper than domestic staples. These actions created biases against agricultural exports (Iyegha, 1988; Forrest, 1993). After the end of the oil boom era, oil prices declined in the early 1980s, leading to shortages in foreign exchange, which could have been managed by the devaluation of the local currency. However, the government instead tried in vain to circumvent this problem by instituting rationing and import bans, resulting in foreign exchange crisis.

There were several attempts by the Nigerian government, albeit unsuccessful, to promote rural development and food production. First, in 1973 the federal government reformed the marketing board system with the aim of increasing producer prices for export crops by replacing the state-based system with seven national commodity boards. This reform failed to stimulate agricultural production, however, since the problem lay with the stagnate world market, and the growth of the domestic subsistence crop market, in which the prices paid by traders exceeded the marketing board prices (Baker, 1989). Second, there were a number of federal initiatives aimed at promoting both large-scale farming and the smallholder agriculture. Agricultural projects provided a range of input subsidies, extension service networks, and developed infrastructure, but were plagued by poor management and limited funding. In addition to these measures, the federal government promulgated the Land Use Decree in 1978 which transferred all land to state ownership with the aim of allocating unused or under-used land to large-scale enterprises. However, because of the threat posed to the local land market, strong opposition from local communities, and ineffective enforcement, the impact of this decree was limited (Lambo, 1987; Baker 1989; Forrest, 1993).

(Box continued on next page)

Box 1 (Continued). Agricultural Policy in Nigeria: An Overview

In summary, policies of the 1970-85 period were characterized by increasing government involvement, especially at the federal level. This was made possible by the oil revenue windfall to the federal budget. With respect to research, this resulted in the federal takeover of all state-owned agricultural research institutes in 1975. According to Idachaba (1987, p. 339), "This destruction of a decentralized, cooperative joint federal-state agricultural research system remains a major handicap of the national agricultural research system today."

1985- present: In the face of chronic balance of payments difficulties and slow production growth, Nigeria started implementing the Structural Adjustment Program (SAP) in July 1986 with its emphasis on market forces and private enterprise. The reform included the revaluation of the exchange rate, the dissolution of the marketing boards, the promotion of food and cash crop exports, and the banning of maize, rice, wheat, and vegetable oil imports in order to stimulate local production and use of local raw materials. The effects of SAP were mixed. On the positive side there was a rapid rise in output prices, improvement in production efficiency, and an increase in opportunities for small business enterprises. On the negative side, however, it led to increased input prices and a sharp increase in the cost of living relative to nominal income (CBN/NISER, 1992). According to Nwosu's (1991) analysis, on average, SAP benefits has had a positive impact on farm incomes and employment. However, national-level consumption has declined following SAP's implementation.

The rapid expansion in agricultural research was partly due to tacit agreement with the norm that a desirable agricultural research investment target should be in the range of 0.5% to 2.0% of the total national value of agricultural GDP (World Bank, 1981). But Eicher (1989) observes that this norm was derived from industrial countries with a century or more of experience in mobilizing political and financial support from farm organizations, commodity groups, private firms, and state and federal organizations. He concludes that NIFOR was top-heavy with administrative staff and it was less productive because a very substantial part of NIFOR's budget was used to pay the salaries of its vast administrative, scientific, and support staff, and only about one-third of its regular staff were directly engaged in research. In addition, Idachaba points out that a lack of sustainable funds and inconsistency in research policies made it difficult for researchers to maintain a long time horizon (Idachaba, 1987).

4.2. The Role of Environment and Coordination

After independence the main official interest in agriculture was to ensure that agricultural resources were extracted and used in industrial development. The oil palm sector was no exception. From 1964-1974, the producer prices given by the Board were less than half of f.o.b. prices (Lambo, 1987). Johnson (1968) reported that the Board's severe pricing policies were obstacles to the adoption of HYVs. We have to note, however, as Eicher (1967) mentions that, "until alternative sources of revenue such as petroleum become available on a sustained basis or improved administration *(was)* forthcoming to implement a land or income tax, the marketing board *(was)* likely to continue to perform an important fiscal role in financing infrastructure and state industrial development scheme". The more important issue was how to make the marketing boards perform their fiscal role more effectively. In fact, the significant difference between

Nigeria and Malaysia, as we will see later on, is that the former pursued a policy of import substitution by imposing heavy taxes on agriculture, while the policy of the latter was relatively *laissez faire* and export taxes on oil palm were usually less than 10-20% at the most.

