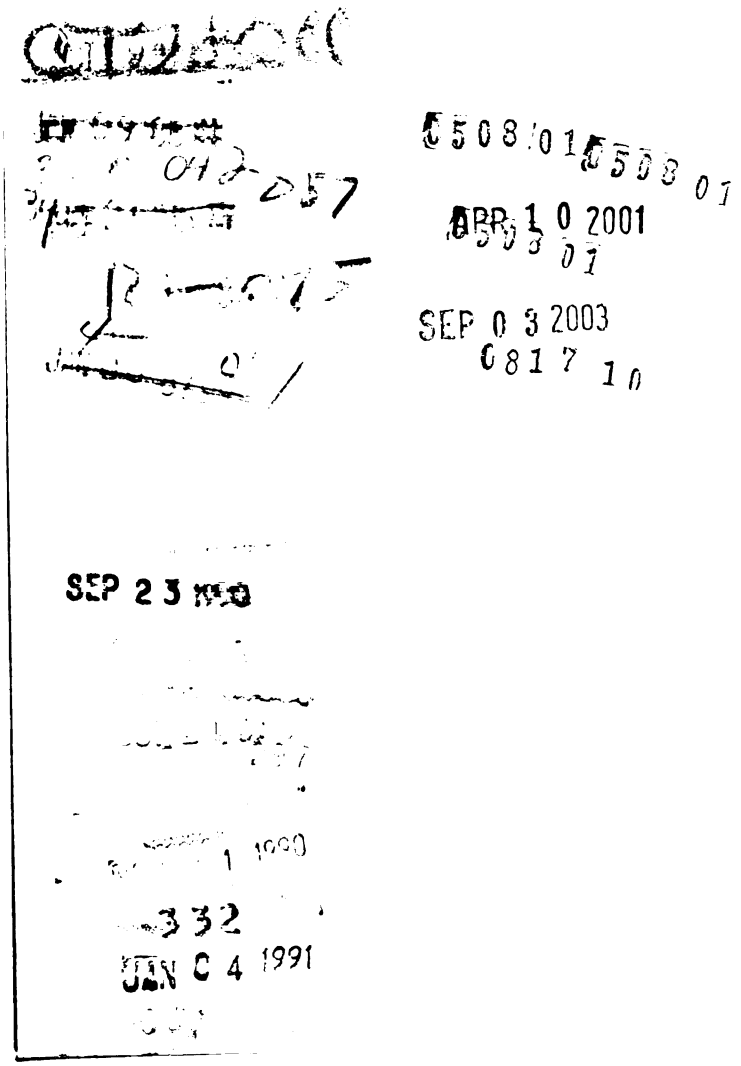
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THE POLITICAL ECONOMY OF GRAIN MARKETING AND STORAGE IN THE SAHEL

By

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ABSTRACT

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AND STORAGE IN THE SAHEL

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Weather-induced instability in domestic food grain supplies in the subsistence agricultural economies of Sahelian West Africa is the overarching, immediate problem which motivated this study. The dimensions of this problem--exaccerbated and widely publicized during the 1968-73 regional drought--and potential solutions involving increased grain storage and improved marketing institutions and services are explored within a political economy conceptual framework. This framework applies a general theory of structural systems dependency to the particular historical and environmental conditions of West Africa. In this perspective complex coalitions of actors and institutions in the center and periphery of an evolving world economy functionally serve the interests of increasingly concentrated financial capital. In Sahelian West Africa this has led to structural underdevelopment which is characterized by rapid urbanization with high unemployment, formation of new elite classes, increasingly unequal distribution of wealth, rural stagnation and increasing dependence on foreign food as well as capital. In the future these patterns of dependence may be exaccerbated or an alternate path may be followed toward greater

economic and political independence and self-reliance. The latter option stresses rebalancing domestic production and consumption in decentralized patterns of self-generating development whose structures and incentives are consistent with the realistic promotion of stated Sahelian objectives of increasing food self-sufficiency and autonomous economic growth.

Following an overview of Sahelian macro-economic indicators the study focuses on trends in regional grain production, consumption and food imports. Regression analysis of 1951-75 aggregate production levels showed long term stagnation in grain production aggravated by severe drought particularly in 1972-73, little evolution in estimated crop yields except for those under irrigation, and substantial variation in production levels within and among Sahelian countries which indicates potential for expanded locally and nationally held grain stocks.

A review of traditional Sahelian grain marketing reveals that, within the context of relatively free local grain markets, non-market factors play a substantial role in determining differential ability to engage in spatial and temporal arbitrage. This, coupled with cash and food crop marketing and pricing policies disadvantageous to producers, tends to limit the expansion of production and self-generated growth in the agricultural sector and leads to the underutilization of cost-efficient traditional grain storage technology.

The remainder of the study involves a detailed examination of issues in Sahelian government involvement in grain marketing, an analysis of existing grain boards in the six countries, and proposals for possible incremental change in these institutions and policies to meet

Sahelian development objectives. In addition to macro-economic issues, the key policy areas examined are those involved with translating traditional emergency and buffer stock options to the Sahelian environment and the specification of appropriate analytical procedures.

Existing Sahelian grain boards are hampered in their pursuit of marketing and storage objectives by inappropriate institutional structures--which lead to overcentralization, duplication of effort, disfunctional incentive systems, very high operating costs and distributional effects biased in favor of certain urban groups--by insufficient storage and transportation infrastructure, and by overly rigid and badly timed official grain price structures.

The general strategy outlined for institutional reform involves holding greater quantities of grain at all levels of a federated national grain marketing system to be based on strengthening village level storage capacity to provide a risk-minimizing service to all segments of the rural population. This is illustrated by the village stock system proposed in a detailed case study of Upper Volta. Urban supply stabilization, inter-regional transfers and the holding of strategic emergency stocks would be assured by streamlined regional and national institutions, aided by practical programs of technical assistance in grain stock management and the promotion of increased functional contacts among Sahelian grain boards.

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CHAPTER I

INTRODUCTION

In recent years there has been increased international concern with natural disaster and related development problems in the Sahel, a contiguous belt of West African countries which is usually defined to include Mauritania, Senegal, Mali, Upper Volta, Niger and Chad.[1] In this study, I will concentrate on two general tasks: development of a structural theory of political-economic change to explore underdevelopment in Sahelian West Africa, and, within this context, the specific examination of applied policy issues in the area of food grain storage. This work is based on available secondary data, on reports furnished by national governments and international organizations, and on several field assignments in the region. It is hoped that the study will be useful to policy makers in the governments of the Sahelian countries, the United States Agency for International Development, and other bilateral and international donor agencies, as well as be of some interest to academic colleagues.

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[1]Some definitions also include the small riparian country of the Gambia and the Cape Verde Islands off the coast of Senegal. "Sahel" is an Arabic word meaning "shore", referring here to the "southern shore" of the Sahara Desert.

Poverty and Crisis in the Sahel

By virtually every quantitative measure commonly used the countries of the Sahel rank very low in the provision of government services and productive infrastructure, in agricultural modernization, and in overall levels of material development. With a few exceptions they are on all lists of the world's least developed countries. Within most of this region only 5 to 20 percent of the population live in urban areas although this percentage has been increasing rapidly in recent years. The bulk of the population is comprised of nomadic herders and sedentary farmers, and both groups are highly self-sufficient and only partially integrated into a cash market economy. Cotton and peanuts have been the major international agricultural exports with cattle playing an important role in West African trade.

Ironically, for a region at the periphery of the world economy, the Sahelian countries are highly dependent. They are dependent on imported energy, technology, skilled personnel, foreign aid to meet investment and sometimes recurrent budget expenditures, outside markets for primary commodities, and the overall health of the economic system in more developed areas. Even food--primarily for urban areas--has been increasingly imported in recent years. The agricultural sector is heavily dependent on levels of rainfall occurring in general east-west belts which gradually decrease and taper off to nothing in the sands of the Sahara (see Figure III-1 in Chapter III). As in other traditional societies in arid and semi-arid environments, highly specialized nomadic pastoral and sedentary agricultural systems have evolved over time to minimize risk and

help insure survival under very harsh conditions. It is important to understand the nature and extent of these physical and economic dependencies because, in large measure, they define the parameters of the current problems of the Sahel and give some clues as to likely and possible evolutionary paths open to the region. Policy makers, no matter what their objectives but particularly those concerned with longer-run investment strategies, should attempt to take these factors into consideration to maximize their effectiveness. A description and interpretation of these patterns of Sahelian dependency, seen in a political economy framework, will be outlined in the following chapters to provide perspective for the more focused analysis which follows.

The vulnerability of Sahelian agricultural systems was dramatically demonstrated during the 1969-73 drought. During these years of abnormally insufficient rainfall, the magnitude of production shortfalls and degree of physical suffering varied substantially by sector and subregion of the Sahel. Overall, however, the consequences were grim. It has been estimated that up to 100,000 deaths could be directly attributed to these unusually severe conditions, occurring primarily among the most vulnerable, the very young, and old.[2] Perhaps one-fourth of the total livestock herd perished and cash crop exports fell drastically. The production of the primary staple food grains, millet and sorghum, was heavily affected. Total output of these grains, which had not increased as rapidly as population between 1960 and 1968, was off by a third or more

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[2]For a very clear assessment of drought impacts, see Caldwell [1975].

particularly in 1972 and 1973 although there was great variation in these shortfalls among subregions. Even though the 1974 crop season saw a return to more normal aggregate grain production levels across the Sahel, individual countries continue to be hampered by local grain shortages due to natural causes ranging from insufficient or poorly distributed rainfall, to flooding, as well as insect and rodent infestation. These local shortages (and surpluses), in ways typical to all agricultural systems, give rise to sharp fluctuation in marketed grain surpluses and in attendant food grain prices on both an intra- and inter-annual basis. In ways observed throughout history, these extreme supply and price movements carry with them the risks of consumer-led political instability and producer disincentive effects.

The institutional response to extreme and normal fluctuations in food grain supplies has been complex, attracting both praise and criticism. First, the governments of the Sahel states were often quite limited in their capacity to provide immediate emergency assistance to their own populations. Politically independent from France only since 1960, these governments are small, highly centralized institutions with very tenuous control over rural areas and often little positive impact on the economic and social life of the peasant population. Attempts of Sahelian governments to directly and indirectly exert a stabilizing influence on fragmented food grain markets through price policy and the direct actions of grain marketing boards have been largely unsuccessful to date.

Second, the bilateral and international aid community, once mobilized, provided significant amounts of grain and other food aid to the drought affected countries. From 1973 through 1975 alone

this aid had a value of over $400 million.[3] Given normal problems in aid and relief coordination and given inadequate food handling, storage and transportation infrastructure which necessitated the use of costly improvised logistics, the relief operations were judged quite effective. There were, however, instances in which donated grain was of a quality unfit for human consumption, in which supplies rotted on the docks in coastal countries or in mismanaged government warehouses or were diverted to black market channels for private gain. This type of problem and the high cost of using ad hoc distribution systems have reinforced the concern on the part of the Sahel governments and the donor community for increasing food production and stocks, improving food storage methods and implementing related food security strategies. The concern is both to diminish the need for future assistance by increasing the resistance of the Sahel to drought conditions and to improve the efficiency of distribution channels and facilities for relief purposes.

During the drought period a number of organizations were established to help channel relief assistance and begin planning for more substantial longer-run recovery and development projects, among them OSRO (the Office of Sahel Relief Operations) of the Food and Agriculture Organization (FAO), UNSO (the UN Special Sahel Office) and CILSS (the Permanent Interstate Committee for Drought Control). The latter organization, in response to donor offers of assistance, prepared initial lists of development projects in the six countries. This has led to the creation of a quasi-official grouping of

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[3] U.S. Agency for International Development [1976a].

bilateral and international donors and Sahel governments, the *Club des Amis du Sahel*, whose purpose is to coordinate and plan for substantially greater long-term development assistance to the region.[4]

In the past two years donor agencies have completed at least eight major studies of development strategies in the Sahel,[5] as well as numerous special sector studies. In one of the most ambitious studies, FAO assembled a hypothetical list of development investments totaling $7.6 billion over the next twenty years[6] and seen as necessary to meet the general objectives for the region agreed on by CILSS:

> Reduce the consequences of emergency situations in the future, insure self-sufficiency in staple foods (cereals and meat), and accelerate economic and social development, particularly in the least developed countries of the region.[7]

All of these studies have made reference to the positive role food grain stocks could play in the economic transformation of the region but provide very little systematic, detailed analysis of the subject.

Concurrently with the peak of the Sahelian drought, severely depleted grain stocks in North America and rising prices for petroleum-based inputs into food production technologies added to renewed world concern over the adequacy of food supplies. As one response to these circumstances, the constitution of food grain

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[4]See Shear [1976] for a description of the history and objectives of the "Club".

[5]See IBRD [1975d]; MIT [1974]; OECD [1976]; SCET International, SEDES and ORSTOM [1976]; UN, FAO [1976a]; UN, SO [1974]; USAID [1975b]; and USAID [1976c].

[6]UN, FAO [1976a].

[7]USAID [1976c, p. 7].

reserves to be held internationally, regionally or nationally received considerable promotion and debate. In 1973, past FAO Director General Boerma proposed a system of nationally-held emergency reserves and this has remained the basic FAO position since then. The United States proposed a more international reserve system to the World Food Conference in 1974 stressing cost and risk sharing and open flows of crop production information. The size, location and net benefit incidence of alternative reserve systems has also commanded significant attention in the recent literature of agricultural economics.[8]

While little progress has been made on proposed international grain reserves, FAO through its new Food Security Assistance Programme has been quite active on the national level in third world countries with a program of food security evaluation studies[9] and within the past year has begun to help institute tightly run emergency food grain stocks in three of the Sahel countries, Mali, Upper Volta and Niger, and has engaged in some preliminary planning for the others. By 1976 all six countries had operational cereals marketing boards engaged in grain storage and various open market operations. All now employ food grain price controls, most involving fixed producer and consumer prices for sorghum, millet, maize and rice. In several cases attempts at grain market intervention have been pushed several steps further with the cereals marketing board or another arm of the central

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[8] See, for example, Eaton and Steele [1976]; Hillman, Johnson and Gray [1975]; Reutlinger [1976]; Rojko [1975]; Trezise [1976]; Van Teutum [1975]; and Walker and Sharples [1975].

[9] For two examples in Africa, see UN, FAO [1974a] and [1975a].

government being given theoretical monopoly marketing powers although they clearly do not have the means to fully exercise such powers. Many of these policies have yet to receive careful study or evaluation partially due to the sensitive political nature of agricultural marketing and price policy and partially because various factions have differing, yet often vaguely formulated, ideological views on the wisdom and propriety of government intervention in food grain markets.

Problem Definition and Study Objectives

The first order problem facing the Sahel is that food grain supplies are chronically or cyclically inadequate and unreliable to meet development needs. There are clearly numerous potential strategies or groups of strategies that could be employed in attempting to find a solution to this overarching condition.[10] Investment programs--to increase agricultural productivity through the self-sustained use of new technology, to increase total agricultural output through acreage expansion as a result of improved water and land management, or to expand the reach and depth of markets in primary products and consumer goods--all involve substantial periods of time to reach fruition. Investments in food grain stocks under appropriate complementary policies and management conditions offer the potential of contributing to food security and supply stability in the short run

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[10] R.H. Green [1975] provides a broader, yet succinct definition of what he calls the "paradigmal rural African problem". It "combines uncertain rainfall, mediocre soil, low unit value crops, scattered population, meagre input levels for both physical (e.g., seed, fertilizer) and knowledge (e.g., extension, new techniques) items, and resultant constant minimum level of cash income and recurrent near-famine conditions".

and can provide a strengthened base for further transformation of the agricultural sector. This is not an *either/or* situation; investments in holding food stocks complement and facilitate other productive investments regardless of the ultimate objective function of the society. Grain stocks are held by most societies at all levels of economic development; the crucial questions involve the functional roles of stocks and how their use is related to the overall political-economic evolution of a given society.

Failure to understand the possible functional roles of food stocks in a particular economic setting or attempts to transplant stock systems from one economic environment to another have resulted in costly failures which may, in fact, promote increased supply instability and maldistribution. We must make our investment choices carefully in an environment of extreme resource scarcity where human survival and well-being are at stake. It is in this light that the overall purpose of this study is to provide a pragmatic policy analysis of alternative roles for food grain stocks[11] as one part of the solution to the problems of aggregate food grain supply instability and more general underdevelopment of the Sahel.

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[11]Terminology in the area of food grain storage tends to be a bit imprecise, with the names of various types of "stocks" and "reserves" being used interchangeably. In this study *stocks* will be used instead of the more ambiguous *reserves* as the generic class with types of stocks named according to their principal functional purpose. Therefore, *emergency stocks* will refer to those stocks, held primarily by government bodies, to be used under specified rules to relieve "severe" food deficits, particularly where there is a risk of loss of life or severe malnutrition. *Buffer stocks* are those stocks, collectively held, whose functional role is to mitigate or "stabilize" fluctuations in supply (or price) whether on an intra-annual or inter-annual basis. I will also refer to *pipeline stocks*, those marketed grain supplies held by the private commercial sector for potentially stabilizing temporal arbitrage or potentially

To achieve this overall purpose this study has the following more specific objectives:

1. To outline a political-economy conceptual framework which provide insights into underdevelopment in the Sahel and which helps place policy alternatives in historical and socio-economic perspective (Chapters II and III)

2. To assess the quantitative dimensions of the Sahel food grain supply problem through the analysis of trends and variation in production, weather-production relationships, and longer-term patterns of food demand, particularly changes in consumption in urban areas (Chapter IV)

3. To describe private Sahelian food grain trade with particular attention to patterns in the marketing and storage of millet and sorghum (Chapter V)

4. To analyze, within the framework of Sahelian underdevelopment, government participation in food marketing and storage, particularly its holding emergency and buffer stocks (Chapter VI)

5. To review the structure and initial performance of the six Sahelian grain boards which are the focus of government market intervention (Chapter VII)

6. To explore in detail in a case study on Upper Volta the economic and institutional dimensions and practical problems associated with emergency and buffer stock programs (Chapter VIII)

7. To summarize the findings and implications for technical and material assistance to Sahelian grain stock actions and for further macro and micro level research needs (Chapter IX.

It would be helpful to the reader to understand that the analyses in this study focus on different levels and aspects of an interrelated socio-economic system over different time periods. The analysis of Sahelian underdevelopment in the first few chapters

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destabilizing speculation, and to *farm-level stocks*, those stocks held by rural production units, the "compound" or extended farm family, and used for a variety of purposes but principally home consumption. Clearly these labels are arbitrary because the categories are not functionally distinct (e.g., emergency stocks can play a buffer role and buffer stocks may diminish the need for emergency stocks, etc.) and their use is not meant to conceptually prestructure the analysis which follows.

adopts a long term perspective in which system goals and basic socio-economic conditions evolve over time. This general political-economic framework plus the specific chapters on Sahelian grain production, consumption and trade provide background and insights into the last four chapters which focus more narrowly on government participation in food grain marketing and storage. In these latter chapters the analysis is more limited in time and concentrates on the structure and performance of Sahelian grain boards and the practical institutional and economic policy options open to them in modifying their operations to more fully meet national policy objectives.

In summary, the component chapters of this study are complementary. The political-economy framework will be used to describe the current economic state of the Sahel. It thus provides the context for understanding the economic and institutional constraints which define "micro level" policy options in grain storage, a rationale for alternative grain storage policies which might not be fully considered on economic grounds alone, and suggested patterns of institutional and policy structures more consistent with underlying political and economic conditions and, thus, more likely than other patterns to foster the progressive structural transformation of Sahelian economies.

CHAPTER II

UNDERDEVELOPMENT IN THE SAHEL: A CONCEPTUAL FRAMEWORK

Introduction

In this chapter, I elaborate a conceptual framework for the analysis of underdevelopment in the Sahel which provides a context for the more restricted analysis of grain stock questions to be presented in subsequent chapters. A number of descriptive and analytical concepts, diverging somewhat from standard economic analysis, are introduced and developed in their Sahelian context.

The focus is on the resource base, international position, and economic-institutional viability of the Sahel countries today, how these factors evolved to their present state and the likely path of their future change. This will be done through the elaboration of a theory of structural systems dependency which incorporates selected observations and generalizations on Sahelian socio-economic life, most of which are widely accepted by those knowledgeable of the region.[1]

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[1]This elaboration of theory through the use of observable reality is in the tradition of historical or dialectical (dynamic) materialism. Materialism stresses that ideas, philosophies, etc., take form within the influence of (and are determined by) real material conditions. The dialectical (or dynamic) method, according to Gurley [1976, p. 18] makes the following assumptions:

To be useful this exercise must be capable of pragmatic applications; thus, it must be well grounded in the existing structural and institutional positions of the individual countries and of the region as a whole. This is particularly true given the very narrow range of realistic policy options open to Sahelian leaders.

Gerald Helleiner wisely points out that, "the essence of successful development policy is knowing what must be assumed constant during any particular period, what is truely variable."[2] In order to follow his prescription we need an analytical base which can provide an adequate description of basic socio-economic conditions and relationships and also give us some clues toward explaining the seemingly ironic situation whereby most foreign assistance in rural development in West Africa has been judged to have failed in achieving desired change while, at the same time, we can point to growing numbers of successful foreign instigated commercial ventures in the region. It must be able to demonstrate the key relationships between a successful food policy--which, it is safe to say, has eluded most West African states--and a successful general economic policy. Finally, we need an analytical system which can practically address specific development goals. R.H. Green, who has provided many years of pragmatic assistance to the Government of Tanzania, suggests a number of goals,

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"(1) all things are in constant change; (2) the ultimate source of the change is within the thing or process itself; (3) this source is the struggle of opposites, the contradiction, within each thing; (4) this struggle, at nodal points, brings about qualitative changes, or leaps, so that the thing is transformed into something else; and (5) practical-critical activity resolves the contradictions."

[2]Helleiner [1976, p. 14].

beginning with an explicit value preference for movement toward greater distributional equity, which I will adopt as a reasonable set with which to evaluate the applied usefulness of the analytical model to follow:

1. Attainment of a radically less unequal income distribution eliminating the most glaring urban/rural, educational level, and class anomalies;

2. Sustained progress toward ending absolute poverty in personal consumption capacity and access to public services;

3. An integrated assault on entrenched rural poverty;

4. Primary attention to identifying and meeting mass needs, including consumption goods and public services;

5. Attainment of a better balance between national and sectoral production and use structures;

6. Greater flexibility in resource use based on greater knowledge (itself the most flexible of resources) and a greater coherence between domestic supply (production) and demand (use);

7. A more defensible international economic position based on higher national economic integration and flexibility, providing greater power to secure less unequal bargains;

8. A ratio of domestic to foreign investments (in personnel, knowledge and finances) adequate to ensure effective national control is maintained.[3]

The analysis which follows makes use of the observations and analytical procedures of a number of noneconomic disciplines as well as various schools of thought within economics. They are called upon for the conceptual insight and richness of detail which they bring to the structural theory of domination/dependency. Depicting alternate theories in rigid terms so as to provide easy targets for academic demolition does not meet a reasonable criterion of practical utility.

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[3] R.H. Green [1975, pp. 117-118].

Neither a demonstration of the lack of relevance of neoclassical macro-economics for sub-Saharan Africa nor an analysis of Marx's failure to foresee peasant revolutions against world capitalism would have useful significance for the government officials charged with operating a Sahelian grain stock system.

A Political-Economy Model of Center-Periphery Domination and Dependency

The most striking feature of the international political-economic system is pervasive inequality in the distribution, control and ultimate consumption of human and physical resources. Since these levels of inequality clearly cannot be attributed simply to the distribution of physical wealth we must look to the dynamic interaction of various sectors or components of this international system for some explanation. It is assumed that various shifting alliances or coalitions of components in the system over time gain differential access to power and the derived benefits which result from domination over other components. Specifically, nation-states and subnational groups are in *center-periphery* domination and dependency hierarchies such that some states and subnational groups coexist in relations of *harmony of interest* and others in *conflict of interest*. It is the operation of these asymmetrical relationships which provides the dynamic (dialectical) drive or motor to the system as a whole.

What is proposed is a political-economy model of center-periphery domination which provides specific definition for terms such as "underdevelopment" and "dependency" and which hopefully provides an accurate and useful descriptive framework for the Sahel

as a component of a larger West African region, which in turn, is structurally integrated into the international system. Definitions and acknowledgement of historical origins are the first orders of business.

Model Definitions

A *political economy* model is one which includes as endogenous a range of political and social factors which are normally held to be outside, or exogenous to, more narrowly defined economic models. This is in the tradition of the classical political economy of Smith, Ricardo and Marx before the narrowing introduced by Austrian neo-classicists and the term is used largely as a warning that a wider range of variables is being explicitly employed.[4]

The terms *center* and *periphery* apply to groupings within the international economic system, particularly nation-states and sub-national population groups. Center and periphery are somewhat

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[4]There are, of course, many important implications which stem from this difference in approach. While beyond the scope of this study, it is possible to link these theoretical differences to significant divergence in underlying value theory and to elaborate the theoretical havoc introduced into neo-classical economic theory through modification of assumptions such as the exogenous determination of demand. Dobb [1973, p. 25] pointed up the implications of the clear non-neutrality of economic theory stressing that:

> "The form and angle of generalization, according to what it selects for emphasis and what it casts into shadow, cannot be held without influence, not only upon human attitudes and beliefs, and hence upon social activity (e.g., whether 'social engineering' is attempted or radical institutional change), but upon the intellectual diagnosis of particular social and economic problems."

We will see later on, for example, the difficulty of applying conventional theory dominated by "exogenously determined demand" (i.e., "producing for the market") to the traditional Sahelian rural economy where peasants are producing for use (subsistence) rather than for the market.

arbitrary groupings useful for theoretical simplification and model application. As such they may range from discrete bivariate groupings (i.e., all nations or all population groups within a nation combined into two groups) to a continuous function ranging from most central to most peripheral. The terms are useful because they connote two variables important to the development of the model, the idea of domination and the idea of this process occurring over space. The normal meaning of *domination*, a disproportionate directed flow of determining or guiding influence among units, is employed here. The model here is a sub-type of *dominance systems* which can be elaborated in personal or international terms.