Part of the trade surplus of the Board was channeled to development schemes. Most attention was focused on large-scale plantation and oil mill development. At the end of the civil war in 1970, the oil palm sector was seriously disrupted. Virtually all plantations were abolished, processing mills destroyed, and smallholders and oil palm groves received low priority as all the available labor was devoted to the production of staple foods (Moll, 1987).

After the 1970s, the oil palm sector suffered even more adversely from the oil boom as did the whole agricultural sector in Nigeria. Both labor and capital moved out of farming to urban activities, in spite of the new marketing system -- the Nigerian Palm Produce Board (NPPB) -- established to promote the prosperity of rural oil palm producers. The Federal Government sought to revive production of agricultural commodities and initiated a program in 1975 for the oil palm sector with financial assistance from the World Bank, and the federal and state governments. The program was designed to link the plantation sector with the smallholders to take advantage of the former's economies of scale and scope, employment opportunities for smallholders and facilities for fruit collection and processing. Thus, the funds had to cover both plantation and smallholder projects. However, an unforeseen wage escalation diminished financial resources for this project. With regard to the smallholder project, financial constraints forced some state governments to curtail supplies of free seedlings and fertilizers, and to stop providing loans for land preparation. Inadequate funding and poor management resulting from conflict between the federal and state governments also set back these projects (Ataga, 1986; Forrest, 1993).

The number of large-scale plantations with modern processing facilities increased as a result of the projects launched by the government in the 1970s. An interesting question, however, is whether there was any opportunity in Nigeria for the voluntary emergence of large-scale production systems to take advantage of more efficient processing at modern mills? Because of fruit perishability, the efficient operation of a modern processing mill requires coordinated fruit collection efforts to ensure that processing is done within 24 hours after harvesting. Given the fact that Nigerian smallholders are geographically dispersed and oil palm is intercropped with other crops, there are high transaction and transportation costs involved in assembling and conveying harvested fruits in accordance with the mill processing capacity. These factors make modern, high-scale processing mills uneconomical. In addition, domestic consumers prefer palm oil produced using traditional processing methods, which yield an oil with higher levels of fatty acids than in modern mill-processed palm oil. In other words, environmental factors and the lack of coordination mechanisms would have made it difficult for the voluntary emergence of large-scale, modern processing mills.

To encourage modern, large-scale processing mills requires environmental improvements and reorganization of the subsector in order to reduce both transportation and transaction costs. In the late 1970's, the Nigerian government initiated group participation programs to facilitate the

consolidation of land holdings. The Land Use Decree of 1978, which abolished the private ownership of land by transferring it to the state, facilitated land consolidation, but discouraged voluntary land transactions by damaging the liquidity of the local land market (Udom, 1986; Baker, 1989).

The improvement in the policy environment during the last decade has had some positive impact on the oil palm sector. For example, the introduction of the structural adjustment programs in mid-1980s resulted in a significant increase in the real farmgate price of palm products. This was because of the dissolution of the marketing boards and the banning of vegetable oil imports. However, the concurrent increase in production costs (mainly the increase in cost of imported inputs caused by the devaluation of Naira) canceled out some of the production incentives (Nwosu, 1991). Most of this increase in oil palm production came from the smallholder sector. With the increased producer prices, farmers resuscitated abandoned farms. Small scale oil milling, which was abandoned due to poor returns was also revitalized by the farmers and agro-processors (CBN/NISER, 1992).

4.3. Summary

In summary, several technological and environmental factors have contributed to the stagnation of the oil palm sector in Nigeria. High yielding varieties of oil palm were available at research stations, but few smallholders have adopted them, resulting in the stagnation of oil palm yields. Disincentives to technology adoption included the marketing board's pricing policy in the 1960's and the civil war in the late 1960's. These factors were further aggravated by the adverse effect of the oil boom in the 1970's. Government projects tried to revitalize the smallholder sector and to introduce plantation-style management, but their success was limited because of management problems and lack of sustainable funding. Furthermore, the small-scale production farms and lack of coordination with input and output markets, did not allow the widespread vertically integrated plantation system to develop beyond government-project sites. The structural adjustment programs introduced in 1986 had small but positive impact on the oil palm sector.

5. SUCCESSFUL TRANSFORMATION IN MALAYSIA

We now turn to the success story in Malaysia. Oil palm was first planted commercially in Malaysia in 1917 when rubber was the dominant industry, as a result of British colonial policy. However, major breakthroughs in oil palm production and processing techniques during the 1960's, combined with a favorable policy environment and innovations in subsector coordination, led to a shift in the emphasis from rubber to oil palm cultivation. As a result of this combination of technological innovations and environmental improvements, Malaysia has successfully implemented the strategy to 'leapfrog" the then leader, Nigeria, in oil palm production. Within a period of three decades, Malaysia has emerged as one of the largest producers of oil palm products in the world, increasing its share from 8% in the early 1960s to 51% in 1993. In the

following section we examine the role of technology, environment and coordination in the transformation of the oil palm industry in Malaysia.

5.1. The Role of Improved Technology

Until 1950, oil palm research in Malaysia had been ineffective compared to West Africa and Indonesia. Research on oil palm breeding in Malaysia expanded significantly in the 1960's through the creation of the Oil Palm Genetics Laboratory (OPGL) by four major private plantations, and the establishment of a large exchange program with Africa by the Malaysian Department of Agriculture (Hartley, 1988). Yield increases achieved with planting materials developed by the OPGL provided a major thrust to the oil palm industry in the 1960s by making its cultivation commercially attractive.

As the number of producers increased, and the exclusion of free riders from access to research results became more difficult, the industry successfully lobbied for the creation of a public research institute. As a result, the Palm Oil Research Institute of Malaysia (PORIM) was set up in 1979 through a cess (producer levy) on oil palm production. PORIM's research was carried out in collaboration with the private research stations owned by the large plantations. In addition to gains in on-farm productivity from HYVs, improvement in the quality of oil through innovations in processing has resulted in increased demand for palm oil for human consumption (Kheiri, 1987). In order to continue on the path of industry expansion and reach new technology frontiers, in recent years, PORIM's primary foci have been demand expansion (e.g., by developing diesel and fat substitutes from palm oil), cost reduction through farm mechanization (which is in response to rising labor costs), and increasing the efficiency of planting materials through tissue culture. Dissemination of research results, in addition to research task sharing between public and private organizations, have been very effective as well.

5.2. The Role of Environment and Coordination

A typical transition pattern in Malaysia involved replanting of rubber plantations with HYV oil palm, followed by the installation of mills at the site. In contrast with Nigeria where the colonial government attempted to give land rights to small farmers, plantations were the dominant agricultural production system in Malaysia. Since the management and infrastructure requirements for rubber and oil palm plantations are very similar, the cost of transition was relatively low. Furthermore, Malaysia's historical specialization in rubber had resulted in the development of an efficient distribution system for food and other consumables, resulting in the effective integration of the plantation sector with the economy as a whole. Thus, Malaysia's smooth adoption of the large-scale plantation structure for oil palm, and associated components of the technology, was facilitated by historical investments in a similar structure in its predecessor industry -- rubber.

In Malaysia private-sector plantations took the initiative to provide the market order during the transition, while the government took a low profile regulatory role with regard to the oil palm industry. The Malaysian Palm Oil Pool was started as an association of private palm oil producers in 1954 in order to reduce the risk arising from the world markets of which Malaysia at the time claimed only a small portion. The Pool set a common selling price and allowed all members to use port bulking installations which were owned by major palm oil producing companies. As the industry grew, the rigidity of the Pool became a constraining factor for the oil palm industry. Thus, in 1974, the Pool system was terminated and a federal regulatory body, the Palm Oil Registration and Licensing Authority (PORLA) was established. PORLA theoretically had responsibility for regulating and coordinating all activities relating to supply, sale, storage, trade and quality of palm oil, and for the collection and dissemination of information concerning the industry. However, in practice PORLA has not interfered with the establishment of free market prices, nor has it used its powers to limit competition. Instead, PORLA has focused on the provision of goods and services with public goods characteristics such as quality control and information.

The technology environment was also favorable to the adoption of HYV during the period of transition from rubber to oil palm. The government allowed rubber replanting funds to be used to plant oil palm, and simplified the land registration procedure to facilitate the consolidation of holdings into viable units. A lower export tax for oil palm also encouraged substitution. Disincentive effects from exchange rate and fiscal policies were smaller for Malaysia than for its competitors (Jenkins and Lai, 1989).