Two of the descriptive terms which stem from the center-periphery analysis are the related ideas of underdevelopment and dependency. *Underdevelopment* represents two things: (1) the conventional description of the less materially advanced, more powerless countries or subnational groups within a country, and (2) the idea that underdevelopment is a product or state in system interaction. This means that integration into the larger system implies change from a traditional, isolated society (or *un*development as A.G. Hopkins suggests)[5] to an underdeveloped position within the larger system and, further, it represents a shift in thinking from the conventional view that underdevelopment is a stage on a unidirectional path toward attainable development. As Alain de Janvry puts it:

> Underdevelopment cannot be treated apart from development if backward areas or countries are related by the market to the advanced areas or countries. In fact, within the world capitalist system, a theory of underdevelopment and rural poverty

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[5]A.G. Hopkins [1976, p. 32].

> needs to be a theory of economic space which can explain how the contradictions of development in certain areas transform, in other areas, traditional societies into underdeveloped ones.[6]

This does not preclude the movement of individual peripheral groups or states toward more central or developed (dominant) positions but it does imply that the continued stratification of groups and states is a precondition for system maintenance. *Dependence* refers to that set of subordinate model interaction relationships which apply to the peripheral groups and states within the system. Detailed examples of dependent relationships in West Africa will be presented below as well as several further definitions as part of the specification of the model. Underdevelopment is descriptive of the *state* of the periphery; dependence refers more to the *process* of interaction between the periphery and the center.

Historical Note on the Center-Periphery Model

The use of the center-periphery terminology and some of its specific ideas have their modern origins in the work of Raul Prebisch who employed them in the context of Latin America.[7] These ideas were further developed by writers such as Frank and Cardoso and the work of de Janvry[8] represents a comprehensive review and updating of the Latin American case. It is important to note that the model must

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[6] Alain de Janvry [1975, p. 490].

[7] United Nations, Economic Commission for Latin America (ECLA) [1951]. An interesting statistical updating and elaboration is contained in Anibal Pinto and Jan Knakal [1973, pp. 34-89].

[8] Frank [1967], Cardoso [1972] and de Janvry [1975]. A review of the Latin American "dependency literature" is contained in Chilcote [1974].

be specified for different parts of the underdeveloped world given the widely differing ecological, demographic and institutional patterns which prevail across these regions. For example, the extensive concern in Latin America with land tenure arrangements and the existence of *Latifundia* is not relevant in West Africa with the exception of the plantation areas of a few coastal countries such as Liberia and the Ivory Coast. There are, however, close similarities between the land tenure problems in many Latin American and other African countires such as Ethiopia.

For West Africa the exploration of the center-periphery model has been dominated by Samir Amin and his followers.[9] Much of the work in East Africa has centered on and been conducted in Tanzania or the former East African Community.[10] All of these works stress adaptation of center-periphery ideas to the particular historical, resource, demographic, political, and economic patterns of various parts of the African continent.

The general model presented in this chapter draws heavily on the work of Johan Galtung, Norwegian conflict theorist.[11] His

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[9]Among his many publications, see particularly Amin [1970, 1972 and 1973], a very useful series of case studies he edited [Amin, 1975] and one of his most recent works [Amin, 1976].

[10]See, for example, Green [1975], Brett [1973] and Cliffe and Saul [1973].

[11]Galtung [1972]. His neutral use of the term "imperialism" applied to the center periphery domination system will not be followed here due to the impossibility of its dissociation from overwhelming ideological connotations. Galtung, while demonstrating the neutrality of the domination pattern, fully acknowledges his indebtedness to Lenin for major ideas incorporated into the model structure. See Lenin [1967] and Gurley [1976] for a very lucid overview of Lenin's work.

presentation has been the clearest and most ideologically neutral, stressing that the domination patterns explored apply, with some modifications, to socialist as well as capitalist variants.

Definition of Center-Periphery Domination

In its most general statement, center-periphery domination is "a system that splits up collectivities and relates some of the parts to each other in harmony of interest, and other parts in relations of. . . conflict of interest."[12] Conflict of interest can occur when there is a gap in the "real interests" of system components. These real interests can be summarized as *living conditions* (LC) which can be made up of indicators such as income, material standard of living as well as by notions such as quality of life, independence, etc. There is *conflict of interest* when system components are coupled together such that the *LC gap is increasing;* there is no conflict, or *harmony of interest*, when the components are interacting in such a way that the *LC gap is decreasing.*[13]

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[12]Galtung [1972, p. 94].

[13]Galtung immediately adds a number of cautionary notes and qualifications to this very simple schema. First, system components must interact in order for there to be a conflict of interest. Second, the theory, at this level, describes conflict of interest (not *goals*) among system components (not individual actors). Third, he notes the logical problem of a constant LC gap and states that this could represent a conflict if wide enough. Fourth, the LC gap has two dimensions, its initial absolute width and whether it is decreasing or increasing. This permits more detailed theoretical presentations to talk about *degrees* of conflict and harmony of interest, *static views* of absolute gaps at various points in time and the more important *dynamic changes* in the LC gap over time. Fifth, a value preference for equality is internalized in the model since a system *interaction* structure which increases the LC gap (creates more inequality) is not in the interest of the weaker party.

Using these building blocks the simple case of a two nation system can be defined. A domination system

> . . . is a relation between a Center and a Periphery nation so that (1) there is harmony of interest between the center (group) in the Center nation and the center (group) in the Periphery nation; (2) there is more conflict of interest within the Periphery nation than within the Center nation; and (3) there is conflict of interest between the periphery (group) in the Center nation and the periphery (group) in the Periphery nation.[14]

This simple two nation case can be represented diagramatically which reveals further assumed elements of system composition and interaction. Figure II-1 represents this case and summarizes a number of important points:

1. The center socio-economic group of the Center is linked to the center socio-economic group of the Periphery through a harmony of interest.

2. There is a conflict of interest within each of the two nations. We assume that the LC gap even in the Center nation is, at best, constant.

3. A key point is that there is more conflict of interest in the Periphery nation (dotted line within circle) represented by a wide and increasing LC gap,[15] than in the Center nation where redistribution measures keep the LC gap approximately constant.

4. There is structural conflict of interest between the two Periphery socio-economic groups (dotted line).

5. The center of the Center grows faster (larger area on circle) than the center of the Periphery which serves as a conveyor belt for a net transfer of resources.

6. Alliance formation is avoided between the two peripheries as the Center nation becomes more cohesive and the Periphery nation less so.

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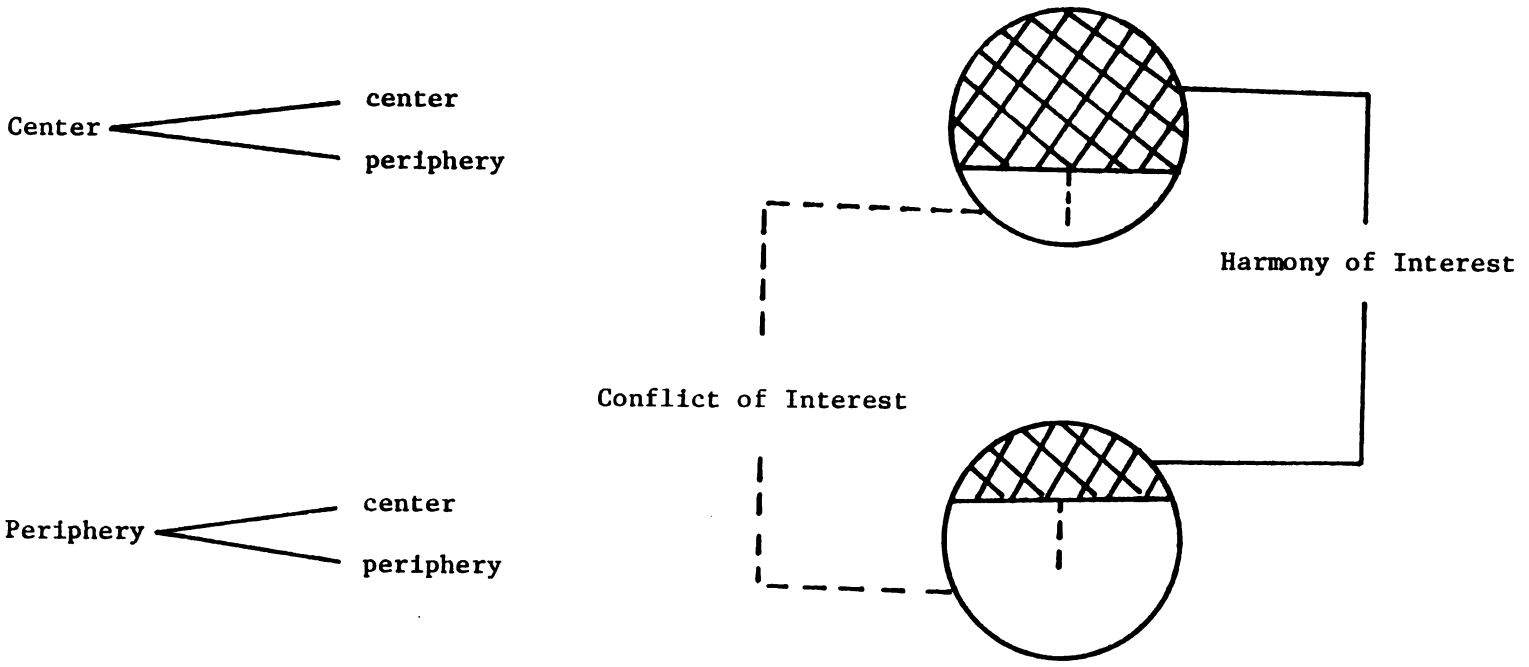
[14] Galtung [1972, p. 97].

[15] Irma Adelman and Cynthia Morris [1973] provide very convincing evidence for this assertion in their multinational statistical study, Economic Growth and Social Equity in Developing Countries.



SOURCE: Galtung [1972, p. 97].

FIGURE II-1

THE BASIC STRUCTURE OF CENTER PERIPHERY DOMINATION

7. There is, therefore, a net conflict of interest between the two nations (not represented) which is often referred to, but this should not obscure the basic fact that center-periphery domination is a combination of *intra-* and *inter-national* relations. The "bridgehead" relationship between the two centers with a communality of interest is necessary, by definition, for the operation of the model.

Mechanisms of Domination

Galtung proposes two general mechanisms by which the Center dominates the Periphery and which also apply to intra-national relationships. The first is the *vertical interaction relationship* in which vertical international exchange is considered to be unequal if the interaction is cummulatively asymmetric in terms of what the two parties get out of it. There are two indicators which can be used to examine the symmetry or equality of system vertical exchange; they are inter-component effects and intra-component effects. This is illustrated in the case of economic interaction between two nations (components) in an international interaction "budget", shown in Figure II-2. In this example, "Underdeveloped B" is exporting raw materials in return for manufactured goods from "Developed A". Because we are examining both inter- and intra-national effects we can see that, even if the terms of trade between raw materials and goods were equal and the negative by-products (pollution, depletion, internal exploitation) could be considered equivalent for the two nations, the overall relationship is still asymmetric since A gains positive benefits from spin-off or multiplicative industrial or technological development while B gains few equivalent benefits from its importation of manufactured goods. This tendency is visible in many actual trade relationships. First, there is the omnipresent *gap*

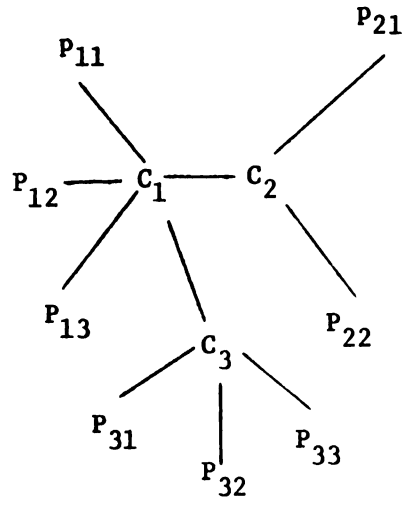
Direction/State	A: Developed Nations		B: Underdeveloped Nations	
	Inter-national Effects (Flows)	Intra-national Effects	Inter-national Effects (Flows)	Intra-national Effects
In/Positive	Raw Materials	Industrial Development	Manufactured Goods	Little or Nothing
Out/Negative	Manufactured Goods	Pollution, Exploitation	Raw Materials	Depletion, Exploitation

FIGURE II-2

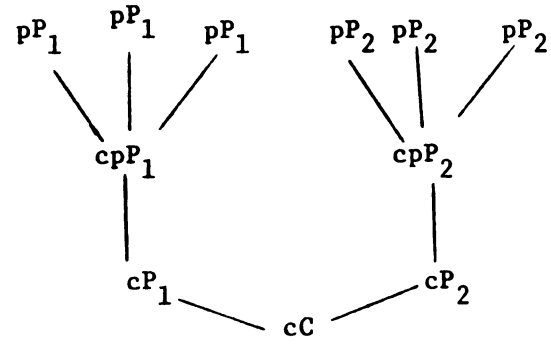
AN INTERNATIONAL INTERACTION BUDGET

in levels of product transformation with more advanced countries generally performing the higher levels of transformation. Secondly, since LDC economies, by definition, are less functionally integrated, they would, in general, benefit from a lower growth multiplier effect from imports. As we will see, these conditions certainly hold for Sahelian and West African trade patterns.

The second mechanism of domination is the *feudal interaction structure*. This is a general principle by which boundaries, barriers, institutions, geography, transportation patterns, etc., tend to structurally restrict and channel system interaction into limited hierarchical patterns. Very crudely put, these patterns tend to promote inequality through the structural functioning of the principle of "divide and rule". This can be illustrated in the diagrams in Figure II-3. Type A represents, for example, the general relationship between three colonial metropoles and their captive peripheral countries. This relationship is characterized by vertical relationships between the Centers and their Peripheries, a lack of direct interaction among the Peripheries linked to one Center and among all the Peripheries, and only indirect Periphery interaction with other Centers and Peripheries by way of respective Centers. (This, in an overly simplistic way, could represent the historical interaction of French, German and English colonies in West Africa.) Type B could be thought of as representing the classical dendritic marketing and transportation patterns which existed in colonial West Africa. Areas of primary product production in two colonial areas (the p^{P}_{1} and p^{P}_{2}) are linked by largely independent channels to the colonial metropole (cC) through regional market towns



Type A



Type B

FIGURE II-3

FEUDAL CENTER-PERIPHERY INTERACTION STRUCTURES

(cpP_1 and cpP_2) and the coastal capitals of the two areas (cP_1, cP_2). Trade flows primarily along the lines indicated and monopoly profits are derived from their control.[16] Some of the most striking examples of dependency relationships incorporate these feudal interaction structures. For an underdeveloped economy we often point to concentration of trade partners in import and export markets and commodity concentrations (e.g., an export economy comprised of one or two primary products). One can make a fairly plausible argument that capital accumulation in a transitional society involves the dynamic interaction of this type of structural rigidity and the operation of relatively free markets within vertical interaction relationships. In this conception, as in neo-classical theory, markets are relatively neutral exchange mechanisms whose role and purpose is defined by the structures and interaction relationships by which they are integrated into an overall system.

Two final points concerning these mechanisms of domination. First, it should be explicitly stated, if not already intuitively obvious, that they operate within nation-states as well as among them. The growing urban government class in West African countries has used both of these mechanisms plus its control over an imported system of new property rights and institutions for systematic expansion and enhancement of its position as the center of the Periphery. Michael Cohen provides a detailed description of this process at work in

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[16]Carol A. Smith [1976] provides a very good introduction to the analysis of this type of system and the descriptively useful study of central place theory.

Abidjan, one of West Africa's most dependent and fastest growing "boom-towns".[17]

Secondly, the combined operation of these two mechanisms builds into the system what Galtung calls "a subtle grid of protection measures against the major potential source of 'trouble' [i.e., system dysfunction], the periphery of the Periphery."[18] As we have seen this part of the system is the most disadvantaged by the process of unequal exchange and is structurally and functionally maintained in this state of powerlessness, disorganization and absolute poverty through the operation of the two mechanisms. This can be termed "structural violence" and the degree to which it is effective obviates the need for the Center to employ direct violence to maintain the system. In addition we may also point to the internal effects in the Center of rapid growth and increasing industrial and economic concentration (e.g., environmental pollution, unemployment, "stagflation", urban decay and citizen malaise) as being additional undesirable consequences of participation in this interdependent Center-Periphery system.

Types of Center-Periphery Domination and Dependency

The general interaction model presented so far can now be broadened by specifying *types* of Center-Periphery exchange. Galtung suggests a number which will be briefly discussed as dependency relationships. These groupings are not ordered by importance

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[17] Cohen [1974].

[18] Galtung [1972, p. 108].

or magnitude[19] and are clearly arbitrary due to a high degree of overlap and inter-type interaction but are quite satisfactory for brief West African illustration.

Economic Dependence

This type of interaction has been illustrated above and will be covered in greater detail for the Sahel in the next chapter. At this point it will suffice to offer a few summary generalizations about system economic interaction and dependency.

1. We have seen that basic economic exchange involves trade across "gaps" in levels of product processing with the Periphery exporting raw materials and labor-intensive primary agricultural products with the Center providing higher level processing (generally with greater "value added"), sophisticated manufactured goods, technology and investment capital.

2. Extracted raw materials usually flow along feudal, dendritic paths through coastal enclaves and, thus, have almost no direct economic interaction effects. Even employment impacts are limited due to the common use of highly capital-intensive extraction technologies.

3. In more realistic and complex presentations of the model, we can include a layer of Periphery import substitution industries, particularly in more advanced Peripheral countries, such as Senegal, the Ivory Coast and Nigeria in West Africa. It has been convincingly shown that these industries can lead to greater dependence due to the fact that they:

    a. Often make heavy use of imported capital, factor-distorting technology and even raw materials (e.g., Upper

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[19] In some presentations of the Center-Periphery model, particularly Marxist versions, there is strong insistence on the primacy of economic relationships in driving the model. While it is true that system transformation stems from evolution in broadly conceived relations of production and not from abstract concepts originating in the "super-structure", overly rigid, non-dialectical attempts to find narrowly-defined, preconceived theoretical relationships in operation can lead to untenable arguments and somewhat nonsensical ideological battles. At this level of abstraction, we can assume that the immediate impetus to system transformation or maintenance can come from relationships described by any one of the following types of Center-Periphery dependency.

Volta's Bata shoe factory makes cheap shoes from imported plastic rather than use abundant local leather. Even more importantly, the factory absorbed scarce local investment capital and had negative employment effects through the destruction of the local, labor-intensive shoe industry);[20]

b. Have limited "spread" or linkage effects due to (1) lack of overall modern economic integration in the Periphery and (2) the nature of the products produced, classically, simple consumer items such as bottled drinks, matches, soap, cooking oil, plastic shoes, flashlight batteries, etc., or the output of "paint, polish and package" industries which use cheap labor to assemble imported goods such as motorbikes and bicycles; and

c. Are hampered by narrow domestic markets. High levels of unemployment and underemployment, coupled with a stagnant agricultural sector, limit demand for local industrial production causing substitution industries to often operate at very low percentages of capacity.

4. Exchange is characteristically asymmetric or unequal both internationally and domestically. In many historical periods international *barter terms of trade* move consistently against the Periphery. When more complex indicators are used, (e.g., *single or double factorial terms of trade*), we see even greater distortions due to high increases in labor productivity in the Center compared to largely stagnant productivity in Periphery primary product export production (e.g., small holder peanut and cotton production in the Sahel, with the technological change being introduced--animal traction, fertilizer, improved seeds, credit, etc.--often having further significant negative distributional effects). Additionally, and of equal importance in the model we have outlined, *domestic terms of trade* move strongly against the majority agricultural sector, confirming the model's assumption of the relative (and often absolute) impoverishment of the periphery of the Periphery. This trend, which will be demonstrated below for the Sahel, illustrates one type of differential intra-national trade effect between Center and Periphery which results in the relatively positive "labor incorporation" in the former and negative "labor marginalization" (impoverishment)[21] in the latter. In sum, in the principle of unequal exchange for the LDC, causality involves sequential or simultaneous coercive deterioration of

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[20]Many similar conclusions can be drawn from the important micro-level work on small-scale industries in Sierra Leone reported by Chuta and Liedholm [1976].

[21]See de Janvry [1975] for a fuller discussion of these concepts and terms.

external terms of trade (facilitated by Center control over feudal interaction structures and market conditions) and generation and maintenance of low real wage rates in the periphery.

Political Dependence

In the West African colonial period the Center or metropole directly controlled system political relationships; in 1960, the era of "political independence" began when nominal political sovereignty was granted. In terms of the structural model, indirect control or political dependence occurs since Center nations are the source of many political and administrative models, procedures and decisions; Periphery nations supply at least some acceptance and application of these models and procedures and obedience to decisions. It should be stressed, again, that dependent decisions may often be made jointly by the two center groups and applied to the periphery of the Periphery. Indicators of West African political dependence can be seen in patterns of voting in international organizations and in government reliance on capital transfers for administrative investment and often to cover large portions of recurrent expenditures. It is clear that there is a loss of political independence which accompanies this type of budget support and related reliance on foreign expertise to fill key manpower positions.

The internal political systems of West African countries, like those of other national participants in the interaction system, are also characterized by dependency. A new area of study in the "politics of underdevelopment" is that of "patron-client relationships",

which are, in essence, inter-group and inter-personal political feudal interaction structures.[22]

Military dependence is a subset of political dependence. This is a fairly obvious structure which has some francophone West African governments heavily dependent on France for defense guarantees, weapons, training, skilled manpower (many military aircraft in the Sahel are flown by French pilots), and, until quite recently, large numbers of French troops. Major garrisons were maintained in Niger and Chad until 1974 with significant counterinsurgency activities taking place in Northern Chad. The Ivory Coast is today the base for the largest numbers of French military in the region today.

Cultural Dependence

Cultural dependence is a final, related type which also needs little elaboration. The center of the Periphery uses the Center's language, is educated by its teachers and universities, reads its books and sees its films. Galtung sarcastically notes a variant of this pattern in the vertical division of labor in science where

> . . . scientific teams from the Center go to the Periphery nations to collect data (raw material) in the form of deposits, sediments, flora, fauna, archaeological findings, attitudes, behavioral patterns, and so on for data processing, data analysis, and theory formation (processing, in general) in the Center universities (factories), so as to be able to send a finished product, a journal, a book (manufactured goods) back for consumption in the center of the Periphery--often first having created a demand for it through demonstration effect, training in the Center country, and some low level participation in the data collection team.[23]

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[22]See, for example, LeMarchand [1972].

[23]Galtung [1972, p. 112].

Communications dependence, a subset of cultural dependence, exists in two basic forms where feudal interaction patterns are of obvious significance. First, international and domestic transportation networks are largely vertical in character, employ hierarchies of Center technology and run on Center fuels. International air routes provide many more Center-Periphery vertical linkages than they do Periphery-Periphery horizontal ones, just as railroads and roads inherited from colonial times run in parallel patterns from the coast to the interior with many fewer integrating horizontal linkages. Second, other forms of communications such as telephone and news dissemination services are dominated by the Center. Dependency exists when a phone call from the Ivory Coast to neighboring Ghana must be routed by way of Paris and London. Dependency in news flows is illustrated by the fact that Center news gets much more coverage in the Periphery than Periphery news (except the sensational) gets in the Center.

Historical Phases in the Center-Periphery Model in West Africa

The system embodied in this model, like others with roots in current and historical phenomena, has a strong implicit time dimension and is assumed to evolve over time both in complexity and in the possible structure of its interaction mechanisms. Galtung suggests that this evolution can be seen most clearly in changes in the patterns which link two centers together. Somewhat simplistically he proposes three phases in the evolution of the domination system: (1) a period of *colonialism* in which the center of the Periphery is composed essentially of personnel from the Center nation itself;

(2) *neo-colonialism* in which nominal political independence is granted which means that a small center in the Periphery is constituted locally, related in harmony of interest to the center of the Center, with indirect control relationships among system components, facilitated through a series of international organizations; and (3) he proposes a future pattern, *neo-neo-colonialism*, in which the role of international organizations will diminish to be increasingly replaced by a fuller, integrated network of more flexible, direct communication linkages between business and government components in the entire system. These changes are facilitated through growth in the level of system activity and integration at all levels and rapid improvements in the speed of transportation and communications.

From a similar but more Marxian perspective Samir Amin has grouped historical Center-Periphery relationships in West Africa into four rough periods (five including the current neo-colonial phase).

Pre-mercantilist

Before 1600 or so international trade with West Africa was largely by way of interior trans-Saharan trade routes which carried high-value, scarce and luxury items. This pre-mercantilist period is evaluated by most economic historians as providing West Africa with more net equality in trade effects than later periods.[24]

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[24]For a good summary of historical evidence for this period see A.G. Hopkins [1973]. Hopkins in another article already cited [1976, p. 38] contends that the Center-Periphery analysis does not apply too well to African history prior to the slave trade which is in complete agreement with model conditions that a sufficient level of interaction must take place between two areas across a major gap in technology. For further discussion along these lines see E.A. Alpero [1973].

Mercantilist

Covering roughly the 1600s and 1700s, the mercantilist period saw a number of simultaneous developments in the growing international system. Feudalism was declining in the Center (Europe) with the rise of domestic capitalistic production. This process demanded and fed an accumulation of wealth, much of it from the Periphery (primitive accumulation) which was provided by mercantilist trade relationships engendered by improvements in sailing technology and the aggressive conquest of the Americas. For Africa, this period was dominated by the slave trade and saw the rise of a coastal trading pattern and the decline of the Saharan trade. "Trade relationships" certainly deteriorated in favor of the Center in this period which saw the establishment of small coastal enclaves which promoted a "center of the Periphery" role for certain coastal ethnic groups to the detriment of their interior neighbors.