The industry's vertically integrated structure provided an essential coordination mechanism. Unlike Nigeria's widely dispersed production structure, the geographic concentration of production in plantations, combined with ease of communication between production and processing managers within a vertically integrated structure in Malaysia, made it possible to match the supply of perishable fruits to processing capacity in a timely manner. Vertical integration also facilitated the access to imported inputs such as fertilizer. Many plantations were first established by European trading companies and have maintained strong ties with them. Hence large plantations were usually in direct contact with input suppliers.

Malaysia has also been experiencing the emergence of a smallholder oil palm sector along with the plantation subsector. The smallholder oil palm cultivation has been gaining momentum since the mid-1970s, accounting for 6% of national production in 1982. Such small holdings usually have 2 to 3 ha of land, with oil palm plantings often scattered amongst rubber and other crops. Smallholders do not process fruit themselves but sell their fruits to the plantation mills for processing. Alternatively, if there is no plantation mill in the vicinity, they use the state mill,[5] which generally has smaller capacity. Thus, the growth in the smallholder sector in Malaysia was

[5] The capacity of the small modern mills and the quality of crude palm oil are inferior to the large modern mills (Moll, 1987).

encouraged and supported by the opportunities for milling and marketing provided by the infrastructure already existing for the plantation sector and government schemes (Barlow, 1987). In the 1970s and 1980s the Nigerian government tried to introduce this structure by undertaking smallholder projects and by setting up plantations. But it failed to build the critical linkage between the two sub-sectors and to take advantage of the complementarity between the two.

5.3. Summary

In summary, the development of profitable techniques by private sector research led to a shift in plantation managers' interest in favor of oil palm cultivation. The large-scale capital intensive structure of the subsector is the most profitable alternative given the historical pattern of investment, institutional environment and coordination mechanisms. In Malaysia, government policy and the prior development path (the existence of rubber plantations) favored the transition from rubber to oil palm. As the number of oil palm plantations increased, some regulatory activities were transferred to the federal government, and research effort was shared between the private and public sectors. A continual flow of research results has consistently pushed the technology frontier outward in Malaysia.

6. FUTURE PATH FOR NIGERIA: STRENGTHENING THE SMALLHOLDER OIL PALM SECTOR

Because of the increased demand for palm oil resulting from an increase in population and income growth, relative to the low productivity of the oil palm sector, Nigeria has become a net importer of palm oil. At the same time, the rapid devaluation of the Naira combined with the high transportation costs from ports to internal markets, put imported oil in a competitively disadvantage position. Thus, Nigeria's first goal should be to meet the domestic demand and then, if possible, seek to become competitive in export markets. Nigerian palm oil production is potentially competitive in the domestic market if oil palm sector productivity is increased by shifting the technology frontier further. Transformation of the oil palm industry would enhance the overall economic development through the income and employment effects in the rural and urban economies.

The Malaysian success story has depended to a large degree on the plantation sector with large modern mills (as characterized in Table 1). However, attempts to copy the Malaysian model of large-scale plantations with modern mills would not be cost effective for Nigeria because of her different historical path, demand structure, and institutional arrangements. The system of large-scale production with large modern mills would be unprofitable in the absence of a modified environment and coordination mechanisms for Nigerian smallholders. It would require major investments and time for the infrastructure development and the emergence of new institutional arrangements required for large-scale production. Furthermore, if food markets are not reliable, smallholder specialization in oil palm may undermine rural food security. Thus, the development of this system will be restricted to existing plantations, most of which are presently neither

maintained nor harvested (Moll, 1987). Malaysia's experience could be usefully applied to regenerate these plantations.

However, to revitalize the oil palm industry in Nigeria will require adopting strategies that focus primarily on strengthening the smallholder oil palm production. Malaysia's emerging smallholder oil palm sector described in Table 2 (column 1) can provide a useful model for Nigeria. Like Nigeria, the oil palm production occurs on small land holdings under multiple cropping system. However, unlike in Nigeria, smallholders in Malaysia sell their fruits to the plantation or state mills for processing and further marketing. These linkages between the smallholder oil palm production and the infrastructure of the large-scale plantation sector in the post-harvest stages of the food system (such as milling and marketing services) have contributed to the successful emergence of the smallholder sector in Malaysia. This system of smallholder production with large-scale, consolidated processing and marketing deters some of the diseconomies of size and scale associated with small-scale production.