Capitalist Integration

In the 1800s, it is argued, mercantilist and slave-labor system components began to hinder the further growth of industrial capitalism in the Center and this led to their gradual elimination.[25] New levels of development in the Center demanded new roles for the Periphery. For West Africa this meant an expansion of colonial enclave activities but primarily meant the use of existing and new African institutions and social structures (some of which had been established during the slave trade) to promote the production of raw materials and agricultural primary products which could be used

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[25]See, for example, Williams [1964].

to increase the Center's aggregate return on domestically invested industrial capital. We have already seen the pattern of unequal exchange between manufactured goods and these primary products. Geographical areas of influence of different Center nations gradually solidified with the increasing domination of exchange by monopoly trading companies and an erosion of free trade favored by the economically dominant British.

Global Domination

The colonial era in West Africa began around 1900 when three Center nations rapidly partitioned the region in response to the initiative of the French who, as a second class capitalist power, had more to gain by restricting free trade and formally imposing a more rigid, territorially-based feudal interaction structure. Moving from an indirect system to one of direct administrative and commercial control of the Periphery increased the efficiency of, what is termed in French, "l'économie de traite". The definition of this term, poorly translated as the "trading economy", conforms to the structural unequal exchange elements of the basic model. The introduction of money taxation helped force peasants to produce the primary products desired for export by the large colonial commercial houses which gained increasing monopoly control, largely at the expense of indigenous African traders.[26] The colonial interests

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[26]By the 1930s, three large European firms, U.A.C., C.F.A.O. and S.C.O.A. (United African Company, Compagnie Francaise de l'Afrique Occidentale, Société Commerciale de l'Ouest Africain) controlled over one-half of West Africa's overseas trade. Similarly, West African shipping was largely controlled by four firms, one British, two French and one German (Elder, Dempster and Co.; Chargeurs Reunis; Fabre et Fraissinet; and the Woermann Line);

generally employed Lebanese as intermediate traders and also relied in some areas on indigenous groups such as the Islamic Mourides of Senegal. In areas where such local groups could not be relied on to engage in cash crop "marketing and extension" activities (and in most areas as colonial control tightened) these functions were taken over, in French-speaking areas, by *sociétés d'intervention* which provided inputs, technical advice and often the entire crop evacuation market structure.[27] Many of these companies have been nationalized or replaced by government boards since independence but their structural roles have not evolved greatly.

This "trading economy" has had two major variants in West Africa, both of which have been important to the Sahel countries. First, a plantation pattern has been common in the coastal countries from Liberia through Nigeria with private, corporate and state models using wage labor to produce oil palm, coffee, cocoa, and, more recently, rubber, and fruit (such as pineapples and bananas) for export. They are important to the Sahel primarily because that region has provided a large share of the migrant labor to the coastal countries. The second pattern is that of small holder, communal tenure, dry-land agriculture which characterizes the Savannah belt which undergirds the Sahel region. These two patterns persist today and development assistance program and project planning should take them into account.

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banking was dominated by two giants, the Bank of British West Africa and the Banque de l'Afrique Occidentale [Hopkins, 1973, pp. 199-200].

[27]In the Sahel the most visible of these sociétés was the CFDT, the Compagnie Francaise de Développement de Fibres Textiles.

Model Refinements

As the discussion to this point illustrates, the basic two nation, four group structural model can illuminate basic interaction mechanisms and structures but needs to be broadened as it is applied to any given historical and regional setting.

Further, it is clear that any system, as it evolves in complexity over time, will develop further specialization in form and function with new intermediate levels often playing critical roles in subsequent system modifications. This can be illustrated in two areas. First, in addition to noting that the Center in our case is made up of a complex coalition of European and North American countries with France still in the leading position, we have seen that several countries in West Africa (e.g., the Ivory Coast and Nigeria) will probably expand their emerging roles as intermediates in the Center-Periphery structure. This would push the core Sahel countries into what Barbara Ward has called the "fourth world" and illustrates a level of Periphery nations called "go-between" by Galtung, "sub-imperial" by Amin and "semi-peripheral" by Immanuel Wallerstein, who strongly suggests that their creation is necessary and inevitable in the dynamic survival of the overall system as it reacts to changing patterns in factor mobility, relative resource prices, transportation costs and shifting political-economic conditions.[28]

Second, this principle also applies to intra-national (or class) relationships with two groups often not sufficient to represent key interactions. This is well illustrated in our examples of the West

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[28]Ward [1974], Galtung [1972, pp. 129-131], Amin [1972], Wallerstein [1974, pp. 1-26].

African colonial center of the Periphery dealing with peasant producers by way of a third group, Lebanese traders or some form of traditional religious or political hierarchical structure. However, even incorporating these and other refinements, it is important to stress that in situations of underdevelopment in the world economy, the basic mechanisms of unequal exchange and dependency still animate the system.

Comparison with Other Development Models

The Center-Periphery model provides one method of examining a wide range of political and economic relationships over time which will hopefully contribute to an understanding of at least a part of the functioning of the West African system. Other macro-level approaches and certainly many micro-level research efforts will provide additional valuable insights into system structure and functioning.

It should be obvious to those familiar with the literature of economic development that there are both similarities and differences between the Center-Periphery model and more conventional neo-classical labor surplus, dual economy models as developed by Lewis, Fei-Ranis, Jorgensen and others. Dual economy models are based on observations of the same differential development patterns within LDCs but foreign trade and the relative internal effects in developed and underdeveloped countries are generally given very little attention. Byerlee and Eicher review the contents and relative contributions of a wide range of development theories and assess the degree to which they apply to African conditions and to which they have

been emprically verified.[29] It is clear that the center-periphery model is broader in the scope of its variable inclusion and the length of its implicit time horizon than most of the conventional theories.

In conventional development theories based on the principle variables of concern in neo-classical economics, the dual economy nature of the LDC economy is analyzed in partial-equilibrium terms which produces policy recommendations which may serve to blunt the worst structural excesses in order to permit the overall system to function more smoothly.

Hollis Chenery points to some of the differences in the two theoretical approaches when he contends that:

> . . . the neoclassical framework minimizes the effects of specific rigidities (i.e., the "vertical integration and feudal interaction structures" as I have presented them) in the economic system, while the input-output system (his shorthand for structuralist alternatives) tends to exaggerate them . . ."

and further he correctly emphasizes that,

> . . . the structuralist concept of development as characterized by rigidities that limit economic adjustments (i.e., market price adjustments) requires an analytical framework in which external policy is more closely linked to domestic resource allocation than does the neoclassical view, which minimizes these restrictions.[30]

What is important to add is that within a more general structuralist framework as elaborated here we can analyze "pockets" of market activity which exist at various levels and in various geographical locations in the Center-Periphery system. This will be explored more in later chapters of this study.

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[29] Byerlee and Eicher [1972].

[30] Chenery [1975, pp. 310-316].

Much of the real testing and adaptation of alternative development theories depends on the accumulation of micro-level data and analyses. Much of what has been advanced here can be successfully subjected to the growing body of empirical evidence from anthropological and micro-economic research efforts in West Africa. In later chapters, I will draw on the results of micro-level studies in various Sahelian countries and particularly on results from studies in Northern Nigeria which are perhaps the most wide-ranging and important yet conducted in West Africa.[31] Similarly many of the conclusions of approximately five years of micro-research in various parts of West Africa under the African Rural Economy Program can be seen as supportive of theoretical conclusions drawn here.[32] As was stressed in the beginning of this chapter, the development of useful macro-level theories of rural development and the growing understanding of the micro-level functioning of West African rural socio-economies are necessarily complementary activities.

Implications of the Center-Periphery Model for Alternative Development Strategies

To this point, the Center-Periphery model, which has been briefly outlined and contrasted with alternative models, can be considered a description of past and current observable reality. As such, it may be judged on two grounds, breadth of content (are all important system variables included?) and synthetic coherence (does it all

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[31] See Norman [1973] for a good introduction to this important program of micro-economic studies.

[32] The major conclusions of this program of research are contained in Byerlee, et al. [1977].

hang together?). From here, the rest of this study has two objectives: (1) to delve into greater detail as this logical framework is applied to observations of the interdependent system's "near past" and present, focusing on one sub-sector, food grain production and distribution, and (2) to project into the "near future" the consequences for this sub-sector of two possible alternative evolutionary paths for the larger system. Most of the effort will be concentrated on the first task since it is there that we have our "data" and observations and since the second is more perilous and subjective. The second task must, however, be undertaken particularly if we are going to engage in policy-oriented recommendations. Therefore, just as a knowledge of the past helps understand the present, a description of alternative futures may help sort out consequences and options for one policy area in the near future.

Two additional preliminary comments are in order before we proceed. First, this is a difficult task because it involves tracing linkages between various levels of an interconnected system. The Center-Periphery model has been presented at a very high level of aggregation; it is now necessary to go from this macro-level with a fairly long implicit time horizon to more micro-level sub-sectors with shorter time horizons. This is a process which is necessarily both arbitrary and complex. It is arbitrary because we must be selective in our choice of areas to explore and we will be successful in this to the extent we are adept in knowing what to "hold constant" and what to "vary". It is complex because we must either explicitly account for a great number of variables at different levels of analysis ("hold them constant") while watching interaction among a few

or we must use complicated procedures for allowing the greatest number of variables to interact concurrently. In a sense, we must pilot our ship between the shoals of historical reductionism and the brooding monster of mechanistic methodology.

Second, in drawing linkages between the macro- and micro-levels of this venture some chapters will have more of a "vertical", integrating function to their analysis and description and others will concentrate on the elaboration of greater "horizontal" analytical and descriptive detail. Thus, in addition to this current chapter, the former, integrative function will be served more by Chapter III, which applies the Center-Periphery model to Sahelian economies, by Chapter V in which traditional private grain trade and storage is examined; by Chapter VI, which focuses on conceptual, analytical and applied policy issues in the constitution and operation of Sahelian grain stocks; and by Chapter IX, summary conclusions and policy recommendations. Chapters IV, VII, and VIII respectively explore in greater "horizontal" detail current trends in Sahelian grain consumption and production, government actions in grain marketing, grain market institution building, and the specific operation of current and proposed emergency buffer grain stocks in Upper Volta.

Beginning with the Center-Periphery analysis of the current political-economic system, we may attempt to elaborate reasonable alternative paths to the *structural transformation* (or "development") of the Sahel, a major part of the West African Periphery. As in any historical system which evolves dialectically, the seeds of alternative future paths exist, often in confusing and contradictory

forms, within the current system. This is a necessary condition if social systems are to evolve as the product of the interaction of physical and historical environmental factors with the products of man's efforts and free will. A natural dichotomy in the principle variable in the Center-Periphery analysis, the degree of *system dependency* (as defined earlier in this chapter), is used to describe two models whose differences are sharply exaggerated at the macro-level so that it will be possible to trace linkages, through intervening layers of the sytem, to observable differences in policy application at the micro-level in food grain security programs. As we will see in Chapter VIII actual policy application deals in the grey areas and the contradictory forces between the two extreme model types. An advantage of this approach is that it *highlights system contradictions* which can help avoid policy actions which are structurally and functionally predestined to failure.

The elaboration of these alternative models and strategies to promote them as presented simply in Figure II-4, is clearly a task far beyond the scope of this study. However, we may achieve a somewhat less precise but still useable picture if we use both historical and comparative, cross-national examples to illustrate some of the likely characteristics of the two evolutionary paths. We also note that it is possible to differentiate among *intermediate cases and strategies* along some of the variables which are analyzed in this brief attempt. This can be done most expeditiously by comparing the probable states of different types of system variables--at different levels of aggregation, which is done in Figure II-5 which follows. Note that there are few countries which meet all of these suggestive

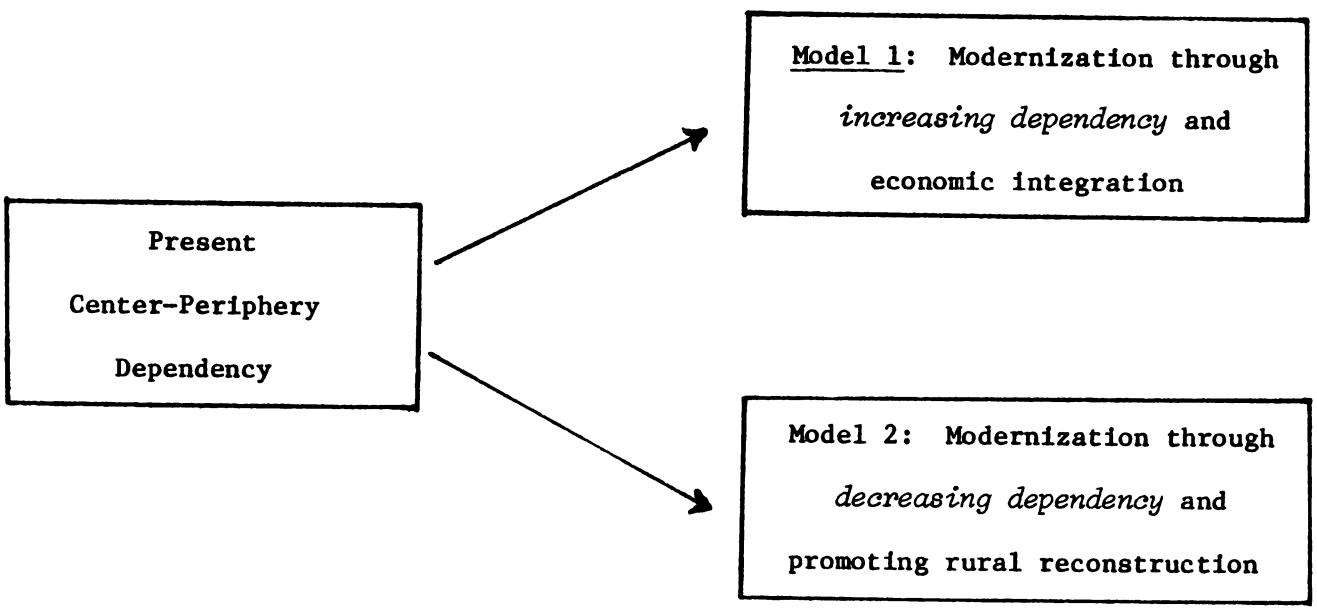

FIGURE II-4

CENTER-PERIPHERY STRUCTURAL TRANSFORMATION: EVOLUTIONARY PATHS FOR THE PERIPHERY

FIGURE II-5

ALTERNATE MODELS OF PERIPHERAL STRUCTURAL TRANSFORMATION

Selected System Variables and Characteristics at Various Levels of Aggregation	Model 1		Model 2	
	Extreme Form	Intermediate Form	Intermediate Form	Extreme Form
I. General direction of system evolution	Very rapid neo-colonial transformation	Neo-colonial transformation with some redistribution	Evolutionary transformation towards national independence	Revolutionary transformation
Change in dependency status	Rapid increase ←	Some increase ↔	Some decrease →	Rapid decrease
II. Country examples				
A. Non-african, large size	India, Brazil ←			→ China
B. Africa, non-Sahel	Ivory Coast, Kenya ←			→ Tanzania
C. Africa, Sahel	Senegal	Other Sahel		Mali
III. Political variables				
A. General stance	"Moderate" ("Reactionary")			"Radical" ("Progressive")
B. International				
1. Alliances	Maintain alliances with metropole or replacement country or group	Diversification toward other developed and independents	Diversification toward other independents and socialists	Movement toward alliances with socialist countries, maintain some limited contact with West
2. Military	Arms, training bases; focuses on "West" ←	Pragmatic		→ Arms, training bases; focuses on "East"
3. International organizations	Effective participation in center dominated organizations ←			→ Leadership in international organizations dominated by Third World

FIGURE II-5 - CONTINUED

ALTERNATE MODELS OF PERIPHERAL STRUCTURAL TRANSFORMATION

Selected System Variables and Characteristics at Various Levels of Aggregation	Model 1		Model 2	
	Extreme Form	Intermediate Form	Intermediate Form	Extreme Form
C. Internal politics				
1. Alliance	Ruling group with "center groups" in urban, rural areas			Ruling group with "periphery groups" in urban, rural areas
2. Political parties	"Administrative" one-party system	(Multi-party system possible)		"Grass roots" one-party system
3. Formal ideology	Functionally unimportant			Most important, actively used to build support, participation
IV. Socio-cultural variables				
A. Socio-economic group (class) formation	Develop rapidly			Efforts made to block appearance
B. General orientation	Outward			Inward
1. Language	Colonial language strongly maintained			Indigenous language fostered
2. Education	Maintain colonial hierarchical system			"Education for self-reliance"
C. Urbanization				
1. Rate	Rapid			Slowed or reversed
2. Social problems	High unemployment, slums, property crime			Rationing, scarcity of some consumer goods
V. Economic variables	*Much depends on initial endowment*			
A. Elements of development strategy	Maintain "good climate for investment" Export of profits Currency convertability Urban orientation "Top down"			Nationalize Tight money controls National currency Rural orientation "Bottom up"

FIGURE II-5 - CONTINUED

ALTERNATE MODELS OF PERIPHERAL STRUCTURAL TRANSFORMATION

Selected System Variables and Characteristics at Various Levels of Aggregation	Model 1		Model 2	
	Extreme Form	Intermediate Form	Intermediate Form	Extreme Form
B. Concentration of private or quasi-private economic ownership	Very high ←			→ Very low
C. Factor prices	Favor Imported capital, capital equipment, energy and cheap labor (severe distortions in enclaves)	← (Many variations) →		Favor Local energy sources technology which uses more labor than capital
D. Incentives				
1. Wealth and modern property accumulation	Proceeds rapidly but very unequal distribution ←			→ Slower but much more equal distribution
2. Salary/wage range	Wide			Narrow
3. Non-material incentives	Limited			More important
4. Direction and effects of incentives	Outward, urban orientation Promotes efficiency in private accumulation, inefficiency in local administration			Inward, rural orientation Frustrates private accumulation, promotes local participation and control
E. Trade patterns				
1. Imports (consumer/capital goods)	Higher			Lower
2. Exports	← Diversification in primary and industrial goods possible (much depends on resource base, starting point) →			
3. Natural resources	Rapid depletion, continued foreign control			Slow depletion (?), nationalization when feasible

FIGURE II-5 - CONTINUED

ALTERNATE MODELS OF PERIPHERAL STRUCTURAL TRANSFORMATION

Selected System Variables and Characteristics at Various Levels of Aggregation	Model 1		Model 2	
	Extreme Form	Intermediate Form	Intermediate Form	Extreme Form
F. Industrial sector				
Tend toward	Importing capital equipment, raw materials, use cheap labor, export production	←	→	Gear manufacturing to local materials, national consumption, linked to increasing agricultural productivity for domestic use
	Highly centralized, enclave approach			Decentralized, build on existing capacity
G. Agricultural sector				
1. Land tenure	Tends to private ownership			Expand on base of collective ownership and management
2. Agricultural surplus	Extracted			Reinvested
3. Diversification	For world markets			For export and local use
4. Crop patterns	Trend toward mono-culture	←	→	Maintain mixed cropping for local self-sufficiency

characteristics for illustration. Also, as shown, most Sahelin countries are in intermediate positions (because of the low level of material development and/or modernization achieved in any of them) with Senegal and Mali in the most relatively extreme positions due to their respective political-economic histories over the past fifteen years. These are not, however, secure "positions" since the region is undergoing such rapid transformation.

It must be clear from the several proceeding pages that the list of model characteristics and detailed hypothetical strategies for structural transformation can be extended very easily It should also be clear that these variables must be specified and strategies optimized for the particular conditions of different countries and sub-national regions under changing resource availability and market price conditions as well as the evolution of production for domestic use. Even so, there are a number of common themes which reappear in the two models.

In Model, the implicit path towards modernization involves increasing dependency on the more developed world, centralization of private and state economic control, the administrative provision of government services to rural areas, increasing inequality in distribution, and interrelated price policies, urban-rural terms of trade, patterns of incentives and attendant urban problems which support this direction of change. Problems and increasing maldistribution are recognized but tolerated because they result in the structural benefit of a center socio-economic group with important linkages to the developed world. Redistributive measures and favorable terms of trade for the rural sdctor appear largely to cajole

participation from reluctant peasants who in many cases can largely retreat back to subsistence production. Model 2, in contrast, protrays modernization as occurring once *dependency bottlenecks* are broken, objective functions are redefined to give more weight to non-material progress, and participation in the structures and institutions of modernization begins in villages and includes particularly the poorest farmers on the poorest land. Land is maintained under collective control, urbanization is curbed on both ends of the migration flow, extension workers and other government workers are selected and controlled by local people, and government--to serve rural construction and service needs rather than purely administrative and extractive needs--is heavily decentralized. This also implies price policies, terms of trade and, above all, incentive structures which support a process of change which builds on secure local building blocks.

As we will see in coming chapters, these alternate models imply differences in the magnitude, ownership and operation of various types of grain stocks. The controversy is not so much in the fact that they are held, which is dictated by common sense when supply varies so greatly, but in how, when, by whom and for whom they are held which will coincide with the demands of the different alternative models and the more realistic "mixed" systems of actual practice.

CHAPTER III

ECONOMIC CONDITIONS IN THE SAHELIAN PERIPHERY

Within the limitations imposed by an extremely weak statistical data base.[1] it is possible to add some economic meat to the bones of the Center-Periphery model elaborated so far. First, however, the usual warnings about not reading too much into economic indicators must be repeated. To say that Upper Volta has a GNP per capita of $70 while that of the United States is $6,200 per capita, reveals little of the richness of some aspects of Voltaic rural life and the poverty of some aspects of life in the United States. Second, these data should reveal something of the relative magnitude of some aspects of economic dependency and the severe short run limitations placed on options open to Sahelian policy-makers.

Table III-1 shows that the Sahel is a vast area (about 57 percent of the size of the United States), that its population is small compared to its land mass, and that it is extremely poor when measured in material terms by GNP per capita. This is particularly true if we look at the four interior countries and exclude Senegal, with its important coastal enclave of Dakar, and Mauritania, with significant exports of iron ore and copper, to boost their per capita

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[1] Elliot Berg [1975] clearly details the limitations of data on Sahelian countries in a very useful statistical summary which will be drawn upon heavily in this section.

TABLE III-1

THE SAHEL AND WEST AFRICA: AREA, POPULATION, GNP AND GNP PER CAPITA, 1975

Country	Area (km^2 000)	Population (000)	GNP ($100 million)	GNP/Capita ($US)	Growth Rates (%) 1960-73	
					Population	GNP/Capita
Chad	1,284	3,900	$ 320	$ 80	1.8	-2.1
Mali	1,240	5,400	370	70	2.1	1.0
Mauritania	1,031	1,300	250	200	2.1	4.1
Niger	1,267	4,400	450	100	2.7	-1.9
Senegal	196	4,100	1,160	280	2.1	-1.8
Upper Volta	274	5,700	410	70	2.1	-0.4
Total Sahel	5,292	24,800	2,960	120	2.2	-0.6
Nigeria	924	71,300	15,050	210	2.5	3.6
Remainder of West Africa[a]	1,681	36,900	8,960	240	2.7	1.7
Total West Africa	7,897	133,000	26,970	200	2.5	2.3
Sahel as Percent of West Africa	67%	19%	11%	60%	88%	--

SOURCE: IBRD, World Bank Atlas: Population, Per Capita Product, and Growth Rates. Washington, D.C.: IBRD, 1975.

[a]Includes Benin, Cameroun, Gambia, Ghana, Guinea, Guinea-Bissau, Ivory Coast, Liberia, Sierra Leone and Togo.

figures. Table III-1 also shows that the Sahel countries are relatively worse off than their coastal neighbors in West Africa. It is important to note that Nigeria alone has about three times the population and five times the GNP as all six Sahelian countries combined. Finally, note that population growth in the Sahel has been somewhat slower than West Africa as a whole (2.2 versus 2.5 percent) but that modern economic growth has lagged far behind.

While there are similarities across the region there are significant differences which stem partly from the relative placement of the broad rainfall/ecological belts which run across the center of Africa. Of the total land mass of the six countries about 58 percent is considered desert, the Saharan zone, and receives less than 200 mm (about 8 inches) of rainfall annually. The Sahel zone is the next belt to the south and receives an average of between 200 to 300 mm and 500 to 600 mm of rainfall anually (8 to 12 inches to 20 to 24 inches). Below 500 to 600 mm we have the Sudan and Guinean belts which extend into the northern regions of the coastal countries. These belts are indicated in Figure III-1. The Sahel and Sudan/Guinean zones each contain about 21 percent of the total regional land area but the relative distribution varies greatly across the individual countries as indicated in Table III-2. This table also serves to warn that some caution should be shown in the use of the term "Sahel" given the varying proportions of land, population, crop and livestock production it contains.