Based on the Malaysian experience with smallholder sector one alternative for Nigeria would be to provide large-scale modern mill facilities to the existing smallholder production structure. A merit of this system of smallholders and modern mills is that it requires a lesser degree of specialization and therefore will not affect the food security situation adversely. However, the ***coordination*** of harvesting with mill processing capacity will be a key factor in determining the success of this model because of the perishability of the palm fruits. The feasibility of this system of smallholders and modern mills requires processing and marketing facilities in the vicinity of smallholders. It requires the existence of processing mills willing to accept fruits from smallholders, and marketing facilities and infrastructure which connect smallholders with the mills (coordination). Whereas in Malaysia the plantation sector performed this role, in Nigeria the government will have to provide this supporting role. But if Nigeria's experience with the oil palm plantation projects in the 1970s is any indication, this path may probably not be financially sustainable. Furthermore, the revaluation of the Naira after the structural adjustment programs has made the importation of modern mills relatively expensive.

An alternative for Nigeria that is closer to the existing structure would be to focus on modernizing farm-level processing (Table 2, column 2). The difference between this system and the system in Malaysia (column 1) is that smallholders, or groups of smallholders, process the fruits *on site* and then sell crude palm oil to local traders. There are several farm-scale processing technologies which vary in extraction rate, ease of use and repair, capital costs and minimum profitable acreage. Depending on the price range, between 2 and 10 hectares of high yielding palm varieties are generally required to ensure a positive net present value of investment in processing equipment. While the quality of oil varies with the type of processing machine used, it is generally inadequate for export (Hyman, 1990). Also, it can meet the domestic demand for palm oil, since rural consumers prefer the sharp taste of local oil with high free fatty acids to the milder oil produced by large mills (Moll, 1987; Hyman, 1990). The advantages of this system are its lower costs in terms of institutional innovations and infrastructure, and the environmental benefits of soil

Table 2: Characteristics of an Emerging Smallholder-based Oil Palm Technology in Malaysia and the Desired Future Path for Nigeria

Characteristics	**EMERGING SECTOR IN MALAYSIA** Smallholder production with modern processing mills	**FUTURE PATH FOR NIGERIA** Smallholder production with improved processing
TECHNOLOGY		
Farm-Level	Multiple cropping; HYVs and modern inputs	Oil Palm intercropped with other food crops; HYVs and modern inputs
Processing	Non-integrated; capital intensive; medium to high volume and extraction rate (85%)	Village-based; intermediate scale mechanical; variable volume, extraction rate and quality
Management Structure	Decentralized management and marketing of fruit	Decentralized production management but group (centralized at village-level) processing and marketing
ENVIRONMENT		
Research	Public research with spillovers from private sector	Public research (NIFOR); private research may emerge with smallholder organizations
Institutions	Consolidated land holdings vertical coordination	Incentives for consolidation, improved marketing infrastructure, developing farmers' organization
Supporting infra-structure	Nurseries, credits, refinery mills of plantation sector	Improved services
COORDINATION		
Inputs	Markets; contracts; extension	Dependent on extension, farmer co-operatives
Output market	Contracts; middlemen; PORLA	Middlemen; Co-operatives; farmers' organization
PERFORMANCE		
Productivity	Moderate	Moderate
Quality of oil	Moderate (not exportable if mill is small)	Moderate (good for local domestic market)
Adoption rate of modern inputs	Moderate (high in vicinity of plantations)	Highly dependent on extension, co-operatives and farmer organizations
Access to information	Moderate (high in vicinity of plantations)	Highly dependent on extension, co-operatives and farmer organizations
Impact on environment	Moderate	Moderate

conservation due to multiple cropping. Also, this system will provide rural community with training in small enterprise management.

An example of the adoption of this model of oil palm industry structure is the successful introduction of small-scale palm oil processing mills in the villages by the Government of Ghana. Under this system, smallholders or groups of smallholders process the fruits at their village and then sell crude palm oil to local trader. This village-based system makes it possible to achieve the following objectives simultaneously; affordability to local people, local manufacturing and repairing, efficient oil processing, and reduction in labor use. The quality of the oil is not as high as a large-scale mill's, but this is not a major constraint for a net importing country since rural consumers prefer the sharp taste of local oil with high free fatty acids content to the milder flavored oil produced at large mills (Moll, 1987; Hyman, 1990). As indicated in Table 2, even this system requires concomitant institutional innovations such as improvement in product and factor markets, and in the extension service to achieve the rapid dissemination of information, capital, and modern inputs including HYV. Nevertheless, the system is probably a reasonable starting point given current environment and coordination mechanisms in Nigeria.