The overwhelmingly rural nature of the Sahel countries is illustrated by the estimated percentages of the labor forces employed in agriculture ranging, in 1972, from an estimated "low" of

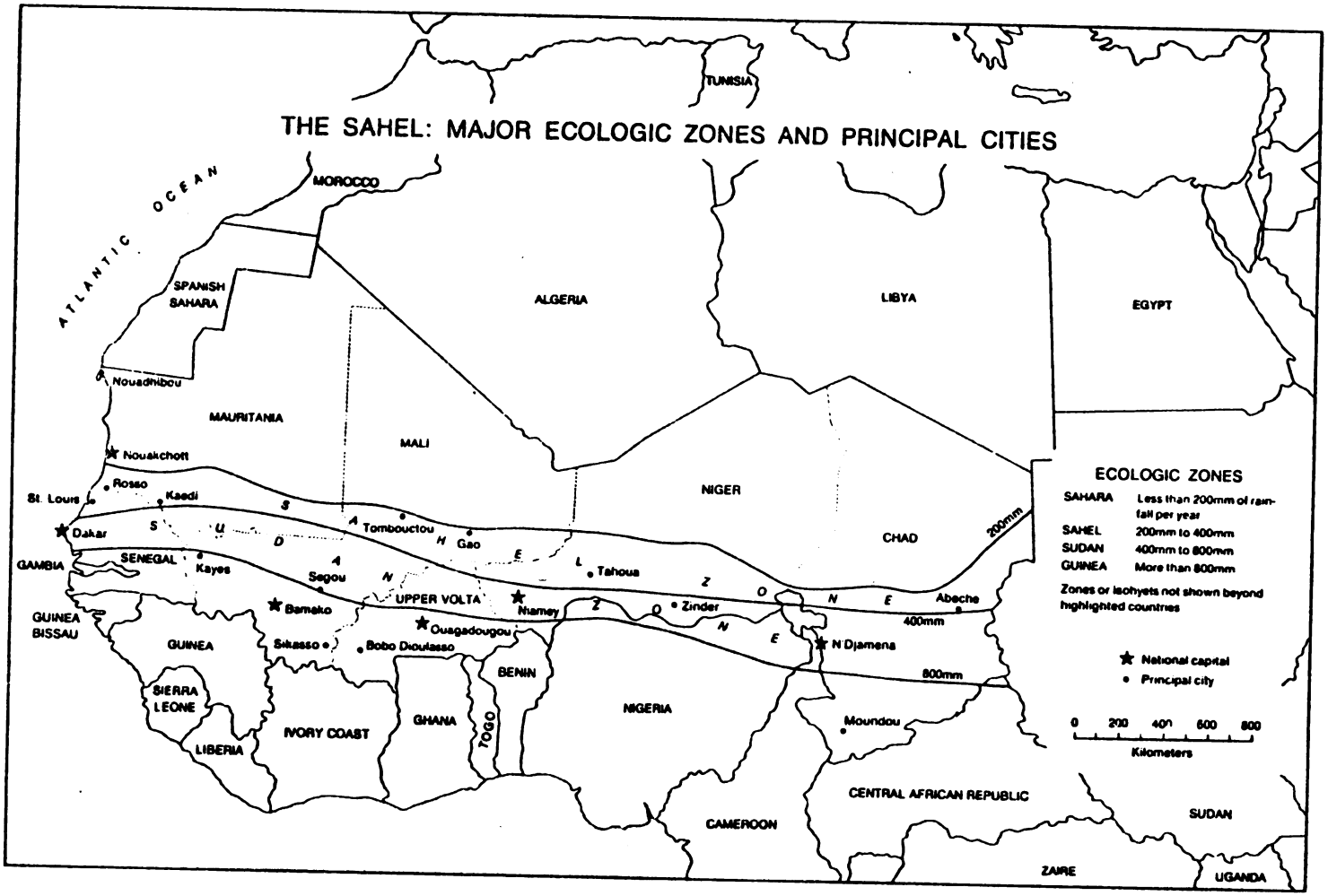
THE SAHEL: MAJOR ECOLOGIC ZONES AND PRINCIPAL CITIES
TUNISIA
ATLANTIC OCEAN
MOROCCO
SPANISH SAHARA
ALGERIA
LIBYA
EGYPT
Nouadhibou
MAURITANIA
MALI
Nouakchott
NIGER
St. Louis
Rosso
Kaedi
Dakar
Tombouctou
Gao
CHAD
200mm
SAHEL
SUDAN
GAMBIA
SENEGAL
Kayes
Segou
Tahoua
Bamako
UPPER VOLTA
Niamey
Zinder
Abeche
400mm
GUINEA BISSAU
GUINEA
Sikasso
Bobo Dioulasso
Ouagadougou
N'Djamena
BENIN
800mm
SIERRA LEONE
LIBERIA
IVORY COAST
GHANA
TOGO
NIGERIA
Moundou
CENTRAL AFRICAN REPUBLIC
CAMEROON
SUDAN
ZAIRE
UGANDA
ECOLOGIC ZONES
SAHARA Less than 200mm of rainfall per year
SAHEL 200mm to 400mm
SUDAN 400mm to 800mm
GUINEA More than 800mm
Zones or isohyets not shown beyond highlighted countries
National capital
Principal city
0 200 400 600 800
Kilometers

FIGURE III-1

TABLE III-2

ESTIMATED RELATIVE IMPORTANCE OF THE SAHEL ZONE IN EACH COUNTRY

	Countries					
	Mauritania	Niger	Mali	Chad	Senegal	Upper Volta
1. Land area: Percent by zone						
Saharan	77	65	50	50	--	--
Sahelian	23	30	25	21	37	13
Sudano-Guinian	--	5	25	29	63	87
2. The Sahel Zone						
a. Percent population	79	53	36	29	18	5
b. Crops: Percent of:						
Area cultivated	87	64	27	27	19	4
Production	91	47	27	16	14	3
c. Livestock: Percent of:						
Cattle	90	78	68	62	45	22
Sheep and goats	60	62	84	52	58	20

SOURCE: UN/FAO [1976a, Vol. 1, p. 6].

76 percent in Senegal, to 85 percent in Mauritania, 89 percent in Upper Volta and a high of 91 percent for Chad, Mali and Niger.[2] These percentages are, of course, closely related to rates of urbanization to be discussed in the next chapter. Further, as our model predicts, the estimated relative returns to agricultural labor in contrast to other economic activity are much lower in the Sahel than they are in most other developing countries and certainly less than the relative returns in Center countries as shown in Table III-3.

These relationships are also evident in estimates of the sectoral attribution of Sahelian Gross Domestic Product as shown in Table III-4. In that table, we see that in Senegal, for example, 30 percent of GDP comes from agriculture (which contains 75 percent of the labor force), etc. Further, we note the major influence of mining in the Mauritanian economy, the large proportion of "value added" in the commercial and transportation/communications sectors and the major role of the government sector in all of the economies. It should also be noted that the mining sector percentages are most likely significantly higher in 1977 due to Mauritania's doubling of iron-ore exports, to Senegal's increased export of rock phosphates which enjoyed a brief but sharp price rise in 1974, and to increases in Niger's exports of uranium ore. Finally, these GDP figures give only rough estimates of actual economic activity and the estimates

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[2] U.S. Agency for International Development [1975a, p. 6].

TABLE III-3

AGRICULTURAL INCOME PER CAPITA AS A PERCENTAGE
OF NONAGRICULTURAL INCOME PER CAPITA
FOR SELECTED COUNTRIES

Countries	Years		
	1960/62	1964/66	1969/71
Mali	8	8	8
Mauritania	11	8	9
Niger	10	12	12
Senegal	11	13	11
Tchad	7	8	11
Upper Volta	11	13	10
Average of:			
Underdeveloped countries	28	27	27
Industrialized countries	54	56	55
With: France	37	37	39
United States	61	66	73
Great Britain	103	103	108

SOURCE: P.L. Iacoacci and E.F. Szczepanik, "Income Inequalities Between Agriculture and Other Economic Activities at Different Levels of Development," UN/FAO/PAD, draft document, 1975; quoted in UN/FAO [1976a, Vol. 1, p. 2].

TABLE III-4

SECTORAL ALLOCATION OF SAHELIAN GROSS DOMESTIC PRODUCT, FACTOR COST ESTIMATION FOR 1970 (IN PERCENTAGES)

Sectors	Countries					
	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Agriculture	50.5	43.1	33.6	57.1	30.2	44.3
Mining	--	--	31.7	0.1	2.4	--
Industry	8.5	13.3	3.6	7.2	13.8	12.2
Construction	3.7	5.1	7.6	2.6	2.1	4.5
Commerce	15.8	19.1	7.3	13.5	21.7	17.3
Transportation and commerce	1.6	4.2	3.0	2.9	5.5	5.0
Administration and defense	14.3	13.1	10.5	5.9	15.5	10.2
Other services	5.6	2.1	2.6	10.7	8.8	6.5
Percentage totals	100.0	100.0	100.0	100.0	100.0	100.0
Factor cost GDP in $US million	(238.8)	(231.2)	(177.7)	(347.2)	(741.6)	(301.7)

SOURCE: UN/FAO [1976a, Vol. 1, derived from tables on pp. 24-29].

themselves vary substantially among sources[3] and are subject to major sectoral shifts in response to changing world prices, etc.

Since trade plays a major role in the theoretical model a brief look at the structure and magnitude of trade is instructive. Table III-5 presents official trade statistics for the 1969-71 period which shows that exports represented from 8 to 50 percent of Gross Domestic Product while imports ran at totals which represented from 20 to 32 percent of GDP.[4] Agricultural products play a predominant role in exports, ranging from 64 to 94 percent, except in Mauritania (25 percent) where they are outweighed by mineral exports. It should also be noted that agricultural products, primarily food stuffs, make up a large part of total imports. Part of this is due to the drought period, but part is also attributable to secular trends of increased consumption of imported wheat and rice which will be explored in the next chapter.

Table III-6 shows the estimated valorum percentage composition of Sahel exports over the 1963-70 period which illustrates the general

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[3]Berg [1975, p. 11] notes, for example, that estimates of real annual GDP growth between 1960 and 1970 range from a 23 percent difference (6.5 to 8.0 percent) for Mauritania to a 1,220 percent difference (0.5 to 6.6 percent) for Mali.

[4]Berg [1975, p. 11] makes several important points concerning what these figures indicate about the degree of "openness" of Sahel economies and the implications for economic policy:

> "These figures are surely indicative of openness, but even they underestimate the degree of openness, in two respects. (i) The trade figures are probably "official" trade; and (ii) about 30 to 40 percent of the GNP estimates in these areas is an inputed value for subsistence production. So taking account of unrecorded trade and calculated as a share of *marketed* GNP, imports and exports would be much more substantial. This means that budget deficits or expansionist monetary policies have quick effects on the balance of payments, on rates of exchange in parallel markets in neighboring countries and on flows of illegal trade."

TABLE III-5

OFFICIAL COMMERCIAL TRADE, ANNUAL AVERAGES, 1969-71, BY SAHEL COUNTRY

	Countries					
	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Value of trade (CFA billion)						
Exports	9	11	25	9	42	6
Imports	20	17	16	14	54	15
Trade as percent GDP						
Exports	14	19	50	13	21	8
Imports	30	30	32	20	27	20
Agricultural products as percent trade						
Exports	94	70	25	90	64	85
Imports	18	26	29	9	36	20

SOURCE: Derived from UN/FAO [1976a, Vol. 1, p. 16].

TABLE III-6

EXPORT VALUE BY SELECTED CATEGORIES OF EXPORTS, 1963-70
(IN PERCENTAGES)

Category	Countries					
	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Peanuts and peanut products	--	21	--	60	58	19
Cotton	79	21	--	--	--	24
Live animals (recorded)	2	35	--	14	--	39
Meat	11	--	--	--	--	--
Fish	--	--	6	--	6	--
Iron ore	--	--	88	--	--	--
Phosphates	--	--	--	--	9	--

SOURCE: Berg [1975, Annex A, Table iii, p. 152].

pattern of dependence on one crop or raw material for total export earnings: Chad, 79 percent on cotton; Mauritania, 88 percent on iron-ore; Senegal and Niger, 58 percent and 60 percent, respectively, on peanuts. Mali and Upper Volta are only somewhat more diversified with 77 percent and 82 percent of export earnings respectively coming from similar proportions in each country of peanuts, cotton and livestock on the hoof. Livestock export figures are notoriously unreliable and underestimated, generally due to a large amount of smuggling to avoid paying taxes.

Our description of Sahelian exports certainly would not be complete if we did not include what, for several countries at least, is their most valuable export, namely, human labor. Labor migration, whether of a voluntary or involuntary nature, has played a major role in shaping the economic history of West Africa. This includes various periods of internal and external slavery, colonial forced labor migration (which was officially abolished in French areas only in 1945), internal rural-urban migration of the classic variety, and seasonal or permanent international migration from the interior countries primarily to the plantations and cities of coastal West African countries. As one illustration of the magnitude of the latter flows, it is estimated that perhaps one third of Upper Volta's active male labor force is in permanent or temproary foreign residence, primarily in the Ivory Coast and Ghana.[5] This provides a very important component in the center-periphery development of the region. Voltaic workers in the Ivory Coast (in this case, the center of the

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[5]For a thorough exploration of this phenomenon in a center-periphery framework, see Gregory [1974].

Periphery) receive wages, much of which go to Upper Volta as substantial remittances. But these workers, however, do not have easy access to the economic growth of the "Ivorian miracle" due to the difficulty they have in gaining effective ownership rights to land and property. The economic impact of remitted wealth in Upper Volta, while not negligible in some instances, has not proven to be of much overall importance as witnessed by the secular stagnation of the Voltaic economy. These factors are among those which caused Samir Amin to harshly categorize Mali, Upper Volta and Niger as "labor-reserve economies", partly because this was one of the chief roles they played in the colonial era of forced-labor and partly due to the current, post-independence realities of massive international migration.[6]

Another trade relationship which is embodied in the feudal interaction structure of our model is the concentration of an already undiversified trade with a limited number of trading partners. This pattern is dramatically confirmed in Table III-7 which contains the percentages of Sahelian exports and imports to and from the leading trade partner and the top three. Similar data are presented, for comparison purposes, for the Ivory Coast, Nigeria, France and the United States. Not surprisingly, France was the leading exporter to every Sahelian country and the top importer for three of them. These data are for 1965, five years after independence, when preferential trade agreements were still in effect with France; there has been a diversification of trading relationships

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[6]Amin [1973].

TABLE III-7

CONCENTRATION OF SAHEL TRADE TO AND FROM MAJOR EXPORT AND IMPORT PARTNERS WITH COMPARISONS TO SELECTED OTHER COUNTRIES (1965)

Country	Exports			Imports		
	% to Top Partner	% to Top 3 Partners	Destinations[a]	% From Top Partner	% From Top 3 Partners	Origins[a]
Chad	45	68	FR, YU, NG	46	68	FR, NA, US
Mali	30	71	IC, GH, SN	24	66	FR, PRC, USSR
Mauritania	25	64	UK, FR, GFR	47	84	FR, US, GFR
Niger	56	84	FR, NG, AL	53	63	FR, PRC, NL
Senegal	81	86	FR, GFR, MR	54	65	FR, CB, GFR
Upper Volta	52	79	IC, GH, FR	54	76	FR, IC, MI
Ivory Coast	38	63	FR, US, IT	62	73	FR, GFR, US
Nigeria	38	61	UK, NL, GFR	31	54	UK, US, GFR
France	19	36	GFR, BL, IT	18	37	GFR, US, BL
United States	21	35	CA, JP, GFR	23	41	CA, JP, UK

SOURCE: Oxford Economic Atlas of the World.

[a]Trading partners code:

Al	Algeria	IC	Ivory Coast	NG	Nigeria
BL	Belgium/Luxembourg	IT	Italy	PRC	People's Rep. China
CA	Canada	JP	Japan	SN	Senegal
CB	Cambodia	MI	Mali	UK	United Kingdom
FR	France	MR	Malagassy Rep.	US	United States
GFR	German Fed. Rep.	NA	Netherlands Antilles	USSR	Union of Sov. Soc. Rep.
GH	Ghana	NL	Netherlands	YU	Yugoslavia

since then but the concentration of trade partners is still quite high compared to the countries of the Center. It is of interest to note that Mali and Upper Volta--which had no mineral exports and a smaller, yet more diversified export structure--had a much higher trade with neighboring countries than any of the others. Mali, in 1965 heavily oriented toward the Socialist Center, also had shifted its import patterns so that 44 percent came from the Peoples' Republic of China and the U.S.S.R. with only 24 percent still coming from France.

Of greatest theoretical and practical importance in the field of trade relationships is the movement and systematic significance of terms of trade, both domestically and internationally and the *two acting together*. This is at the heart of the principle of unequal exchange and is a very complex subject given the patterns of interaction and interdependency generated by the real world center-periphery system. However, a few general and several specific illustrative points can be made.

First, the general terms of trade situation has worsened for the Sahel in recent years with substitution of synthetics for raw materials, slackening demand for exports due to the reappearance of cyclical recession in the heart of the Center economies, with severe imported inflation due both to the direct and indirect effects of petroleum price rises, and with wider secular inflation in the prices of manufactured goods. Further,

> . . . according to the World Bank, less developed countries which export neither oil nor minerals can expect substantial terms of trade deterioration by 1980, with the poorest--those with under $200 *per capita* income which had already suffered

> in the recent commodity 'boom'--projected to suffer further terms of trade deterioration of about 20 per cent.[7]

This is certainly not a new phenomenon in world trade relationships. Colonial powers, almost by definition, imposed themselves physically to guarantee a continued deterioration in terms of trade against the Periphery. But the mechanism, to be "successful", is generally more complicated than that. There is some evidence that Center-Periphery terms of trade may be cyclical in nature with major changes in direction representing not only changes in technologies and relative factor prices but discontinuous evolutionary "jumps" in Center-Periphery structural relationships. Along these lines, A.G. Hopkins offers this very relevant summary of historical terms for West Africa:

> Since 1800 West Africa has experienced only three periods when both barter and income terms have moved sharply in favour of producers for at least ten years. The first period [peaking between 1854 and 1861] played an important part in establishing the new commerce; the second, from 1900-1913, helped to install the colonial rulers; and the third, from 1945-1955, was a phase of expanding expectations and economic diversification which was associated with the end of the colonial era.[8]

A statement such as this must be backed up empirically for any country or shorter historical period to insure its credibility, a process which is beyond the scope of this study. However, several sources of intriguing secondary clues are available. Amin reports the work of Vanhaeverbeke[9] who analyzed the historical evolution of

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[7] G.K. Helleiner, paraphrasing Robert McNamara [1974] in Helleiner [1976, p. 9].

[8] Hopkins [1973, p. 132].

[9] Vanhaeverbeke [1970] reported in Amin [1973].

the terms of trade for Senegal's groundnut economy. (Some summary figures for the period 1884 to 1970 are given in Table A-1 in Appendix A.) Large-scale groundnut production for export began in the early 1880s and reached a record export level of just over a million metric tons in the 1965-66 season. Indices of groundnut export prices and retail prices for imported goods moved fairly closely together compared to the percentage growth in each. This resulted in fairly stable commodity terms of trade over an eighty-five year period. However, when the double factorial terms of trade are computed (i.e., those taking account of the relative changes in productivity in French manufacturing and Senegalese groundnut production), the picture deteriorates rapidly for Senegal. These terms (indexed at 1938 equal to 100) decline from an index of 346 in 1890-99 to 40 in 1965-69 and this has interesting implications, admittedly somewhat hypothetical, in our Center-Periphery model. First, equality in commodity terms of trade is not an indicator that the functioning of the interaction system is necessarily producing equal effects in both areas. It is safe to say that productivity increases in a more advanced, integrated economy will have disproportionately greater total "multiplied" effects (within some limits regardless of whether productivity rewards go primarily to labor or capital) than the limited effects possible in a less integrated, undiversified, predominantly subsistence Peripheral economy. To this should be added the obvious fact that Center nations have a number of these relationships with various Peripheral areas which would most likely increase the magnitude of interactive growth processes.

Second, it is clear that the second "ratchet" in this multi-layered process is the evolution of domestic terms of trade. Berg provides very convincing evidence that such a deterioration took place in Senegal between 1960 and 1974 with the government marketing board having replaced colonial trading houses in Dakar. Total income distributed to groundnut producers is estimated to have dropped by one third over this period.[10] Much of this can be attributed to price policies practiced by the "Stabilization Fund". Ostensibly constituted to protect producers from a fluctuating world market, the Fund has proved more successful in generating government operating funds in classic marketing board fashion.[11] Most dips in world prices have been met with equivalent cuts in producer prices while only a fourth to a third of the increases in export prices have been passed along to producers, a pattern replicated in most of the Sahelian countries.

To see this from a somewhat different angle, recent preliminary work done by the World Bank estimates that in Senegal the net effective tax (gross margin retained by the *Caisse de Périquation et Stabilisation des Prix* less input subsidies and other services provided to producers) between 1971 and 1975 to be approximately 20 percent of the aggregate world market value of groundnut production. In summary, there has been little stabilization for producers, only declining cash crop output and rural stagnation as outside dependence increases.

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[10]Berg [1975, particularly pp. 14-24].

[11]See Helleiner [1966, particularly Chapter 6] for an excellent discussion of this topic.

A final indicator of Sahelian economic dependence is represented by the proportion of government recurrent and investment expenditure which is financed by "development assistance" from the Center. Table III-8 shows that over the three year period 1972-74, the annual average of bilateral and multilateral aid in grants and loans represented from 32 to 123 percent of total annual government expenditures in 1973 (recurrent as well as investment). Similarly, these magnitudes of official capital transfers to the Sahel represented from 6 to 10 percent of total estimated GNP. These percentages are substantially less for mineral-rich Mauritania and for Senegal with its relatively larger, more diversified economy.

It should be noted that these figures center on 1973 which was the height of the drought period and thus may be somewhat inflated over prior years. However, with the increases in foreign assistance to the Sahel projected for the next decade, this may be, in fact, a permanent state of affairs particularly for the four interior countries. Anyone who has visited any of the Sahel capitals in recent years can attest that much of the boom in construction and crowded first class hotels can be attributed to the spectacular rise in the assistance activities of bilateral and international organizations.

There are, of course, many other dimensions to the economic and related dependency of the six Sahel countries and the West African region to which they are tied. Questions such as the evolving role of multinational firms--which have much more of an interest in West Africa as a whole than the Sahel per se--can and should be

TABLE III-8

TOTAL BILATERAL DEVELOPMENT ASSISTANCE (FROM MARKET ECONOMIES) AND MULTILATERAL ASSISTANCE (1972-74 ANNUAL AVERAGE)[a] IN RELATION TO 1973 TOTAL GOVERNMENT BUDGET EXPENDITURES (INCLUDING INVESTMENT)[b] AND TO TOTAL ESTIMATED 1973 GROSS NATIONAL PRODUCT[c] BY SAHEL COUNTRY

Country	1972-74 Average Annual Development Assistance ($US Million)			Total Annual Aid Per Capita ($US)	1973 National[d] Budget ($US Mill.)	Total Aid as Percent of	
	Bilateral	Multilateral	Total			National Budget	GNP
Chad	29.7	16.0	45.7	$11.80	66.9	68%	14%
Mali	39.3	31.0	70.3	13.10	73.0	96	19
Mauritania	15.3	11.3	26.6	21.10	45.3	59	11
Niger	50.3	30.8	81.1	18.90	66.0	123	18
Senegal	48.4	26.5	74.9	17.80	236.9	32	6
Upper Volta	36.4	24.0	60.3	10.50	51.5	117	15

[a]Source: United Nations Statistical Yearbook, Table 206, p. 829.

[b]Source: Berg [1975, Tables VIA, VIB, pp. 202-213].

[c]Source: IBRD, World Bank Atlas, p. 14.

[d]Conversion rates used: CFAF 1 = $0.0044, MF 1 = $0.0022, UM 1 = $0.022.

explored.[12] The purpose of this chapter has been to present macro-level data for West Africa relevant to a conceptual framework which seeks to describe and explain why this part of the world is so extremely underdeveloped and dependent. It should be clear, as the example of the American Southwest illustrates, that it is not simply because the Sahel is desert and semi-arid that it is inherently poor. Rather, the Center-Periphery model suggests that the operation of the multi-layered world economic system, with its shifting patterns of technology development and coalitions of interest, has served to negatively reinforce a slim resource base and has maintained a series of production patterns, trade flows and structural interaction mechanisms which have systematically worked against self-sustained and self-directed economic development. The limits to rapid modification of this system are also abundantly clear. This should not, however, deter us from realistic assessments of the situation and an exploration of pragmatic measures which can be taken on the long road to a more independent alternative system. We will begin this process in the next chapter with an examination of trends in the production and consumption of food grains in the Sahel.

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[12] A starting place would be the essay by Green [1975] and the book by Barnet and Muller [1974].

CHAPTER IV

TRENDS IN SAHELIAN FOOD GRAIN CONSUMPTION AND PRODUCTION

Since there are no apriori optimum food grain stock levels for any country, qualified statements on stock optima can only be derived from an exploration of the many physical and monetary determinants of food grain demand and supply within the context of the specific objectives to be pursued in national grain stock and food policies. This chapter lays some of the needed groundwork for this exploration through a brief analysis of available data on trends in food grain consumption (and major determining variables: growth in population, urbanization and income levels) and food grain production.

It is important to keep in mind that these are not isolated trends; they form a part of the picture of the increasing unification and integration of segmented traditional West African economies into the world economy. The Center-Periphery conceptual and economic framework outlined in the previous chapters impels us, as do other realistic structural change theories, to carefully examine the nature and extent of rural-urban exchange and patterns of consumption by various socio-economic groups.

It is clear that food self-sufficiency, at any level of geographical aggregation, can be the basis for general economic self-sufficiency and true independence where the total benefits of trade

can be more equitably distributed. We will see, however, that food trade in West Africa, even through the medium of free markets, can contribute to the overall pattern of emerging socio-economic stratification which is a key variable in the transition to peripherical underdevelopment.

In six countries, the number of variables to be examined, most of which merit entire separate studies, and the quality of most available data series channels our examination toward major differences and similarities among countries and toward those trends with significant implications for national stock programs. Policy makers will have little real control over some of these trends but others clearly lend themselves to potential modification through government food policy and general socio-economic initiatives.

Food Grain Consumption

There are several broad patterns in diet composition and source of food grains which characterize the six countries. Some of these are illustrated in Table IV-1. First, cereal grains dominate Sahelian diets, representing, on the average, between 60 and 76 percent of total daily calories consumed as estimated by the FAO Nutrition Division. Millet and sorghum account for 59 to 72 percent of total calories in the four interior countries and 32 to 43 percent in Senegal and Mauritania, respectively, where greater amounts of rice and wheat are consumed. In contrast with coastal West Africa, roots and tubers play a small dietary role on the average but are more important in the southern-most parts of the Sahel group as well as in speciality foods consumed in urban areas.

TABLE IV-1

TOTAL DAILY PER CAPITA CALORIES CONSUMED BY FOOD CLASS
FOR SAHEL COUNTRIES (IN PERCENTAGES)

Food Class	Countries					
	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Cereals (Millet/Sorghum)	65 (59)	76 (59)	60 (43)	76 (72)	66 (32)	75 (64)
Roots and tubers	3	3	1	4	4	2
Sugar	2	2	10	1	6	1
Legumes	9	2	3	6	2	10
Oil products	14	8	2	4	11	7
Vegetables and fruit	1	1	2	1	1	1
Animal products	7	8	23	9	9	4
Calorie base	(2,446)	(2,235)	(2,178)	(2,255)	(2,737)	(1,889)

SOURCE: UN/FAO [1976a, p. 71].