7. CONCLUSIONS AND LESSONS FROM THE EXPERIENCE OF NIGERIA AND MALAYSIA

Successful strategies for a sustainable transformation must be rooted in the underlying structures and characteristics of the countries. Thus, we face inevitable difficulties in comparing Nigeria and Malaysia in that the structure of the oil palm industry and the political culture in these countries are quite different.

With regard to structural differences, palm oil production in Nigeria depends mainly on smallholders who cultivate scattered semi-wild oil palm groves, extract the oil by traditional methods, and sell a large part of their produce in the domestic market, while production in Malaysia began with the establishment of large plantations and the adoption of factory methods of oil extraction for the purpose of exporting the produce to the world market. With regard to political differences, Nigeria has been involved in civil conflict resulting in the loss of labor and resources, and has had inconsistent, unstable agricultural policies. Malaysia has fortunately not experienced either of these conditions. One of the implications of this case study, therefore, is the reiteration of the importance of the political culture for agricultural transformation. The comparison of these two countries also provides some other limited yet useful lessons for agricultural transformation strategies.

First, an important lesson of the oil palm stories of Malaysia and Nigeria is that a particular technology becomes profitable in the presence of a specific set of environmental and coordination mechanisms. Transformation of the environment and coordination mechanisms to take advantage of technological opportunities involves investment and time. Thus, the cost effectiveness of the development path should be examined from a *systems* point of view. The strategy to shift the technology frontier further will depend on the prior development path, demand structure, and the

role of the industry in the economy. For example, attempting to copy the Malaysian models would not be cost effective for Nigeria because the two systems with large modern mills would be unprofitable in the absence of a modified environment and coordination mechanisms for Nigerian smallholders. It would require major investment and time in infrastructure development and the emergence of new institutions and organizations.

The second important lesson derived from the success story of Malaysia is the catalytic role of the private sector in agricultural transformation. The private sector played an important and initiative role in technology development for the oil palm sector in Malaysia. Collaboration of private plantation companies provided technical and institutional innovations (research and the Pool system) in the initial stages of oil palm sector development. As the industry grew and the number of producers increased, PORIM and PORLA took over some parts of this role in response to the pressure from the private sector. Today, the research task is shared between the private research institutes and PORIM. PORLA has followed a strategy of least market intervention, focussing its activities mainly to the provision of goods and services with public goods characteristics such as quality control and information.

Because of structural differences, Nigeria cannot expect the same technical and institutional innovations to occur voluntarily from the private sector, since the collaboration among a large number of dispersed smallholders is difficult. Nigeria will have to rely more on public research, public programs for market improvement, co-operatives, and formal smallholder organizations. However, needless expansion of public sector activities will neither be efficient nor financially sustainable as the experience of NIFOR and the oil palm projects indicates. What is important to learn from Malaysia's experience is that the public sector in Nigeria should be aware of its changing role in the industry as agricultural transformation progresses.

A third lesson from this case study is related to the appropriate size of the national agricultural research systems. The Nigerian Institute of Oil Palm Research (NIFOR) has been unproductive and top-heavy with administrative staff since its expansion in the 1970s. NIFOR's expansion did not fit with Nigeria's early stages of scientific and institutional maturity, resulting not only in current inefficiencies, but also financial unsustainability.

NIFOR (formerly WAIFOR) productively released its research results stimulated by Zaire's genetic development and by Malaysia's new nursery technique. Thus, we should not overlook the cost-saving impacts of research spillovers and technology-borrowing which reduce research duplication. Regional research collaboration may be the way to reduce duplication and capture spillovers.

Nigeria has ignored the colonial experience of high payoffs to small research teams. It would be useful to examine the optimal size of NIFOR in terms of the number of commodities covered by one institute, the composition of research teams, including administrative officers, and facilities such as research stations and extensions. Creating tighter linkages between the research institute budget and industry surplus could be a key factor in constraining the unwarranted expansion of a research institute. Oil boom created a "fiscal superman" syndrome at the federal level and made

NIFOR's rapid expansion possible. This would have not happened, if research funds had been more tightly linked to the surplus from the oil palm industry as was the case until the 1960's and as has been in the case of PORIM in Malaysia. It may be useful to reconsider the sources and size of available research funding in examining the optimal size of the research institute.

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