Table IV-1 reveals several other significant aspects of average diet composition. Sugar plays a bigger role in Senegal and Mauritania where it is consumed in large amounts in tea. Legumes, such as cowpeas and various beans (Niébé, etc.), are substantially more important in diets in Chad, Niger and Upper Volta than in the other three countries. Animal products are more important in Mauritania and Senegal and illustrate the relevance of the geographical location of those countries. Mauritanian pastoralists, estimated to be 70 percent of the total population, consume large amounts of meat and milk products from their herds. Fish are important in coastal Senegalese and Mauritanian diets and play a larger role in the interior countries of Mali and Chad, which have relatively greater fishery resources, than Niger and Upper Volta. (See Appendix A, Table A-2, for a breakdown of animal protein by food class and country.)

The source of supply of grain consumed reveals another difference among the six countries. Mauritania imports large quantities of grain both from outside the region and from neighboring Mali and Senegal. To some extent this is offset within the region by important Mauritanian livestock exports, a case of reasonably obvious comparative advantage at work. Senegal also imports substantial quantities of grain, mostly rice and wheat, to feed the large urban population of Dakar and the Cape Verde Peninsula.

In a recent World Bank study, "self-sufficiency rates" were calculated for all West African countries in 1975.[1] Mauritania and

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[1]The self-sufficiency rate is the percentage of total grain consumption met through net domestic grain production which is total domestic production less seed, animal feed, waste and milling losses, normally taken to be about 20 percent of total [IBRD- 1976b].

Senegal were rated at 51 and 68 percent self-sufficient, respectively, while the other four countries were almost entirely self-sufficient: Chad, 98 percent; Mali, 97 percent; Niger, 99 percent; and Upper Volta, 96 percent. As we will see below, a major policy concern is that the latter four countries will slip further below self-sufficiency in the future if average per capita production fails to keep pace with population growth and that the situation in Senegal and Mauritania will continue to deteriorate in this respect.

Table IV-2 provides further detail on the composition of the staple portion of Sahelian diets. It highlights the relatively high per capita consumption of rice in Mali, Mauritania and Senegal and the importance of wheat in the diets of the latter two. It also illustrates a fairly wide divergence in total grain equivalents derived from staple foods. Mauritania's low of 132 kg per head per year is partially attributable to the greater importance of animal products in that diet and is also thought to be partially a result of substantial underestimation because of a large unrecorded trade, particularly with Senegal. Conversely, Senegal's total consumption may thus represent a slight overestimation because part of national production is flowing to Mauritania (and particularly to Gambia if relative official product prices are of the right magnitudes) where prices have tended to be significantly higher.

As with many other Sahelian demographic and economic variables these average *national* consumption levels can be highly misleading since different segments of the national population often consume only one of the various staples to any great extent over time. Indeed, most Savannah ethnic groups traditionally have had very strong

TABLE IV-2

ESTIMATED SAHELIAN CONSUMPTION LEVELS OF MAIN STAPLE COMMODITIES
(AVERAGE KG PER HEAD PER YEAR, 1967-71)

Commodity	Countries					
	Chad	Mali	Mauritania	Niger	Senegal	Upper Volta
Rice	7	20	17	6	56	4
Wheat	3	3	14	1	22	5
Maize	2	10	2	2	15	10
Millet/Sorghum[a]	145	123	98	186	123	133
Total cereals	157	153	131	195	216	152
Yams	--	--	--	--	--	3
Cassava	3	--	--	33	39	6
Other roots	3	42	3	3	6	3
Total roots/tubers	6	42	3	36	45	12
Total kg	163	195	134	231	261	164
Total grain equivalent[b]	159	167	132	207	231	156

SOURCE: IBRD [1976b].

[a]Includes all other cereals such as fonio.

[b]Roots/tubers converted to grain equivalent by (net weight divided by 3).

preferences for one type of sorghum or millet over all others as the staple of choice. It is also fair to generalize by saying that most wheat and much of rice consumption has been limited to cities and towns. Table IV-3 crudely disaggregates the consumption figures in Table IV-2 for Mali and Upper Volta into urban and rural consumption patterns. This was done by allocating a portion of total cereal and root consumption to the "urban population" (15 percent for Mali, 10 percent for Upper Volta) based on average 1972 consumption figures reported by SEDES for Bamako and Ouagadougou respectively.[2] The remainder of national consumption was then averaged again for the rural population. These are, of course, very gross estimates which mask great differences in consumption within each sector but they do illustrate an important gap between urban and rural staple diets. Rice and wheat make up approximately 30 to 40 percent of urban staple consumption (by weight) in Upper Volta and Mali respectively but only about 3 and 8 percent of average rural consumption levels. We should also note that these allocative estimation procedures point up noticeable differences in average urban and rural levels of total staple consumption.[3] In some respects these are not startling figures and

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[2]SEDES data for Bamako and Ouagadougou contained in Secrétariat d'Etat aux Affaires Etrangères [1973].

[3]These data do not deal with the related key question of the nutritional adequacy of diets in the Sahel. For an excellent introduction to this topic (another which is unfortunately beyond the scope of this study), see Alan Berg [1973]. In addition, Reutinger and Selowsky [1976] have recently published the results of important research on the relationship between malnutrition and poverty in the third world. They examine the critical relationship between income distribution and age-specific calorie deficits and explore various ameliorative policy options open to the underdeveloped world. Not surprisingly, they find that the "development process" does not necessarily diminish but, in fact, may increase rates of

TABLE IV-3

ESTIMATED URBAN AND RURAL STAPLE GRAIN AND ROOT CONSUMPTION IN UPPER VOLTA AND MALI, 1972 (IN AVERAGE KG PER HEAD PER YEAR AND PERCENTAGES)

Upper Volta

Commodities	Kilograms			Percentages		
	Urban[a]	Rural	Total[b]	Urban	Rural	Total
Rice	28	1	4	17	1	3
Wheat	21	3	5	12	2	3
Maize	13	10	10	8	6	6
Millet/Sorghum	106	136	133	62	88	85
Total cereals	(168)	(150)	(152)	(99)	(97)	(97)
Roots/Tubers[c]	1	4	4	1	3	3
Total staples	170	154	156	100	100	100

Mali

Commodities	Kilograms			Percentages		
	Urban[a]	Rural	Total[b]	Urban	Rural	Total
Rice	66	12	20	35	7	12
Wheat	16	1	3	8	1	2
Maize	8	10	10	4	6	6
Millet/Sorghum	96	128	123	50	77	72
Total cereals	(186)	(151)	(156)	(97)	(91)	(92)
Roots/Tubers[c]	5	16	14	3	9	8
Total staples	191	167	170	100	100	100

SOURCES: [a]S.E.A.E. [1973, pp. 38, 48].

[b]IBRD [1976b, Table 1.5].

[c]Roots and tubers reported in grain equivalents.

the magnitude of urban/rural dietary differences should not be exaggerated given the large role played by coarse grains in both average diets. However, if these trends continue and are coupled with prolonged rapid rates of urbanization they will have strong implications both for domestic production strategies and for grain stock requirements.

A recent U.N. study of cereal production and marketing in Chad reports somewhat fragmentary consumption survey results which support the above patterns of consumption variation by location and by income level.[4] However, it also adds a good deal of illuminating data on the unrevealed complexity of these consumption patterns. Three particular sub-patterns deserve special attention and, at least on an impressionistic level, these patterns are observable across the Sahel.

First, there are marked seasonal differences in both the composition and total consumed calories of average rural diets and these two factors have a complex pattern of interaction. For example, while sorghum and millet make up the bulk of diets in southwest Chad, their lowest consumption occurs during the harvest period from mid-September to mid-December while, during the same period, total calorie intake reaches a maximum due to increased consumption

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malnutrition (largely as a by-product of increasing inequality in money incomes) calling for secondary redistributive measures such as "food stamp" programs. This result is certainly consistent with the Center-Periphery schema, as incorporation into hierarchical world economic structures leads to the relative "marginalization" of the periphery of the Periphery including disruption of traditional ecological production/consumption relationships and continued downward pressure on real money wages as part of the process of capital accumulation.

[4] H. Auffret et al. [1974].

of non-cereal products (roots, tubers, legumes, etc.). Cereals, because of their relative ease in storage, are consumed in larger proportions further from harvest time although total calories reach a low point in the "hungry season" (the *soudure* in French), the four month period which extends from just before through most of the growing season. (See Appendix A, Table A-3, for greater detail.)

Second, it would be a mistake to equate urbanization with improved diet although this seems to be the case when we look at average urban consumption figures. Results from a consumption survey in Chagoua, one of the poorer quarters of N'Djamena, show that the average per capita calorie ration was inferior to that of all surveyed rural areas in the southwest of Chad even during the "hungry season".[5] Thus, while the problem of urban poverty is not as acute, in a relative sense, as it is in other parts of the third world, we must recognize the urban poor as an increasing percentage of the Periphery population. Seasonal food shortages and price increases result in an *average* decline in urban calorie consumption which again would be disproportionately borne by the lower-income segments of the population.

Third, the Chad study points to the importance of millet beer in total sorghum/millet consumption. In rural areas of southern Chad an average of 12 percent of total grain consumed was in the form of local beer. In towns in the survey region this figure rose to 22 percent of total consumption. This pattern is repeated across much of the Sahel. In Ouagadougou it is estimated that about 15 percent of the active female population is engaged in the small-scale production of millet beer (*dolo* in Upper Volta) which also consumes

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[5]Auffret [1974, pp. 117-120].

about 15 percent of the total cooking fuel (wood) imported into the city and substantial quantities of grain since an average recipe calls for about one kg of grain for each three kg of beer.[6] The character of this industry has changed with its transplantation to urban areas. While traditionally serving a functional purpose of inducing and facilitating participation in communal agricultural labor, in urban areas it has provided a cheap means of social drinking although sharply rising costs are driving prices upwards and near those of modern bottled beer.

Population Growth and Urbanization

Total population growth and its geographical distribution are undoubtedly the strongest immediate determinants of changes in aggregate demand for cereals in Sahelian countries. Across the Sahel the rate of increase in total population has been accelerating and is generally expected to do so through the 1990s with urbanization and improvements in health care both contributing to this trend. FAO estimates that the average overall annual rate of population growth for the Sahel will rise from its estimated average of 2.5 percent per year in 1970 to 1975 to a rate of 3.0 percent per year for 1985 to 1990.[7] These estimates are somewhat more liberal than those employed in deriving the United Nations "medium variant" population projections which are used in this study.[8] These trends are contained

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[6]Société Africaine d'Etudes et de Développement (S.A.E.D., 1976].

[7]UN/FAO [1976a, p. 63].

[8]These demographic projections and implications are discussed in detail in IBRD [1976a].

in Table IV-4 in which total population for each country is broken down by numbers and percentages for the rural and urban sectors and for the respective capital cities only. Over the next dozen years the total population of the region will climb from its current 27 million or so to approximately 38 million. The 1990 total population is projected to be 204 percent of what it was at independence in 1960; but the key trend is the dramatic increase in the relative size of the urban population which in 1990 will be 423 percent of the independence level while the comparable increase for rural areas is 184 percent.

Urbanization in the Sahel is a relatively new phenomena although towns have played an important role in Sahelian life for many hundreds of years. Precolonial towns were quite small although important as political and commercial centers, particularly in some of the larger Savannah feudal empires and at key junctions on inland trade routes. Increased integration into the world economy led to the development of various urban centers in a fragmented Periphery. Consistent with, or in fact implied in, the center periphery framework are both "demand-pull" and "supply-push" factors at work in the process of rural-urban migration. These are not dissimilar to patterns in other parts of the developing world but may be more explicit due to the narrow economic foundations of the Sahelian urban sector and due to West African rates of urbanization which are among the highest in the world because of a very small initial base.

On the "demand" side as we have seen, the money economy and the creation of associated modern property rights as means to accumulate private wealth are located almost exclusively in cities and

TABLE IV-4

POPULATION OF THE SAHEL BY SECTOR
(IN MILLIONS AND PERCENTAGES)

	Year	Chad	Mali	Mauri-tania	Niger	Senegal	Upper Volta	Total Sahel
Millions, Total	1960	2.98	4.08	.95	2.91	3.03	4.40	18.35
	1975	4.02	5.70	1.28	4.60	4.42	6.03	26.05
	1990	5.55	8.46	1.80	7.05	6.41	8.65	37.92
Millions, Rural	1960	2.78	3.68	.88	2.74	2.34	4.16	16.58
	1975	3.46	4.93	1.14	4.17	3.17	5.53	22.40
	1990	4.29	6.89	1.50	6.09	4.08	7.58	30.43
Millions, Total Urban	1960	.20	.40	.07	.17	.69	.24	1.77
	1975	.56	.77	.14	.43	1.25	.50	3.65
	1990	1.26	1.57	.30	.96	2.33	1.07	7.49
Millions, Capital City	1975	.19	.35	.12	.12	.80	.17	1.75
	1990	.43	.68	.25	.27	1.43	.34	3.40
Percentage, Rural	1960	93	90	93	94	77	94	90
	1975	86	86	89	91	72	92	86
	1990	77	81	83	86	64	88	80
Percentage, Urban	1960	7	10	7	6	23	6	10
	1975	14	14	11	9	28	8	14
	1990	23	19	17	14	36	12	20
Percentage, Capital City	1975	5	6	9	3	18	3	7
	1990	8	8	14	4	22	4	9

SOURCE: IBRD [1976a].

towns. This, of course, is a key structural component of the international system as described in Chapter II and is associated with exaggerated patterns of colonial administrative centralization. Access to almost the entire imposed value system is through opportunities in urban centers. This pattern has accelerated since independence as six new national governments had to be created to replace a fairly streamlined hierarchical system of colonial administration.

That most urban growth in the Sahel, except to some degree in Dakar, is fueled primarily by the expansion of the government sector, is beyond doubt. This is emphasized in Table IV-4 by looking at the percentage of estimated urban population which will be located in Sahelian capital cities in 1990. The average for the region as a whole, influenced by the large population of Dakar, is 45 percent, with the range extending from an estimated 28 percent of the urban population of Niger in Niamey to 83 percent in Nouakchott, Mauritania, which, until the 1960s, was largely sand-dunes. Not only is the government sector the largest employer but it also creates most of the demand for the modern service sector (water, power, education, travel, health services, etc.) and the generally frail import-substitution consumer industries. It is one of the cruelest ironies that the mechanisms needed to transfer development assistance funds, designed in some cases to promote greater self-sufficiency, help speed urbanization which is generally the most tangible evidence of increasing dependency.

The other side of this dependency coin, which is the "supply-push" component of urbanization, has also been discussed. Lack of opportunities for wage employment in rural areas, imbalanced domestic

terms of trade and an entire incentive system geared to rewards in urban areas combine to promote heavy emigration to the cities, both nationally and within West Africa.

The implications of these trends for the production of staple food crops and thus for the magnitude of the grain marketing and storage problems are fairly clear. On one hand an increasing percentage of the population is no longer producing its own food and, through changes in income and life style, the composition of its food demand is also changing. On the other hand, migration (draining off some of the potentially most productive labor power), inappropriate price policies (which have kept urban food prices fairly cheap), competition with export cash production, and inadequate transportation/communications infrastructure have all tended to limit sustained increases in food grain production. The dominant lesson to be derived from the 1967 to 1973 drought period was that this doubly-eroded agricultural economy, undergoing fairly rapid transformation, was a precarious, dependent structure which found it had no choice but to rely on the outside world for basic food supplies.

Trends in Food Grain Production, Yields and Imports

West African food grain production, as many other economic and demographic variables, is dominated by Nigeria, which is home to about 54 percent of the region's population. In Table IV-5, we see that this one country, out of seventeen in our definition of the region, grew in a base period centered on 1969-71, an annual average of 49 percent of total cereals, 58 percent of millet and sorghum and 62 percent of the aggregate tonnage of roots and tubers in West Africa. Northern and central Nigerian production of millet

TABLE IV-5

SAHEL, NIGERIA AND TOTAL WEST AFRICA: ANNUAL AVERAGE[a] GROSS PRODUCTION OF MAIN STAPLE FOODS ('000 MT AND PERCENTAGES OF WEST AFRICAN TOTALS)

Commodity	Sahel		Nigeria		Remainder of West Africa		Total[b] of West Africa	
	('000 MT)	Percentage	('000 MT)	Percentage	('000 MT)	Percentage	('000 MT)	Percentage
Sorghum/Millet	3,712	34	6,363	58	896	8	10,971	100
Maize	192	7	1,146	39	1,585	54	2,923	100
Paddy	407	17	427	18	1,428	65	2,362	100
Total cereals	4,307	26	7,936	49	4,013	25	16,256	100
Roots/Tubers	761	2	25.136	62	14,406	36	40,303	100

SOURCE: IBRD [1976b].

[a]Annual averages computed from different base periods: Sahel, 1969-71; Nigeria, 1967-71; remainder, other comparable periods from 1966-75.

[b]Countries included in West Africa are same as in Table II-1.

and sorghum is a key factor in any consideration of *regional* coarse grain stock or stock coordination schemes. Proposed Nigerian stock plans and their implications for the Sahel will be briefly discussed in Chapter VII of this study.

The Sahel, with about 19 percent of the total regional population, grew a disproportionately larger share of total sorghum and millet (34 percent) and total cereals (26 percent) while producing smaller amounts of other cereals and particularly of total roots and tubers during the same time period. The remainder of West Africa--all coastal countries with generally higher rainfall--grew much grearer shares of maize, paddy and tubers.

Focusing on Sahelian cereals, aggregate national production and yield estimates, obtained largely from FAO, USDA and IBRD sources, were subjected to statistical analysis to examine two key areas: (1) secular trends in country-specific and regional cereal production and yeilds, and (2) the magnitude and correlation of variation in these trends both within and among the Sahelian countries.

Production

Estimated production figures were available for millet, sorghum, maize and rice for most countries from 1951 through 1975. A number of data series were examined and USDA figures proved to be most useful for Senegal, Mali, Niger and Upper Volta.[9] IBRD compilations were used for Chad and Mauritania although these data were originally derived largely from various issues of the FAO Production Yearbook.

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[9]Data obtained on computer printout from the Foreign Demand and Competition Division, Economic Research Service, U.S. Department of Agriculture. More limited, condensed versions of the same time series are available in USDA, ERS [1976].

To assess change over time, the data were analyzed over two time periods, 1951-75 and 1961-75. A detailed summary of the means and standard deviations of these two time series, by country and by crop, is contained in Appendix A, Table A-4. In a few instances the means are significantly different but, in general, they are quite close. Therefore, a few summary figures calculated from the 1961 series are presented in Table IV-6 on the next page and can be considered reasonably representative. The 15 year mean for combined sorghum and millet production, 3.758 million metric tons, is about 87 percent of mean total cereal production, 4.344 million metric tons. These figures are quite close to the averages in Table IV-5 and, for an estimated 1970 population of 23 million, would represent per capita annual millet-sorghum and total cereal production of 163 and 189 kilos respectively.

Trends in total production levels are quite complex given structural change in the production base over time and aggregation problems, both compounded by fairly weak data and the confounding influence of the 1967-73 drought. However, a number of fairly clear trends emerged from regression analysis of the 1951-75 and 1961-75 time series. First, as always, the choice of starting point and length of time series can make a major difference in the trends revealed. A general pattern emerged in the data (present for different crops at different levels of aggregation) and is represented by Figure IV-1 which displays total cereal production for Mali, Niger, Senegal and Upper Volta, 1951-75. In it we can see that production levels increase fairly consistently from 1951 to 1964, oscillate around this level for 6 or 7 years, drop very sharply

TABLE IV-6

MEAN ANNUAL GRAIN PRODUCTION AND COEFFICIENTS OF VARIATION[a] BY CROP AND BY COUNTRY, 1961-75 (THOUSANDS METRIC TONS)

Country	Crop							
	Millet/Sorghum		Maize		Rice		Total Cereal	
	Mean	c.v.	Mean	c.v.	Mean	c.v.	Mean	c.v.
Chad	694	.28	--[b]	--[b]	--[b]	--[b]	745	.25
Mali	735	.16	81[b]	.25[b]	148[b]	.22[b]	964	.14
Mauritania	78	.36	--[b]	--[b]	--[b]	--[b]	83	.34
Niger	538[c]	.10	2	.35	27	.48	850	.12
	283[d]	.20	--	--	--	--	--	--
Senegal	517	.21	40	.40	102	.33	659	.23
Upper Volta	320[c]	.18	93	.38	36	.17	1,042	.18
	593[d]	.21	--	--	--	--	--	--
Sahel	2,986	.11	217	.22	312	.16	3,516	.11
(with Chad, Mauritania)	(3,758)	--	--	--	--	--	(4,344)	--

SOURCE: Appendix, Table A-5.

[a]Coefficient of variation is the standard deviation divided by the mean.

[b]Data not adequate for entire period, therefore omitted.

[c]Millet.

[d]Sorghum.

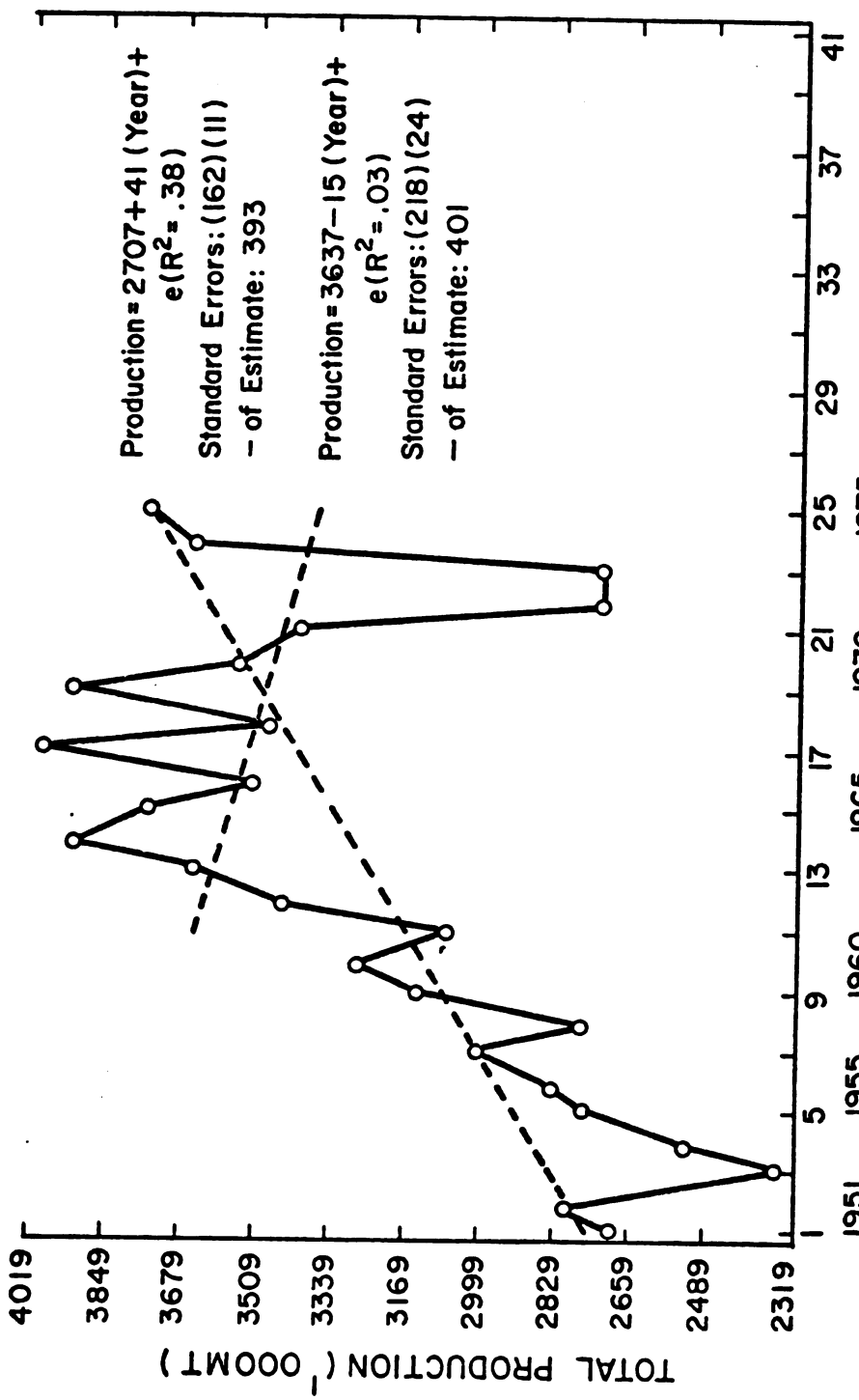

Figure IV – 1
TREND IN COMBINED TOTAL CEREAL PRODUCTION FOR MALI, NIGER, SENEGAL AND UPPER VOLTA, 1951 – 1975

in 1972-73 at the height of the drought, and climb back up to about their 1964-70 average in 1974 and 1975.

Two regression lines, calculated for 1951-75 and 1961-75, are plotted on the same graph and demonstrate that we must be very careful in our choice of base period when analyzing production levels over time. Slopes of opposite sign such as these characterize many of the crop and country-specific time series analyzed over the two time periods. The negative slope is highly sensitive to changes in data points as the low R^2, large standard error for the slope coefficient, and wide variance in the data points indicate. It should also be noted that the "fit" of the 1951 series increases when the data are subjected to natural log transformation, although it is not acceptable practice to compare "R^2's" in these circumstances.

A summary of the more statistically significant regression results[10] are contained in Appendix A, Table A-6. For each country there are really two production trends which are of interest, millet/sorghum and rice. Maize is difficult to analyze in these aggregates because the production is relatively small and, in much of the region, it is grown in small fields directly surrounding or adjacent to the family compound which complicates estimation and can lead to great variations in actual yield.

Taking millet/sorghum first, in Appendix A, Table A-6, we can see that estimated production in Mauritania and Chad dropped sharply and fairly continuously from 1961 through 1974. Mali also shows a

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[10]That there is no linear or log trend in the production figures is also "significant" in that it generally indicates no major systematic change in aggregate output of that crop, just wide year to year variation.

strong decline in production since 1961 but more recent reports in 1975 and 1976 indicate record crops and problems of surplus disposal, particularly for government held supplies.[11] For Senegal, Niger and Upper Volta, millet and sorghum trends generally follow the aggregate pattern in Figure IV-1, increasing fairly strongly over the entire 1951-75 period but generally stable or slightly declining *on the average* since 1964. It should be noted that the *rate* of increase shown in Figure IV-1 for 1951-75 is about 1 percent per year and thus is about half the *rate* of aggregate increase in total Sahel population which is about 2 percent per annum. Increases in aggregate production are thus more nearly consistent with the rate of *rural population growth* which may then be a reasonable indicator to use when projecting production trends.

Rice production increased overall at a rate about twice that of sorghum and millet. Mali, which produces somewhat under half of all Sahelian rice, showed some decline since 1961 but this is largely due to the higher vulnerability of output from major projects, such as the *Office de Niger,* to rainfall shortages. Niger, Upper Volta and Senegal, which have all significantly increased controlled irrigation production of rice, showed strong, continuous rates of production increase, particularly over the longer time period.

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[11] See, for example, Steedman et al. [1976].

Yields

Trends in yields follow patterns not greatly dissimilar to those in production levels but the figures themselves generally have less absolute significance since yields can vary so widely within countries and by type of input "package" employed. Average yields by crop and by country for the two time series are contained in Appendix A, Table A-5 and the most significant regression results are in Appendix A, Table A-6.

Again reflecting the impact of the drought years, yield trends for the coarse grains and maize decline sharply over the 1961-75 period. Yields of rice--some of which is under irrigation--showed much more resistance to drought and fairly strong increases in yields were recorded in Niger and Upper Volta.

As in other semi-arid lands, weather variation, particularly rainfall variation, is strongly associated with Sahelian cereal yields. Where agricultural data systems are very weak, it may be that certain statistical relationships among more readily measurable natural phenomena, such as rainfall and river flows, will provide improved prediction and forecasting capabilities which can be very important to a grain stock system.

In an attempt to examine this for the Sahel, average annual rainfall figures for Upper Volta for 1951-75 were regressed on and correlated with both production levels and yields for all cereals and cereal averages. This did not produce too many encouraging results, but several relationships are worth noting. First, a strong negative linear relationship was observed between Bob-Diolasso rainfall levels and total annual Upper Volta rice production, much of

which comes from the "Bobo" region. (This result has also been reported for irrigated rice production levels in Niger and is hypothetically attributed by other authors to decreased radiant energy caused by greater cloud cover.) Also a strong positive relationship was found over the 1961-75 period between averaged Upper Volta annual rainfall and sorghum yields. Even with only fragmentary results such as these, inquiries along these lines seem to offer potential for relatively cheap early warning crop forecasting systems.[12]

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[12]This is confirmed in the recently published work by Davy et al. [1976]. A number of general conclusions can be drawn from this important baseline study:

1. Weather and resulting crop response is extremely localized in West Africa within the longer-run averages of each broad ecological belt. Since much of the rainfall in the region is convectional in nature and highly specific in incidence there can be great variability among close-by rainfall stations within the same climatic zone. Therefore, rainfall averaging should include readings from as many stations as possible stratified by ecological zone.
2. Even with these data problems very high correlation coefficients have been computed in the Sahel between averaged national and sub-national rainfall figures and the yields of some crops, with these results often as precise as those obtainable from experiment station data. For example, as a rough rule of thumb for Senegal and Niger, the authors suggest that when comparing yields between succeeding seasons, for every millimeter increase in rainfall there may be 1.5 to 2.0 kg per Ha^{-1} increase in millet/sorghum yield per hectare.
3. In addition, large and small river flows, reflecting rainfall and runoff in their respective catchment basins and a close relationship between maximum and mean annual flows, also provide promising means of assessing future average yields both on national and sub-national bases.
4. These statistical relationships must be worked out for each nation or sub-national region based on an adequate number of observations and an in-depth understanding of the agronomic relationships at play in that particular environment.

For an example of a national-level weather prediction model which has been tried with encouraging results for Niger, see LaBonne and Garzia [1975]. For further introduction also see Thompson [1975] and Kelly [1975].

Correlation of Yield and Production Levels Variation

We are interested in the correlation of production and yield variations to assess the extent to which temporarily and chronically deficit regions or countries could be *theoretically* supplied from surpluses in neighboring regions or countries. Highly correlated total production by crop could indicate that this "venting of surplus" to mutual advantage would be more difficult to achieve.

Table IV-7 provides an illustrative summary of the correlation analyses focusing on the relationship in total cereal production by country over both the 1951-75 and 1961-75 periods. (More detailed versions of these results are contained in Appendix A, Tables A-7 and A-8.) What is of particular interest is the correlation of production levels in adjoining countries in the region where it would be possible to conduct inter-grain board exchanges under the right supply conditions.

The data for Chad and Mauritania refer only to 1961-75. During that period both countries showed fairly strong secular declines in production levels and this results in a high "r" value. This also explains the high coefficient with Mali for both countries. Chad production levels are not particularly strongly associated with those in neighboring Niger except with Niger sorghum which also showed a consistent secular decline. Mauritanian production was highly correlated with that of Mali but not of Senegal.

For the other four countries, we can examine these correlations over both time series. For Mali, aside from the relationships mentioned above, only its relationship with Niger production levels is significant over the two time periods. Cereal production in

TABLE IV-7

PEARSON CORRELATION COEFFICIENTS FOR TOTAL CEREAL PRODUCTION BY SAHELIAN COUNTRY, 1951-75 AND 1961-75 (COEFFICIENTS WITH "*" SIGNIFICANT AT .05 OR BETTER

1951-75	Mali	Niger	Senegal
Niger	.35*		
Senegal	.17	.43*	
Upper Volta	.07	.57*	.71*

1961-75	Chad	Mauri-tania	Mali	Niger	Senegal
Mauritania	.62*				
Mali	.73*	.75*			
Niger	.42	.64*	.63*		
Senegal	-.06	.30	.26	.26	
Upper Volta	.13	.23	.00	.41	.41

SOURCE: Appendix, Tables A-7, A-8.

Senegal, Upper Volta and Niger is fairly strongly correlated over the 1951-75 period but less so over the drought-dominated 1961-75 period. As Figure IV-1 showed, all four countries showed a sharp drop in total production in 1972 and 1973 but the levels were *lowest* in Niger and Upper Volta in 1973, Senegal in 1972 and Mali was equally low in both years.

Although not explored in detail, patterns of intra-country variation also show similar contradictions in the correlation of total output by region. In summary, it is probably safe to say that in most years severe shortages will probably be fairly localized and it should be possible to shift portions of relative surpluses to adjoining regions and countries (assuming, of course, that transport costs do not far exceed the spread in relevant prices across the two areas). It should also be clear that in unusually bad years it may not be possible to count on much assistance in this respect from neighboring production zones, particularly if two bad years in a row hit the region as a whole, such as occurred in 1972 and 1973.

Grain Imports

For West Africa as a whole the 1960s produced sharp and consistent patterns of increase in food grain imports largely due to the twin phenomena of rapid urbanization and food policies which have provided limited production incentives to farmers. Average total food grain imports in 1969-71 were 75 percent higher than the average import levels for 1961-65. Senegal and Mauritania alone, out of the 21 countries in IBRD's West Africa region, accounted for an average of 27 percent of total regional grain imports over the

1969-71 period. The decline in self-sufficiency has been much more rapid in these two countries than the four others in the Sahel.

Traditionally wheat and wheat flour have been the major grain imports to the region providing bread and pasta products primarily to a small population in cities and towns. In recent years the amounts of rice and other grains imported (mostly maize and coarse grains) have also grown substantially. The drought period, of course, dramatically increased food imports, much of it food relief which will be examined briefly in the next chapter.

Table VI-8 shows some of the principal variables in the Sahelian food import situation. First, we can see that in more normal years Senegal and Mauritania dominated food imports, with an average of 81 percent of total regional imports (65 and 16 percent respectively). Next, it is clear that wheat and flour have been the dominant import in the four interior countries with rice important to Senegal and Mauritania. Other grains (maize and coarse grains) also made up substantial portions of imports in Mali, Mauritania and Niger. The relative dependency of the two coastal countries is indicated by the fact that average imports for 1969-71 amounted to 78 and 44 percent of estimated domestic production in Mauritania and Senegal respectively.

Import figures are also shown for 1974 and reflect the height of massive food relief shipments to the region. Note that the large amounts of donated maize and sorghum push the relative proportion of "other grains" to 54 percent of total imports. It should not be overlooked, however, that rice and wheat imports also increased substantially.

TABLE IV-8

SAHELIAN FOOD GRAIN IMPORTS, AVERAGED FOR 1969-71 AND 1974

Country	Wheat & Flour		Rice		Other Grains		Total	Percentage of Domestic Production
	('000 MT)	%	('000 MT)	%	('000 MT)	%	('000 MT)	
Chad								
1969-71	10.8	96	—	0	0.4	4	11.2	2
1974	9.0	20	—	0	37.0	80	46.0	8
Mali								
1969-71	13.3	44	4.6	15	12.3	41	30.2	3
1974	20.8	9	65.3	28	146.0	63	232.1	27
Mauritania								
1969-71	16.7	22	19.4	26	39.0	52	75.1	78
1974	19.4	15	32.0	25	75.0	59	126.4	373
Niger								
1969-71	5.5	52	0.1	1	5.0	47	10.6	1
1974	10.7	6	0.1	0	176.0	94	186.8	24
Senegal								
1969-71	107.8	35	150.9	48	53.6	17	312.3	44
1974	116.7	24	230.5	48	130.0	27	477.2	57
Upper Volta								
1969-71	25.5	66	1.8	5	11.5	29	38.8	4
1974	20.8	28	—	0	54.0	72	74.8	6
Sahel Total								
1969-71	179.6	38	176.8	37	121.8	25	478.2	11
1974	197.4	17	327.9	29	618.0	54	1,143.3	27

SOURCE: Various issues of the FAO Trade Yearbook.

Food policies dealing with grain imports will be crucial in the years to come, particularly in considering stock policy. There is an increasing awareness by the Sahelian governments of the strong implications for self-sufficiency of trends in urbanization, income-elastic substitution of higher prestige grains for sorghum and millet, and the effects price policies can have on stimulating food production. Efforts are being made to expand domestic rice and wheat production and to develop substitute flours with a substantial coarse grain content.[13] In addition, several of the Sahelian countries have imposed tight import quotas on items such as rice. So far, however, these efforts have been fragmented and do not address the main issues of international dependency and domestic stagnation which underlie these trends in food production, consumption and imports. These areas will be examined again in later chapters.

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[13]The Technical Institute in Dakar, Senegal, is working on a composit bread made of 30 percent millet and 70 percent wheat. The Government of Senegal has decreed that by 1978 all bread in the country will be of the composite form. Shifting from all wheat to the composite bread will not result in a decline in protein content since millet contains as much protein as wheat flour. However, the composite is not as white in color as bread made from wheat flour.

CHAPTER V

PRIVATE GRAIN TRADE AND STORAGE

This chapter will serve two purposes. First, it will provide further specification of the center-periphery model in the area of food grain marketing and storage. Second, this description of current knowledge of private Sahelian grain trade will help build a transition to the remaining chapters of this study which deal with Sahelian government participation in food grain markets. In doing this, a number of generalizations concerning private grain trade and traditional grain storage practices will be drawn from the literature on West African agricultural marketing.

Rural agricultural markets--often misunderstood, romanticized or manipulated on the theoretical level for ideological purposes--play a vital role in the process which incorporates the Sahel into West African and larger international economic systems. Paralleling the tendency for agronomic research to focus heavily on the development of export cash crops, much of the research in West African marketing has focused on the evacuation of cash crops. The literature on food crop marketing is much more limited and quite diverse, with sharp differences in methodology and approach between studies in the

French and English traditions. We can, however, draw conclusions which are appropriate to the focus of this study.[1]

West African food marketing studies can be roughly forced into three groups, two of which follow food marketing convention and, not illogically, focus on urban food-sheds, and a third is a set of anthropological studies which are largely confined to an examination of the marketing process in a village environment.

The first group involves food marketing studies conducted in English speaking West Africa. As in other domains, this group is dominated by studies undertaken in Nigeria with those centered on the sorghum/millet areas of Northern Nigeria of particular interest. William O. Jones' investigation of staple food crop marketing is by far the most well known. He and his colleagues attempted to analyze

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[1]To fully explore the role of agricultural markets in the nature and evolution of West African center-periphery relationships one should include a review of: (1) economic histories of traditional long distance trade and the nature of surplus extraction in precolonial Savannah kingdoms, (2) sociological investigations of the importance of ethnic diasporas (such as Lebanese, Hausa, Wolof and Dioula trading clans) and specialized market channel participants (such as traditional market place "landlords and brokers") who facilitate exchange over the "feudal interaction structures" of Chapter 2, (3) the literature in economic geography on the spatial organization and evolution of rural market networks--much of which focuses on the function of rural *periodic* market systems in West Africa, (4) the area of rural agricultural factor markets which includes land allocation and use studies, labor migration studies, etc., and (5) the role of modernizing institutions such as cooperatives in village-level agricultural marketing, particularly the extensive cooperative movements in Senegal and Niger.

For an introduction to these topics, see my previous paper, "The Political Economy of Agricultural Marketing in West Africa," Department of Agricultural Economics, Michigan State University, East Lansing, September 1976 (unpublished working paper). In addition, many of the most important works are carefully annotated in Arditi [1975]. Other bibliographic sources are Hopkins [1973], Bohannan and Dalton [1962] and Miracle [1970].

the structure and performance of key staple food systems, including flows, exchange levels, personnel and facilities, in the supply areas of four African cities: Enugu and Ibadan, Nigeria; Freetown, Sierra Leone; and Nairobi, Kenya. The principal focus of this work was to examine market price formation through an analysis of variables such as:

> . . . market information, channels of grade, bulking, transporting, preservation and storage, contracts, financing, risk bearing, traders' margins, restraints on trade, weights and measures, quality standards, fees and taxes, and arbitrage among markets.[2]

Greater detail is available in component studies by Whitney [1968] on Eastern Nigeria and Mutti and Atere-Roberts [1968] on Sierra Leone and the related study by Gilbert [1968] on Northern Nigeria.

At about the same time as the Jones study was being undertaken, Rolf Gusten [1968] conducted a very interesting study of foodstuff flows in Western Nigeria. His work differs from those mentioned above in that he made no attempt to describe causality or efficiency in the system he was "tracking". Lawson [1967] undertook a more descriptive study of Ghanian food markets at about the same time in the 1960s. More recently, Northern Nigeria has been the focus of renewed exploration of food crop marketing with Ejiga's [1972] study of the cowpea trade and H.M. Hays' [1975] examination of the marketing and storage of food grains, a study which is somewhat similar in approach to Jones' earlier work.

A second group of studies, those in the francophone countries, are similar in their focus on the provision of urban food supplies

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[2]Jones [1973].

although they tend to be more descriptive and lack some of the theoretical and analytical sophistication of the anglophone studies. This may be partially compensated for by a greater refinement in descriptions of product flows and in cartographical representation.

Couty [1965] examined the production and marketing of millet around the regional capital of Maroura in the northern Camerouns Diamara Department. He devoted substantial attention to the impacts of market prices and their fluctuations on the competition between the cultivation of millet largely for subsistence, and cotton for the export market. SEDES, the large French para-statal research organization has conducted a large number of market research efforts ranging from studies of commercial possibilities in specific commodity markets to global assessments of marketing strategies, such as their widely used study in Niger [SEDES, 1963]. Recently it completed a study of the problems of "provisioning" five large cities with food in 1985, given current trends in urban growth and consumption (see SEAE [1973]). Le Chou [1966] conducted a descriptive study of commercial trade in the Bouake region of the Ivory Coast and Bollinger [1974] has done the same type of study for all of Upper Volta. The United Nations study on food grains in Chad [Auffet, 1974] which was cited in the previous chapter, contains fairly extensive portions dealing with private marketing as does a very recent study on cereal price structures and marketing mechanisms in Mali [Haik, 1976].

The third group of marketing studies which are of use in considering Sahelian staple foods are anthropological studies focusing on the role of markets in the context of the traditional economy.

A useful beginning is provided by Bohannen and Dalton [1962] who edited a collection of studies on pre-independence local African markets. Claude Meillassaux [1964] conducted important micro-level research among the Gourou in the Ivory Coast and later edited one of the most useful collections of West African market studies which incorporates many elements of the center-periphery framework used in this study [Meillassoux, 1971]. Finally, and also focusing on the impact of outside capitalism on the traditional economy, is an important study by Claude Raynaut [1973] on millet exchange at the village level in Niger.

The studies mentioned here and others have been reviewed to draw summary conclusions on the following topics of direct relevance to the establishment and operation of government grain stocks: grain market structure and operation, the amount and nature of marketed surplus, grain market efficiency and degree of competition, and the distributional impacts of the operation of grain and other staple food markets.

Market Structure and Operation

Here we are interested in the disposition over space and time of the total production of food grain. A farmer's production of millet and sorghum can be disposed of in the following ways:

1. Consumption by the farmer and his family which generally involves the majority of the annual crop. This means that the bulk of the crop must be stored at the local level over at least part of one year;

2. Gifts and other forms of traditional non-monetary exchange (such as Zakka, Islamic grain tithes in Northern Nigeria) which generally take place within the village or within ethnic clan and family structures;

3. Sales to other village residents (for storage, resale or transfer to local markets) and/or other market participants in various types of area markets.

Relatively isolated villages are linked both to isolated periodic markets and less isolated ones which are on roads permitting at least some regular vehicular traffic. These periodic markets are then linked to larger bulking markets and to urban markets, both within and outside a given region.

Traditional marketing nomenclature can be applied to the wide range and large numbers of participants in West African grain markets. Producers, part-time village traders and transporters often may use donkeys or bicycles to convey grain (and, importantly, a variety of other products) to and from local markets. Rural assemblers bulk quantities of grain collected in villages or rural markets and generally make arrangements with transporters to move these supplies to wholesalers, urban assemblers (who have the capital and ability to specialize in inter-regional shipments), and retailers in larger urban and regional markets. It is important to note that such patterns constantly overlap and are often "short-circuited" reducing the number of participants when, for example, farmers can take their grain directly to a regional market or when travelers may profit on a long trip by carrying a few sacks of grain directly to an urban market. In a large market many of these types of transactions may take place concurrently in the same part of the market.

Market periodicity permits both "thin" supply and demand to be concentrated, and allows traveling buyers of farm products and sellers of consumer goods to increase the effective size of their

markets. Communication and transportation to and among markets is a major barrier to fuller economic integration. In effect, "islands of competition" (again, in overlapping patterns) are imperfectly linked together by means of communication and transportation frequently subject to various types of local oligopolistic control. Neither the government nor private parties regularly make actual market prices available either to farmers or traders. In more isolated rural areas transportation is either very costly or is available on a discontinuous basis when, for example, a trader can get a truck to a remote village and obtain surplus production at extremely low prices. The degree to which "cartelization" dominates grain wholesaling in urban areas, as it does other types of longer-distance agricultural trade such as cattle, kola nuts and export crops (when they are not handled by government monopolies) is not fully known and may be difficult to ascertain, particularly when government official prices and other market interventions drive much of the trade from public market places and into private homes and courtyards as has happened in Niger, for example, in recent years. Large wholesalers who operate in major cities do seem to spatially allocate the urban food supply shed among themselves although price competition probably places some rough bounds on such practices.

Marketed Surplus

The percentage of food grain production that farmers take to market can vary greatly across the Sahel. It varies among regions according to the overall food balance, it varies within regions by farm family composition and size, by ability to store grain (and meet current cash needs by other means), by access to markets, by farm enterprise combination which, in turn, is influenced by relative food and cash crop prices available "at the farm gate", at the nearest market, etc. The rule-of-thumb figures often used that the "average farmer" may sell 10 to 20 percent of his grain production may coincide with national aggregate consumption and production estimates but mean little in any particular village or to any strata of farm families. Hays reports, for example, that up to 40 percent of his sample of farm families sold no millet or sorghum at all although they grew both. Given volatile seasonal grain prices the amounts and timing of grain sales by family type can be highly important as we will see below.

Hays also found that, in the aggregate, about 80 percent of grain harvested in Northern Nigeria went into village level storage for later consumption, gifts and sales. Gifts in general amounted to about the same proportion of aggregate production as sales but it is difficult to estimate what part of gifts is eventually marketed surplus due to complex patterns of purchase and resale, or sale of previous gifts. One result that Hays' data clearly reveals is that larger farmers generally sell disproportionately more grain than smaller farmers and they sell higher percentages of that grain later in the season when they can take advantage of seasonal price

increases. As we see below, Raynaut's data for one village in neighboring Niger go far beyond this level of generality in assessing the dynamic importance of differential family ability to produce, store and trade grain.

Market Efficiency and Competition

This aspect of food grain marketing has received the greatest attention in studies in English-speaking areas reflecting a greater concern to demonstrate and validate certain types of assumed market performance. Market efficiency is the key phrase in these studies. Ignoring the warnings of such critics as A.A. Schmid [1974] who warn that "efficiencies do not exist in nature" and, thus, must be provided detailed, multi-faceted definition, market competition and efficiency are measured through an unidimensional analysis of comparative market prices over space and time with price differences compared with transportation and storage costs.

Hays puts this very directly by stating that he wants to test four hypotheses, that:

1. The traditional market structure is basically competitive and fulfills the requirements generally specified as necessary for competitiveness.

2. The margins at each stage of the marketing chain are not greater than marketing costs.

3. The markets for millet and sorghum are closely interrelated and the intermarket price differentials are not greater than transport and handling costs.

4. Seasonal price increases for millet and sorghum are not greater than the cost of storage.[3]

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[3]Hays [1975, p. 2].

He, like Jones et al., before him, basically confirms the first two hypotheses in Northern Nigeria and has mixed results on the other two. Spatial arbitrage is seen as inadequate in grain markets when measured by theory's dictate that intermarket price differentials should differ only by transport costs. He finds that while different sub-systems are internally competitive they are not effectively integrated due to poor information, weak physical and institutional infrastructure, risk bearing behavior and an effective segmentation of the market. Similarly, temporal price differences are greater than they "should be" but this seems to provide the possibility of some distribution of excess profit to market channel participants at all levels. Thus, he, like Jones, goes on to make recommendations that the role of government should be restricted to making "facilitating arrangements" to improve market intelligence and roads, to provide improved standard measures and market facilities, to establish a national marketing service, and to concentrate more attention on the farm input delivery systems. Jones also suggested methods of fostering further integration of urban food systems through strengthening the system of bulking markets in supply hinterlands, and even advocating the creation of commodity exchanges to help facilitate these transactions. Another recommendation was that government should only directly intervene in the market when rapid shifts in demand present unusual opportunities for monopolistic exploitation by private traders.

Few would argue with these conclusions and recommendations as far as they go. They simply do not go very far if one is interested in a broader definition of rural development. There is a strong

tendency to concentrate attention sequentially on the horizontal patterns of market competition at various levels in the market channel and to look at vertical organization and integration in fairly simple terms. This can miss important patterns of concentration and trade restrictions along the dendritic interaction structures which link freer market "islands" of different sizes.[4] These spatial and temporal structures are dotted with ad hoc and permanent, traditional and modern, institutions, rules, borders, boundaries and property rights which only the specialized few can master and which are not completely captured in comparisons of inter-market price and cost differentials. The relationship between institutional organization and the arrangement of economic activity over space is of particular importance. A working hypothesis, inspired particularly by Edgar Johnson [1970] is that, for much of West Africa, the organization of space for agricultural production and marketing is not optimal for a modernizing yet independent, more self-sufficient and locally-controlled system. Finally, the most important objection one can make to this approach is that it does not consider, except by assumption, the relative welfare positions over time of different classes of market participants.

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[4]Marvin Miracle [1968], on the other hand, focuses on the very obvious patterns of cartel formation in the vertical structure and operation of West African food systems and may, in fact, overemphasize the local-level marginal quantity and quality adjustments in food purchases and sales which he sees as further demonstration that the standard assumptions of African market competitiveness are greatly overstated. He does, however, begin to focus on the key role markets play in the process of capital accumulation (largely through violations of competitive assumptions) and speculates as to whether the process of accumulation might not be accelerated if certain types of reforms were implemented. For further details see this insightful article.

Distributional Effects of Market Operation

Micro-level studies being undertaken in West Africa by agricultural economists and practitioners of other disciplines are helping to broaden our knowledge of the functioning of rural systems. However, the illumination provided is sometimes more constrained than need be because partial equilibrium analyses may hold constant key variables whose movement should be followed over time. In the traditional field of micro-marketing studies this is particularly true. Great imporvements can be made simply by broadening the scope of these studies to give traditional conclusions about the nature of competitive markets some contextual meaning. The main point is not to dispute the empirically testable degree of competitiveness of markets but to examine what happens to the participants who deal in these markets and to the societies which contain these transfer mechanisms.

A good example of a more integrated, systematic approach which can realistically comment on distributional impacts is the important study of peasant grain trading in a Niger village by French anthropologist, Claude Raynaut [1973]. He supplemented an original study of production patterns and the socio-political organization of the village and its links to the outside world, by recording all internal and external grain transactions by village adults, their timing, and the purposes for which they occurred (supplement to subsistence food stocks, storage for seasonal resale and profit, repayment of traditional credit in kind, purchase for preparation of food for sale to wage laborers and single adults, etc.). He found that competitive markets, responding to traditional seasonal and biologic rhythms, have a very important role in the process of rural class formation and

wealth accumulation in a traditional society linked, if only tenuously, to the modern state and to more advanced capital-dominated factor and product markets. Moreover he found that relatively better-off farm units (those with more advantageous traditional kin obligations and relationships, a larger number of active adults, or access to better land, etc.) are more able to buy and store grain at harvest time, engage in supplementary activities (prepared meals for sale) and sell more grain later in the year. Poorer farmers in order to meet cash needs--head taxes, small consumer items, etc.--have to sell more of their grain at harvest time and earlier in the crop consumption year. This can lead to a depletion or exhaustion of farm unit grain stocks and the need to sell labor services for wages (in the local area or in other regions) or for payment in kind in order to meet food needs at higher "hungry season" prices. These effects can be cumulative with more prosperous farmers (or, increasingly outside traders or salaried urban residents) better able to take advantage of modern credit and technical assistance packages to produce cash and food crops with improved technology and a greater use of wage labor. (This process is most advanced in parts of Senegal.) These patterns are simply the rural portion of the center-periphery system which is transforming West Africa. It should be stressed that these patterns do vary substantially from place to place and that they are, in many cases, only partially visible and may seem to be contradictory. However, we can put efficient markets in some meaningful context and stress the need to see agricultural trade, including food trade particularly as urban food markets "deepen" and expand,

as an important element in a larger system of asymetric structural economic relationships with strong distributional consequences.

Traditional Private Grain Storage

The bulk of West African grain is stored in private facilities either at the farm level or at various levels in food marketing channels. Grain storage is another complex area because of the large variety of ecologically-adapted local storage techniques employed and because of the lack of reliable and detailed evidence concerning storage costs, efficiency and losses, particularly at the village level. However, a few generalizations can be drawn from the literature and used as background in this study.[5]

First, at the village level, farmers store millet or sorghum on the head or threshed, in a variety of home made containers ranging from mud-brick silos to woven straw graineries. As it moves into marketing channels grain is usually bulked into 100 kilogram (220 pound) sacks and is stored in these sacks in a variety of buildings as it moves to larger markets. Private houses and warehouses are used and almost no grain, even in inter-regional shipments, is handled in bulk due to the lack of appropriate facilities and infrastructure and the need to resack the broken bulk for distribution and resale.

Grain losses in traditional storage from excess moisture, insects and rodents can vary considerably by region, type of grain, type of storage and stochastic events such as unusually heavy rains, or

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[5]For an introduction to grain storage in West Africa see Abdel-Aziz [1975], Ennis et al. [1975], Giles [1965], Hall [1970], Hays [1975], Lindblad, Newman and Vinita [1975], Nyanteng [1972], Volunteers in International Technical Assistance [1976] and various issues of the Bulletin of Grain Technology.

attacks of insects and rodents. Storage losses do, however, tend to be higher in wetter, more humid areas and certainly are higher when grain is stored over one or more rainy seasons rather than just within the consumption year. The selective use of insecticides on farm granaries and gas fumigation on warehouse grain stocks can greatly reduce insect losses. Moisture losses are cut when grain is stored in relatively small farm granaries and when more sophisticated drying techniques are used on larger bulks of grain.

It is not completely meaningful to attempt to compare costs of grain storage at different levels of a highly segmented economy with large subsistence sectors. However, rough estimates do illustrate the cheapness of farm level grain storage and the rapid increase in cost associated with the use of more technologically advanced, large quantity storage systems. Hays estimated the average yearly storage cost in traditional storage (accounting for granary construction by special craftsmen, depreciation and grain losses) per ton of grain to be about $5.30 at 1973 prices.[6] This is compared, for example, to modern "low-cost" portable storage facilities at about $30 per ton per year and World Bank estimates which for the Sahel put modern warehouse operating costs at about $44 per ton per year (or $58 per ton per year if warehouse construction costs are amortized over a 20 year period).[7] These figures are somewhat misleading since we are moving from a semi-monetized portion of the economy to a more

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[6]Hays [1975, pp. 33-38].

[7]Alternative grain storage cost calculations are explored in Appendix B which accompanies the analysis of the costs of government emergency stock holding in Upper Volta in Chapter VIII.

fully monetized one but they do point to the relative ecological efficiency and stability of traditional, localized grain production and storage systems.

CHAPTER VI

ISSUES IN SAHELIAN GOVERNMENT PARTICIPATION IN GRAIN MARKETING AND STORAGE

Introduction

Grain marketing and storage in the Sahel are undergoing rapid transformation as government food marketing and storage institutions attempt to replace or supplement private grain trade ostensibly to promote the goals of increased food self-sufficiency, distributional equity and mass mobilization for economic development. However, Sahelian economies are being incorporated into a dominant world economy which, as we saw in earlier chapters, is producing predictable consequences in a center-periphery structural system, such as very rapid urbanization. This in turn has led to more centralized, capital-intensive distribution mechanisms and structural conflicts which make the attainment of all of the above goals increasingly difficult.

Grain Board Tasks

When we consider food grain marketing and storage specifically, this part of the political economy can be divided into three major task areas which are a function of the consequences of widely fluctuating grain supplies. Assuming a demand for grain which only changes over the long run, short term variation in supply and prices

produces consequences for various market participants and provides a definition, albeit somewhat arbitrary, for distinct cereals office activities. When conditions are "normal" over much of the country, the cereals office can concentrate on commercial supply activities and improving facilitating infrastructure (in addition to activities necessary to maintain emergency stocks, etc.). When supplies are very short, there are the risks of starvation, severe malnutrition and windfall gains through private liquidation of grain stocks at very high prices. These call for the use of emergency stocks. The opposite extreme situation of massive excess supply risks waste and resulting producer disincentive effects and should call into action surplus disposal actions which can be the bane of stock programs, but to this point have not had to be given much attention in the Sahel. In intermediate cases, the cereals office will probably act most effectively in buying and selling stabilization stocks and attempting to regularize supply or price. These relationships are summarized in Figure VI-1 which represents in a sense the standard "Marshallian cross".

This schema, of course, employs a major simplification since these processes take place over time and space, interact with and complement each other, and are linked to larger systems of political, economic and social relationships. Following the logic of Figure VI-1, we can see that the dividing line between emergency stocks and buffer stocks is necessarily arbitrary. In the Sahel, as we will see, however, a very strong structural and operational line has been drawn between the two functions, particularly in the operation of FAO-backed emergency stock projects. This is due to

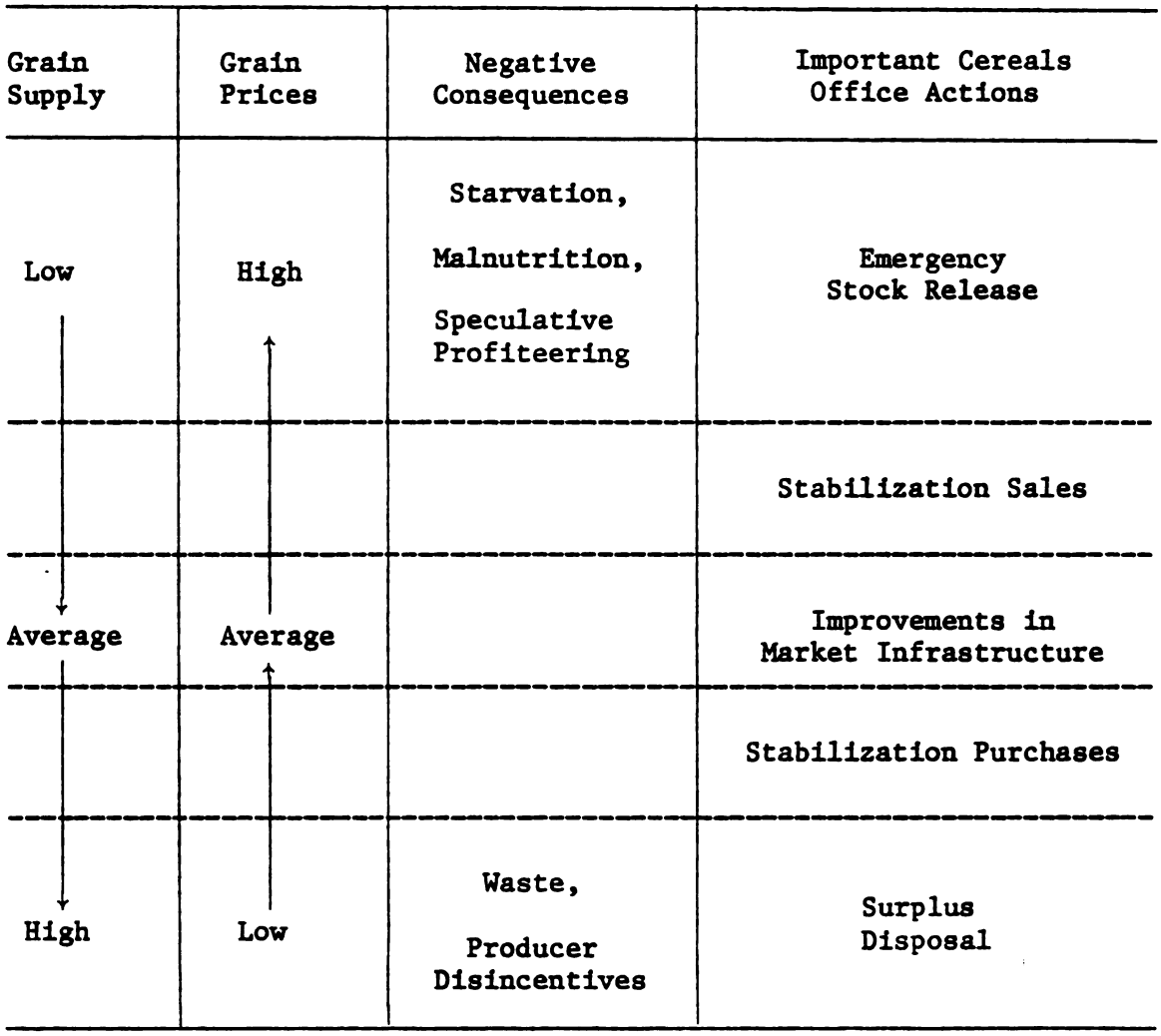

FIGURE VI-1

CEREAL SUPPLY SITUATIONS AND CEREAL OFFICE ACTIONS

three factors: the desire of the FAO group to succeed in the efficient operation of at least one component of a total food grain marketing and storage system, the lack of an overall integrated food grain policy and the infrastructural and institutional means to carry one out.

Three caveats need to be stated at this point. First, changes exogenous to the domain of the cereals office can affect the scope and degree of activities possible for the office to undertake. For example, new physical and biological technologies (e.g., irrigation, improved seed varieties and cultural practices) can reduce aggregate supply variation just as improving commercial pipeline stock holding procedures and infrastructure can make better use of existing supplies and reduce the need for stabilization and emergency stock programs.

Second, grain production and exchange relationships are a subset of a larger group of production and exchange relationships which, as we have seen, have often structurally and functionally worked to the disadvantage of the rural, surplus-producing population. Thus, to be viable, new grain trade relationships must be consistent with and supported by modifications of the larger set of inter-sectoral, inter-socio-economic group trade and non-trade relationships. If not, seeming reforms may simply fail or may backfire leading to declines in efficiency and an exacerbation of negative distributional consequences. Therefore, the larger set of center-periphery relationships will help order choices among alternative policy and implementation strategies. As we saw in the concluding portion of Chapter II the basic dichotomy in policy options is between those which cluster around a trend of continued systemic maintenance of increases in

center-periphery dependence and those which promote movement towards a more self-reliant, independent system.

Stemming from the second, a third caveat is that policy makers do not generally face a simple choice between two distinct packages of opposing policy options. They work in the grey areas of "second best" solutions where methods of judgement decision and trial and error prevail. But there is a pragmatic necessity to choose. As we will see in the next chapter, all the Sahelian countries have cereals offices, all are committed to holding both emergency and buffer stocks of coarse grains (and most have already begun these efforts), all are attempting to directly intervene in cereals markets, all are leery of private traders, all use price controls in cereals marketing, and, most importantly, all are enmeshed in an interrelated system of international and internal relationships which are vitiating their ability to promote their self-proclaimed goals of "food self-sufficiency and autonomous economic growth". All of this is given. The challenge now is to elaborate some of the major issues involved in government participation in grain marketing and storage and to discuss the likely implications of pursuing alternative courses of action over time. In doing this we must pragmatically synthesize the insights derived from the more theoretical macro-level political-economy model with the insights gained from an analysis of Sahelian government grain marketing and storage experiments. However, in order to understand the preliminary responses to the grain crisis in the Sahel in the early 1970s it is necessary to examine the international grain crisis during the same period.

World Food Crisis and the FAO Food Security Assistance Scheme

The holding of special grain stocks for emergency needs has a long historical tradition in both high and low income countries. The recent catalyst for international attention to grain storage problems was the world grain crisis of 1972-74. World grain stocks reached historical lows, world prices jumped more than threefold within a year, and a concerned public in high income nations saw widely publicized reports of drought conditions in Asia and Africa. This contributed to the sense of urgency which surrounded the World Food Conference in 1974. A number of alternative grain stock programs were discussed at the conference but no agreement was reached on the creation of internationally held grain reserves. This led the FAO Council to adopt a resolution proposing "An International Undertaking on World Food Security".[1] In 1975, the Council then created a standing Committee on World Food Security which has held two sessions, one in 1976 and one in 1977.[2]

The FAO Director-General, in order to more fully implement the Committee's recommendation that FAO provide special assistance to developing countries to enable them to achieve national food security objectives, formally created the Food Security Assistance Scheme in April 1976. While drawing most of its personnel from and centered in FAO's Commodity and Trade Division, FSAS, as an FAO interdisciplinary activity, draws expertise from other technical units within that organization. The major stated objectives of FSAS are to:

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[1]Resolution 1/64 of the FAO Council, Rome, November 18-29, 1974.

[2]See UN/FAO [1976c, 1977a, 1977b].

(i) Formulate national food security policies and action plans in line with the International Undertaking on World Food Security and identify projects and programmes in support;

(ii) Mobilize external resources for these programmes and projects;

(iii) Undertake a technical review of the progress of implementation in conformity with the guidelines of the Undertaking and of the Committee on World Food Security;

(iv) Evolve national programmes from an emergency phase to a medium-term approach;

Activities under the Scheme, to be financed from extra-budgetary resources, cover such fields as: building of storage facilities and protection of stored grains; supply of grain for initial reserve stock building; strengthening of marketing system and produce handling infrastructure; commodity policy advice; technical review of national food production programmes; improvement in national early warning systems and related data collection and analysis; and training (storage management personnel, cooperatives, marketing operations, commodity intelligence).[3]

Financing of $16.2 million had been pledged to FSAS by February 1977, with the Netherlands, the Federal Republic of Germany and Switzerland the principle donors up to this point; other nations are cooperating by coordinating their existing bilateral programs with FSAS activities. Country food security policy reports have been completed for thirteen countries (including Niger and Nigeria in West Africa) and FSAS projects were slated for 1977 implementation in eight countries, all in West Africa except for Tanzania.[4] The four Sahelian projects, as we have seen, were initiated as emergency drought relief activities and have been taken over by FSAS which is attempting to consolidate its current projects primarily in West and East Africa.

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[3] UN/FAO [1977a, p. 1].

[4] The countries are Cape Verde, Chad, Guinea Bissau, Mali, Niger, Nigeria, Tanzania and Upper Volta.

FSAS stresses the importance of basic cereals stocks in these countries and is willing to help provide a complementary "package" of necessary supporting projects. Stress is placed on building stocks from domestic supplies to encourage local production, and on the immediate provision of management support and technical and training assistance. A fairly coherent set of pragmatic operating rules have been developed to maximize the efficiency of emergency stock holding and these will be discussed below.

The remainder of this chapter will be devoted to a brief exploration of three interdependent topics affecting government participation in grain marketing and storage in the Sahel:

1. Major policy issues in Sahelian food security strategy
2. More specific operational objectives and program implementation issues in holding emergency and buffer stocks in the Sahel
3. Alternative methods of analyzing grain stock holding activities and a discussion of quantitative techniques to model grain marketing and storage decisions.

In the following chapters, these more general issues will be explored through an analysis of five grain boards in the Sahel and a more extended case study exploration of emergency and buffer stock programs in Upper Volta.

Grain Stock Policy Issues

As we have seen, there are a large number of socio-economic and political variables involved in considering Sahelian food security. These variables can be subjected to different levels of analysis which produce different types of issues--ideological, theoretical, methodological, operational, etc. We have also seen that in a system of interdependent relationships these variables "move

together" over time in both harmonious/integrating and conflicting/ contradictory patterns. This means we must be concerned with the evolution of the whole because it provides the rough boundaries within which policy makers and implementors can operate in the shorter run. We will introduce several assumptions to reduce this complexity and allow us to focus on a number of practical policy issues which are of immediate concern to Sahelian grain storage programs. Two additional points must also be stressed. First, while these issues are generally applicable to all six Sahelian countries, each, in practice, must be precisely defined within the environmental limits and resources of each country. Second, we have seen (particularly at the end of Chapter II) that it is possible to trace implications of macro-micro linkages within the general model of center-periphery dependency. This can be done at various levels: in the abstract, for West Africa as a whole and for each Sahelian country. The two extreme illustrative evolutionary models--those of increased dependency and of increased independence--thus have significance for grain stock policy.

Given the Sahelian environment, the following issues do not turn so much on whether or not to stock grain but rather on physical and institutional problems and the economics and politics of alternative storage systems. Of particularly importance are alternative incentive structures appropriate for different objectives. In addition to these structural and institutional questions, the dependency issue is reflected most clearly in complementary policies linking grain storage to the process of rural transformation.

The policy issues are grouped into macro and micro policy issues for emergency and buffer stock schemes. Before discussing these policy issues we will make the following assumptions:

1. National governments in the Sahel are going to engage in grain marketing activities, particularly:

    a. Supplying at least a part of urban grain needs

    b. Making physical infrastructural improvements, particularly in storage and transportation

    c. Holding emergency stocks

    d. Employing buffer stocks, along with other measures, to act on supply and/or price variation

    e. Generally intervene quite extensively in food markets.

2. Many of the conditions required for competitive markets are met, particularly in localized areas. Less Competitive conditions, however, often exist in longer distance trade and at higher levels of product aggregation in vertical channels.

3. Short-term policy choices are quite limited but in the longer run, the Sahelian countries can engage in development policies which will promote greater structural and functional dependence or independence.

4. Higher levels of outside funding (with some implicit constraints) will be available for infrastructural improvements, technical assistance to grain boards, improved data collection and perhaps to cover some grain board operating expenses.

5. Objective functions will most likely stress "autonomous economic development", increasing or maintaining "food self-sufficiency", mobilizing mass participation in rural development and increasing distributional equity. While it is possible to observe selected trends which are moving toward the attainment of some of these goals, the major contradiction facing Sahelian countries is that structural and functional interaction patterns associated with economic development and development assistance will make the full attainment of all of these goals very difficult.

Macro-Level Policy Issues

Self-Sufficiency

All Sahelian countries ascribe to the general goal of achieving or maintaining national self-sufficiency in basic food stuffs under normal weather and production patterns. At issue is the identification of the costs and benefits of pursuing such an objective particularly if this embraces the extreme position of self-sufficiency under all rainfall conditions. While self-sufficiency seems like a more realistic objective for the four interior countries of the Sahel, this must be examined in the light of the specific conditions of each country. It is necessary to determine the crops to be included (under current trends rice, and particularly wheat, are unlikely candidates for self-sufficiency status as compared to sorghum and millet) and what levels of production shortfall to attempt covering. Under a strategy of greater independence, the "non-economic" benefits of self-sufficiency gain more weight. However, we must still take account of the concept of relative comparative advantage and precisely specify the geographical units for which self-sufficiency would be defined by the local areas, nations, the Sahel countries, West Africa, etc.

Trade Versus Storage

A related issue and one of the main currents in the international debate over buffer stocks has revolved around whether supply variation can be more efficiently combatted through domestic storage or by relying on trade in regional and world grain markets or some combination of both. While generally discussed in terms of total world grain production or in terms of wheat, the argument can be applied

to millet and sorghum by noting that the coefficient of variation in world production (for a recent world mean production of about 100 million MT) is substantially lower than that for West African production (for a mean of about 10 million MT), Sahelian production (about 4 million MT), and that for any particular country (e.g., Upper Volta with mean of about .9 million MT). This is a complex issue that cannot be viewed in zero-sum terms. It must take into account West African regional and international trade both in terms of the time and cost involved in obtaining external food (which varies greatly by food type and country location) and the potential political and economic costs of having to reply on the outside for food. There may be explicit or implicit political constraints attached to dependence on outside commercial or donated food which are not directly obvious when looking at relative prices.

Population at Risk

Formal and informal procedures must be used to identify grain stock program target groups or the "population at risk" (of starvation, severe income reduction due to high food prices, etc.). The nature of the dominant political coalition may influence the definition of target groups, and in turn, affect factors such as information needs, optimal storage location, etc.

General Intervention Strategy

Resolution of the issues above will go a long way to defining the parameters of a general grain marketing and storage strategy. In addition and to some extent independent of the degree of dependency careful attention will have to be given to:

1. Specification of an integrated food policy to help avoid structural and objective function conflicts;

2. Decentralization, including objectives and patterns of participation and incentives;

3. The size and timing of food stock operations.

Training

The issue involves determination of staff training procedures consistent with the achievement of program objectives. For example, in a decentralized grain storage program, participation and control, recruitment and training may be most appropriate if carried out and focused at the local level. Realistic on-the-job training will be facilitated if program infrastructure and operational growth is incremental so that the learning process does not foster a dependence on outside support.

Infrastructure (Physical and Institutional)

As soon as the objectives of grain stock programs have been defined various technical issues such as the cost of transportation, storage and handling can be analyzed using optimization or operations research methodologies. For example, a linear programming transportation model can be used to determine the "optimal location" of new storage facilities given specified existing storage, transportation and storage costs, budget constraints, and the geographical distribution of probable shortfalls. Cost functions associated with infrastructural investment are generally non-continuous. This means, for example, that while different bulk storage systems have technical advantages in long term, large-scale grain stocking, cost savings in bulk handling are only available when bulk equipment is used over

most of the system between producer-first handler and retailer-consumer transactions thus avoiding expensive bagging operations.[5] Similarly, a standardized grading system may be prohibitively costly until it is used on a wide basis.

International and West African Stocks

The outlook for both international and West African grain stock cooperation is not particularly encouraging. For international stocks the main issues are how alternative proposed systems could reduce the reaction time and cost of providing food relief assistance. For West African stocks the main issue involves the extent to which reduction in the cost of holding stocks through regional reserves is possible, assuming that satisfactory decisions on location, ownership, management and trigger mechanisms can be reached. In many instances, the issue will be reduced to what types of functional inter-cereals office contacts, such as information exchanges and reciprocal sales of surplus stocks, are possible to initiate.

Emergency Stock Issues

Objectives

Both logically and in actual fact the primary immediate objectives for the constitution and operation of emergency stocks in the Sahel are twofold:

1. To have a known quantity of grain available to government authorities for immediate distribution under predetermined rules in response to unforeseen events leading to a rupture in normal supply channels, or in response to disasters of natural or human origin which necessitate free or subsidized food aid

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[5] See Appendix B for greater detail in the specification of storage costs.

2. To develop within the context of a coordinated set of food grain policies the institutional and infrastructural means to implement such a stock holding and distribution system and minimize the economic cost of doing so.

These objectives can be intuitively justified from the point of view of Sahelian governments and international donors on interrelated humanitarian, economic and political grounds. The precise mixture and expression of these rationales will vary as we move along a continuum between a high degree of center-periphery dependence and a more active commitment to and movement toward greater independence and self-reliance. In a more dependent environment the pragmatic emphasis will be on the role of food stocks in minimizing the economic costs of future emergency food assistance (with an implied assumption that such assistance will probably be necessary), on increasing the political stability of both international and internal dependency structures through selective food aid to both urban and rural populations, and on minimizing "negative humanitarian publicity". In the more independent context, the emphasis will be on minimizing dependence on foreign food aid, on facilitating local economic development by at least satisfying basic food needs and on maximizing political stability through providing a valuable service to the regime's major ally, the rural population. These are clearly exaggerations of polar types; the actual Sahelian situations lie somewhere between the two.

Related to and stemming from these primary objectives are various possible secondary emergency stock program objectives which are derived from FSAS documents dealing with Sahelian countries:

1. Contribution to the rehabilitation and increase in local cereal production

2. Promotion of grain price stabilization through the careful timing of normal stock emergency rotation acquisition and disposal

3. Improvement of long-term grain storage techniques (or reduction of storage losses)

4. Assistance in the transformation of the subsistence economy to a market economy

5. Providing occasional stock assistance (grain loans) to other national food aid programs

6. Promotion of multi-national regional marketing storage cooperation including short term stock assistance, surplus disposal and more far-reaching actions such as price coordination, etc.

Clearly many of these objectives could only be fully met through coordination with price stabilization and marketing institution and infrastructure improvement programs under the umbrella of an integrated set of rural development and food policy strategies.

Level of Stocks

As we have stated above there are no a priori optimal stock levels since levels must be determined through a balancing of objectives with resources under available technological alternatives. This question will be discussed in detail in the following section on methods of analysis.

Location of Stocks

A decision on stock location must take into consideration the population at risk and their location, the availability of passable roads, the costs of transportation, storage and handling, and opportunities for stock rotation with minimum market destabilization or maximum stabilization.

Constitution of Stocks

The constitution of stocks involves the use of either domestic or foreign grain supplies, and can be effected under alternative food

aid, financial assistance and auto-financing arrangements. Rules for stock reconstitution must also be carefully specified.

Trigger Mechanisms

In considering trigger mechanisms, the issue is deciding what combination of price and non-price signals to use in declaring a formal emergency situation (meeting predetermined criteria) which permit stocks to be distributed.

Practical Management

In terms of practical management a major issue involves the degree to which emergency stocks should be physically maintained and operationally controlled in isolation from buffer stock actions.

Stock Disposal

Loss-minimizing excess stock disposal plans must be available. These may range from subsidized exports to developing feeding programs for commercial livestock finishing.

Distribution of Emergency Stocks

There are several operational issues related to the distribution of emergency stocks. First, the organization responsible for rapid distribution (army, gendarmerie, etc.) must be predesignated and capable of execution. Second, the question of whether distribution is to be free or at subsidized prices must be determined along with the maintenance of an adequate stock rolling fund to rebuild stock levels within a specified time period. Third, a pricing policy for turned-over emergency stocks must be fixed.

Regional Stock Coordination and Cost Sharing

Regional stock coordination and cost sharing makes greatest sense with respect to emergency stocks. Rules and prearranged mechanisms for facilitating regional emergency stock transfers must be prepared and agreed upon. This may be possible using the offices of regional bodies such as ECOWAS or donor agencies.

Buffer Stock Issues

Objectives

The major issue here is the determination of the beneficiary of stabilization efforts, whether it be rural producer/consumers or various classes of non-producer consumers or both. In addition we must consider other secondary or sub-objectives many of which were discussed above under emergency stocks, which differ only in degree from buffer stocks. The specification of buffer stock objectives will, of course, be largely determined by the fixing of prior goals relating to regional and class distributional equity, general economic strategy and so forth.

Ownership and Control of Buffer Stocks

Farmers and traders both own and control their own buffer stocks although their behavior and objectives may differ. In a decentralized, segmented economy, a principle hypothesis is that stabilization can be operated most effectively at the local level. Related to this is the general observation that centralized, hierarchical bureaucracies have a difficult time efficiently operating decentralized activities such as geographically-extensive grain buying, selling and storage. The major issue involved in longer term program planning is how to

promote decentralization, increased local participation and control over stock holding which is seen as a public service rather than a speculative activity connected to larger patterns of differential capital extraction. Clearly a national stabilization program needs to also include centralized activities involved in cereal transfers to deficit areas (both urban and rural) and coordinating mechanisms among sub-national regions and with cereals offices in adjoining countries. A federated system built on a strong locally managed base seems, at first glance, to be a logical alternative but it should be remembered that none of the six countries has attempted to use such a system.

Pricing Policy

This is probably the most troublesome area facing cereals office personnel who are trapped by rigid price and cost *barèmes*, prices which favor urban consumers for political reasons, and pricing decisions which are made far too late in the buying campaigns. Uniform prices with differential transportation margins are about as flexible as the Sahelian systems have been to date and this makes sense in terms of the demands of a centralized bureaucracy. With evolution to a more complex system (under either the greater dependence or the greater independence models), increased price flexibility will probably help increase operating efficiency. Uniform prices for surplus production (beyond the consumption of local areas) with transportation covered at cost would also be possible under a decentralized, locally controlled stabilization system.

Structural Reform

In addition to the changes inherent in alternate solutions to the issues above, the current systems in several Sahelian countries could be made more efficient through structural reform. The major object would be to streamline the system to reduce the number of physical ownership transactions required in the marketing channel. This will be illustrated for Upper Volta in Chapter VIII.

Intervention Strategy

As we have seen, price stabilization has been an elusive goal for Sahelian cereals offices. To promote learning, intervention should probably begin with modest goals in a number of market places (deficit, surplus and "balanced"), combined with a simplified data collection system so the general magnitude of intervention effects and the depth of markets under alternative supply conditions can be assessed. Alternative price trigger mechanisms could be used experimentally, particularly if greater pricing flexibility were allowed a more decentralized system. Also success in storage and market operations within one year's market campaign will help build the experience required to begin the much more difficult task of inter-annual stabilization.

Methods of Analyzing Grain Storage

In United States and foreign literature on grain storage theory and practice, there is a great deal of conceptual and terminological confusion, much of which stems from an imprecise mixing of different levels of analysis and from the complexity of analytical methods available with which to investigate different levels of an integrated grain marketing and storage system. This is a general problem which applies

to consideration of programs oriented toward emergency, buffer or commercial pipeline storage operations.

First, we should cover the problem of level of analysis. Whenever we propose to intervene in a complex, interrelated system by manipulating a limited number of variables we want (or should want) to understand the micro and macro level impacts of those actions on the structure, operations and normatively evaluated performance of that system over time. However, in the operation of actual systems there is a division of labor with different actors having different focuses and time horizons, concentrating their attention on different levels of the system and their labor is appropriately evaluated using different sets of criteria. For Sahelian cereals offices charged with grain marketing and storage, there are basically three levels of analysis which are performed and which are accompanied by characteristics represented in Figure VI-2.

Clearly there are other important dimensions to the different levels of analysis and action in an integrated grain stock system which could be added to Figure VI-2. Also, the categories used are meant to be illustrative and, in actual practice, may involve more overlap and "empty cells" (unfilled tasks) than the chart would indicate. Finally, to the extent that such a system is operationally successful, it would involve communications and feedback mechanisms which are not represented. For example, the successful policy maker or cereals office administrator should be concerned with more abstract grain system modeling and system evaluation analysis, with the day-to-day operational analysis of problems faced by office field buying

	Level of Analysis		
	Macro-Systemic	Intermediate/ Policy Oriented	Operational
Actor	Scientific analyst (consultant to Cereals Office)	Policy maker (Cereals Office administrator)	Implementor (Regional Storage Office)
Time horizon	Longest	Intermediate	Shortest
Principle focus	Evolution of grain marketing and storage *system*	Elaboration of grain marketing *policies or rules*	Grain stock *levels* (tasks to accomplish)
Evaluation criteria	Capability to understand and predict system change and offer programatic insights	Selection of correct policies WRT expressed political economic objectives	Fulfillment of operational tasks with acceptable innovation and efficiency

FIGURE VI-2

CHARACTERISTICS OF DIFFERENT LEVELS OF ANALYSIS OF MARKETING AND STORAGE ACTIVITIES OF CEREALS OFFICE

agents, truckers and warehousemen, and facilitating communication and interaction among all levels of the organization.

The literature reviewed in this study covers all three levels of analysis. Much of the more academic literature[6] focuses on macro level, systemic analysis of stock operations as they interact with fluctuating supply and with demand conditions evolving more slowly over time. Much of the political economy literature cited in Chapter II--to the extent that it deals specifically with food problems at all--is at an even more global level of systemic analysis. Most of the donor agency and Sahelian government documentation on staple food marketing and cereals office programs falls into the category of intermediate policy analysis and, to a lesser extent, of analysis of short-term micro-level operational problems.

Within the area of macro systems modeling of grain stock holding, a wide variety of approaches has been employed. It is crucial for our purposes to note that most of these modeling efforts have been conceived to analyze *grain reserves* which may be thought of as integrated emergency and buffer stocks or basically as buffer stocks which can be put to specific uses under emergency conditions. While this is consistent with the logical structure of grain board activities (see Figure VI-1 again) and with all reasonable attempts to use general equilibrium economic modeling techniques, we will see that this more integrated approach is largely abandoned in much of the policy and operational level analysis of Sahelian grain storage.

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[6]See, particularly, footnote 5 in Chapter I for a beginning list of references.

Gustafson, in his classic article on inter-annual grain carry-over levels (i.e., inter-annual buffer stocks), proposed four categories of analytical approaches used to arrive at storage decisions:[7]

1. The standard method was described as *the level-of-storage approach* which attempts to determine an absolute amount of stored grain which would be available in the case of poor harvests, war, etc. This approach was felt to be inadequate because it did not involve a more flexible *storage rule* which would account for a number of variables concurrently and because no specific level "can be shown to be optimal, that is, no objective way exists for showing that one level is better than another".

2. Another method is to specify a *plausible functional form for the storage rule* to determine annual "carry-out" as a function of differing quantities of available supply ("carry-in" and harvest). Then one calculates "expected cost and benefits under the rule, such expected values being functions of the coefficients or parameters in the rule, and finds store values of the parameters which minimize net expected losses or maximize net expected gains".

3. Storage rules can also be based on *deviations in size from the "normal crop"* or from a trend line in production levels. Gustafson attacked these because they generally used unrealistic or simplistic storage rules; there were no obvious probability criteria for determining needed starting stock levels and, therefore, the rule involved was necessarily unstable over time.

4. Gustafson opted instead for a fourth approach, one based on an *idealized free market* (i.e., "a market in which all stocks are held by private firms, operating under perfect competition, and maximizing expected profits"). With certain simplifying assumptions the stock levels the free market system would hold under alternative supply and demand conditions can then be used to produce an optimum storage rule under the assumption that what happens under the idealized conditions is desirable and is in fact achievable with public sponsorship or instigation under less than ideal conditions.[8] Alternatively, the stock

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[7] Gustafson [1958].

[8] Practical difficulties with these assumptions relate partially to the difficulties of defining optimality under conditions of "the theory of the second-best". Gustafson also used some very demanding simplifying assumptions, including zero transportation cost, zero storage cost, all production and consumption at a single point, etc., in order to reduce computational difficulties. Presumably, most of these could be relaxed through the use of more complex models and more powerful approximate computational techniques such as those employed in stochastic simulation.

levels produced by this method can simply be compared with the amounts that have actually been stored historically. Of the four methods, this one is most congruent with the ideal approach to economic modeling stemming from neo-classical theory.

There are, of course, other ways of categorizing macro-level modeling of grain stock procedures, particularly as new analytical methodologies, such as refinements in econometric and systems simulation techniques, permit a wider range of system variables to be analyzed concurrently. A recent article by Walker and Sharples[9] reviews and compares several of the most prominent recent simulation models while the conference proceedings edited by Eaton and Steele includes several new modeling efforts and a number of insightful pieces of policy analysis.[10]

Most of the literature is focused on two broad subject areas: (1) United States grain stock holding (alternate policies and rules to minimize risk and share costs on a unilateral or international basis, reviews of past experiences, etc.); and (2) international stock proposals themselves (with most making obligatory reference to the 1974 World Food Conference and its predecessors, to a lack of cooperation on data matters from major grain buyers in the socialist camp, to a stress on stock rules rather than levels, and to various insurance type schemes for holding international stocks with the developed world to pay all or most of the "premium" for LDCs). This latter proposal has been most vigorously promoted by D. Gale Johnson.[11]

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[9]Walker and Sharples [1975].

[10]Eaton and Steele [1976].

[11]See, for example, Johnson's article in Eaton and Steele [1976].

To this date very little of this more formal macro modeling of grain stock systems has focused uniquely on LDCs. The Indian subcontinent provides perhaps the most notable exception. India has maintained very extensive food grain stock programs for many years and these programs have been analyzed at various levels. At the macro level, excellent descriptive work was sponsored by the Indian Society of Agricultural Economics and has also been done by Uma Lele and A.M. Khusro.[12] The latter is particularly useful to policy makers since it also delves into some of the micro-economic questions of storage cost. Several formal simulation models have recently been developed. Reutlinger, using India as a base, develops a general model which focuses on the question of cost/benefit trade-offs between supply stabilization through international trade versus domestic storage specified at various levels for illustration.[13] Another simulation model has been developed by Manetsch using Bangladesh as a base which incorporates a very different set of behavioral relationships and even attempts to define benefit functions measured inversely by the number of deaths per time period.[14]

This type of macro-level economic modeling could be of considerable use in the Sahelian region since almost nothing of this kind has

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[12]The Indian Society of Agricultural Economics [1969], Lele [1971] and Khusro [1973].

[13]Reutlinger [1976]. There is another somewhat different version of this research in Eaton and Steele [1976]. This model might be used as a possible base for a detailed West African stock simulation project if substantial modification were undertaken to permit accomodation of important structural characteristics of West African grain markets and putting substantial emphasis on the effects of high transportation and modern storage costs.

[14]Manetsch [1976].

yet been attempted, particularly focused solely on food security[15] or food grain marketing. To be useful, this type of modeling effort for a particular country or group of countries should include geographic variables (e.g., extensive differences in regional supply balances and trade patterns both within and outside the particular country) and the effects of transportation, storage and management bottlenecks and costs. There are, also, some very important characteristics, such as Senegal's coastal urban area, which might not fit into such a more generalized model.

As we move from the macro-theoretical level toward the policy and operational levels, we see that one model characteristic, the proportionality between usefulness and the detail of specification, provides one of the biggest drawbacks in terms of continued utility, that of the need for constant updating and modification in response to changing environmental and policy considerations. This is a very expensive proposition for a Sahelian budget unless this recurrent expense is largely met from the outside. It should be clear that most of the international stock models will be of limited direct application except that they provide further precision on possible changes in transportation time and the real costs of outside relief supplies. As a final critique from the perspective of the paradigm employed in this study, most of these modeling efforts do not include key political-economy variables, although this omission, largely a product of

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[15]The beginnings of such a modeling effort focused on a Sahelian agricultural sector is contained in Maddox [1976].

political convention and disciplinary tradition, would not be conceptually difficult to rectify.

As we will see in Chapter VII, most of the studies of Sahelian government grain marketing have been descriptive in nature and have been forced to use secondary data. Stemming from this, most methods for determining either buffer or emergency stock levels have been rather pragmatic. Most of these methods would be grouped under Gustafson's "level-of-storage approach" which are fairly uniformly criticized as naive by most macro-level policy theorists. In the Sahel, these methods have been used most extensively by FAO/FSAS, and its "multidonor mission" predecessors, in the rough determination of emergency stock levels. In the more sophisticated versions the following clusters of variables have been taken into consideration at least on a nominal level in arriving at these calculations:

1. Rough probability of total shortfall is determined in terms of deficits from production trends (or even values).

2. The gross shortfall is allocated among the population at risk (of starvation, malnutrition, etc.) broken down by geographic region, socio-economic groupings such as farmers, herders and urban population by means of:

    a. Food balance sheets (FAO estimates generally) which divide the total harvest into categories of consumption, seed requirements, losses and waste, etc., and

    b. Average adult and child grain consumption levels.

3. From the gross shortfall (or gross shortfall per capita) is subtracted the amount of outside relief grain which can be expected to be delivered to the population at risk given the time required for its arrival in the country and the capacity of the cereals office to distribute grain with its infrastructural and management capacity. This produces a *net* aggregate (or per capita) *shortfall*, some percentage of which (usually fairly high, e.g., 90 percent) is considered to be a reasonable minimum storage level.

4. These steps are generally repeated several times with sequential modification of essential components in order to produce

"reasonable" or acceptable results in terms of other political or budgetary constraints.

As can be surmised from the number of points in the above methodology where data may be unavailable or unreliable and at which aggregation bias (particularly in a segmented economy) may produce meaningless results; the act of choosing a given storage level represents an "act of faith" in the intuitive plausibility of our guesswork or in our confidence in the availability of adequate financial and political resources to meet secondary or unanticipated needs produced by errors of judgment or changes in broadly defined environmental conditions.

Often the policy and operational methodology for buffer stock holding at the beginning of a particular crop marketing season is equally or even more straight forward. The cereals office is usually heavily constrained by its levels of funding, by officially determined grain price margins, by government purchasing and accounting procedures, and by its existing infrastructural capacity (available trucks, sacks, fuel, empty warehouses, personnel, etc.). This means that under optimal conditons it may be able to buy a limited proportion of available supplies and put it into storage for sales later in the year or in the next year.

Assessment of operational effectiveness can take place at two levels: (1) the efficiency of operational performance in cost/benefit terms--given a precise definition of objectives and available resources-- can be calculated and areas of needed improvement (e.g., minimizing the number of empty "backhauls", cutting warehouse storage losses through correct spraying procedures, etc.) can be specified; and (2) alternatively, the *economic* impact of its actions can be assessed, primarily through estimates of the stabilizing effects on

producer and consumer prices over time and space, and the micro-level impacts on various categories of market channel participants.

In the absence of available data and analytical models (which, as we have seen, have their own cost and application limitations) this level of analysis will be done impressionistically using "rule of thumb" calculations and isolated, somewhat random measurement of performance variables. Cereals office officials will say, "compared to the normal fall in harvest time producer prices under these supply conditions, our intervention in Market 'X' in November and December had a substantial impact and kept prices 5 to 8 CFA/kg higher than they otherwise would have been". This is then followed by a similar assessment of price stabilization in consumer markets and estimates of total producer and consumer savings which are then used to "justify" total program expenditures. Often this process is supplemented by a large volume of time-consuming *pro forma* documentation and financial accounting.

The obvious inadequacy of the type of "economic evaluation" outlined above can be confronted in two ways. First, analytical and evaluation models of food grain supply and demand--with particular emphasis on private and public storage operations--can be developed and employed if requisite reliable data, and financial and personnel resources can be obtained. Second, the problem can be partially "solved" through a redefinition of the unit of analysis and accounting which would, of course, have to be preceded by reorganization of collective grain storage and marketing activities to that level. We have seen the functional difficulties inherent in trying to operate a centralized grain market operation in a decentralized economy. At

least a partial solution could involve a progressive structural and functional decentralization and redefinition of the basic operating and accounting unit so that they are more congruent with the underlying base structure of rural production and consumption, the available physical and human resources of the country and stated rural development and distributional objectives. The two solutions, while somewhat contradictory at the theoretical level, are not incompatible in actual practice as an integrated grain marketing and storage system must operate at different levels to meet multiple objectives. Thus, while the basic food security operational and analytical evaluation unit can be decentralized to the village or village cluster level, other transhipment, commercial sales and storage activities can be more narrowly, but more appropriately, analyzed on a more aggregate basis. This strategy will be detailed and further explored in the following two chapters.

CHAPTER VII

SAHELIAN GRAIN BOARDS: STRUCTURE AND PERFORMANCE

Introduction

In West Africa, government participation in agricultural marketing, both during the colonial era and after independence, has focused more heavily on exported cash crops than on food crops, a fact one would anticipate given the importance of primary exports in the layered process of periphery-center capital accumulation and economic development. However, with increasing urbanization, the development of more extensive food grain markets, relative declines in per capita food production and drought induced food calamities, West African governments have attempted to exert greater direct control over staple food production and marketing. Sahelian grain marketing interventions have included producer and consumer price policies, competitive and monopoly buying and selling associated with grain storage operations, and, more recently, the large-scale distribution of purchased and donated outside food grain relief supplies.

This chapter will review, for each of five Sahelian countries, the structure, objectives, means and initial performance of national grain marketing and storage institutions and policies. These topics will be covered for Upper Volta in the more detailed case study of that country in the following chapter. In addition, attempts to

implement regional grain storage and marketing programs, proposals for Nigerian sorghum and millet storage and the major lessons from recent drought relief efforts will be briefly reviewed in this chapter. Within the larger conceptual framework which has been elaborated so far in this study, emphasis here will be placed on an analysis of these mechanisms as they affect the practical constitution and operation of sorghum and millet stocks.

Country Reviews

Mauritania

In Mauritania, government coarse grain marketing and storage powers are vested in *l'Office Mauritanien des Céréales* (O.M.C.) created by Presidential decree in August 1975.[1] This embryonic organization is not yet fully operational. In late 1976 arrangements were still under negotiation with the German Federal Republic for the provision of initial technical assistance. Crucial rice imports and distribution are handled by the state trading corporation, SONIMEX *(Société Nationale d'Importation et d'Exportation)*, which had also previously handled some other official grain imports. Relief distribution efforts were coordinated by a national committee headed by the Minister of Health and Social Services and aided in vehicle logistics by the "*Service d'Assistance au Profit de la Population Rurale*" of the Army General Staff.[2]

The structure and objectives of the OMC are similar to those of the other national cereal boards in the Sahel and will therefore be

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[1] Islamic Republic of Mauritania [1975].

[2] See UN/FAO [1973c, 1974c, 1975c].

presented in some detail for illustration. The Director and other administrative personnel of the *Office* report to an Administrative Council made up of representatives of virtually all national ministries dealing with rural problems, the national assembly, the trade unions, the central bank and the chamber of commerce. OMC is operationally controlled by the Ministry of Rural Development but the concurrence of the Ministry of Finance is required for most major operational decisions which involve substantial financial disbursements.

As spelled out in the Presidential Decree, OMC's overall objective is "to contribute to putting into effect national policies of supplying interior markets with basic cereals". To this end it will constitute (1) *buffer stocks* to stabilize prices to producers and consumers while assuring a transfer of cereals from surplus to deficit areas and (2) *emergency stocks* to meet supply breakdowns induced by national production shortfalls. To implement these activities OMC is required to:

1. Determine cereal needs in deficit regions
2. Determine levels of marketable supplies in surplus regions
3. Obtain needed supplies by paying producers guaranteed minimum prices which will serve to stimulate greater production
4. Manage transport from supply to storage points
5. Manage necessary grain storage operations
6. Assure a market supply of sufficient quantity to keep grain prices pegged to periodically determined base reference prices
7. To receive and distribute all food grain aid from the international community
8. To acquire in foreign markets all other grain to be imported, except rice

9. To aid producer cooperatives in the collection and treatment of harvested grain to be sold to the Office

10. To train the cadres and technicians needed to meet their objectives.

This is an awesome task in a country which has the least trained personnel and weakest infrastructure in the Sahel. Mauritania's domestic supply areas stretch along the Senegal River and the southern border of the country where there are almost no usable roads or other means of modern transport, and whose deficit regions are very isolated and reached over very long, poor roads. Maintaining minimum producer prices and controlling consumer prices is only a dream under current conditions and an extensive stock system with major interregional transfers will undoubtedly be quite costly. As a recent AID report concludes, the initial policy decision to decentralize grain stocks and marketing to regional capitals seems a logical one under these conditions.[3] It would also make sense that any buffer stock and price support actions be regionalized particularly since measures to promote national integration of the highly fragmented rural economy are just beginning.

In addition to a very poor internal road system, severe bottlenecks have existed in import channels and in the availability of adequate storage facilities. Most imported grain comes by sea or by road from Senegal. Even with attempts to increase efficiency, the wharf at Nouakchott and river ferries at Rosso (on the main road to Senegal) remain bottlenecks for greater than normal levels of imports. Warehouse storage is considered insufficient for projected regional storage plans although recent construction has raised the total to

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[3]U.S. Agency for International Development [1975b, pp. C14-18].

around 17,000 MT out of an estimated 30,000 MT needed for a minimum storage system.

Senegal

In many respects food grain policy in Senegal is more complex and varied than those in the other Sahelian countries. Among the Sahelian countries, Senegal has the most developed modern economic and commercial base, the largest urban population, by far the best communication and transportation system and the most advanced center-periphery extractive relationships which, at least in their classical form, seem to be becoming increasingly untenable. There are recent signs of some diversification away from almost exclusive dependence on groundnut exports and increased attempts to employ decentralized regional development mechanisms. There is also a realization that policies promoting extractive capital accumulation and subsidized food imports for urban areas were not tackling the key problems of rural stagnation and lagging domestic food production. As a result the government is attempting to provide producers a greater degree of control over their own agricultural surplus (e.g., formation of rural administrative districts which would control up to 75 percent of collected local taxes) and assistance in more localized grain marketing and storage. However, old habits of increasing dependence on government enterprise and employment, and urban expectations of lifestyle and consumption patterns remain strongly entrenched along with most of the structural foundations of the previous system.

These evolutionary tendencies are reflected in some recent changes in ONCAD (*l'Office National de Cooperation et d'Assistance au*

Développement)[5] which, until 1974, had played a very limited role in coarse grain storage and marketing except for the distribution of relief supplies in 1973 and 1974. ONCAD, created in 1966 and under the Ministry of Rural Development, originally shared its cash and food crop marketing responsibilities with OCAS (*l'Office de Commercialisation Agricole du Sénégal*) which it absorbed in the early 1970s. In rural areas ONCAD's functions are linked to two principle elements in Senegalese rural development strategy (which as we will see are similar to basic strategies in Mali, Upper Volta, and Niger): semi-autonomous regional development authorities, usually fairly crop-specific in their programs due to historical patterns of regional crop specialization, and a very extensive network of village level farmer marketing cooperatives. ONCAD has the following wide-ranging functions and objectives:

1. Development and support of rural cooperatives
2. The organization of agricultural input supply systems and the collection and marketing of farm output (traditionally the primary focus was on marketing groundnuts), by way of the cooperatives and in conjunction with the regional development organizations
3. Provision of financing and credit for urban rice imports and, through the cooperatives, for farm-level technological inputs and marketing with funds from the BNDS (the *Banque Nationale de Développement du Sénégal*)
4. Provision and management of the transportation and storage needed to achieve this input (including improved seed distribution) and product marketing.

As further background to an understanding of the institutional position of ONCAD, we must note that government price policies,

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[5]This section draws on material from Ediafric [1975], UN/FAO [1973e, 1974e], Food and Feed Grain Institute [1970], IBRD [1975c] and other Bank reports and USAID [1975b].

although more extensive on paper, have had significant impact only in three areas. These areas and their relationship to ONCAD and the National Distribution and Price Stabilization Fund are represented in Figure VII-1. First, in rural areas, ONCAD channels credit and agricultural inputs--primarily fertilizer for cash crops--to farmers through their cooperatives. Fertilizer, sold at fixed prices, has included effective subsidies of up to 50 percent. Second, slowly rising guaranteed producer prices for groundnuts and cotton (and only recently coarse grains) provide product flows through the cooperatives which ONCAD exports or diverts to urban areas (specifically groundnut oil, rice, millet in the latter case). Third, in urban areas, ONCAD stabilizes and, if need be, subsidizes the prices of rice, wheat, groundnut oil and sugar--all urban dietary staples.

The net distribution and production incentive effects of such a system do depend on the nature of relative prices. As mentioned in Chapter III, these domestic terms of trade have often been turned against rural areas with one World Bank estimate placing a net CPSP fiscal "tax rate" of 20 percent (equal to the difference between producer and export prices less import subsidies and production credit which has fairly good repayment rates) on rural production between 1971 and 1975, including the worst drought years. In 1975 a number of relative price and other policy changes improved the situation for the rural sector; producer prices for groundnuts and grain were increased. The consumer price for rice was increased by almost 100 percent. This stimulated rural production, reduced rice imports by almost one-half and dramatically improved the rural/urban terms of trade. Part of the increase in millet consumption is attributable to

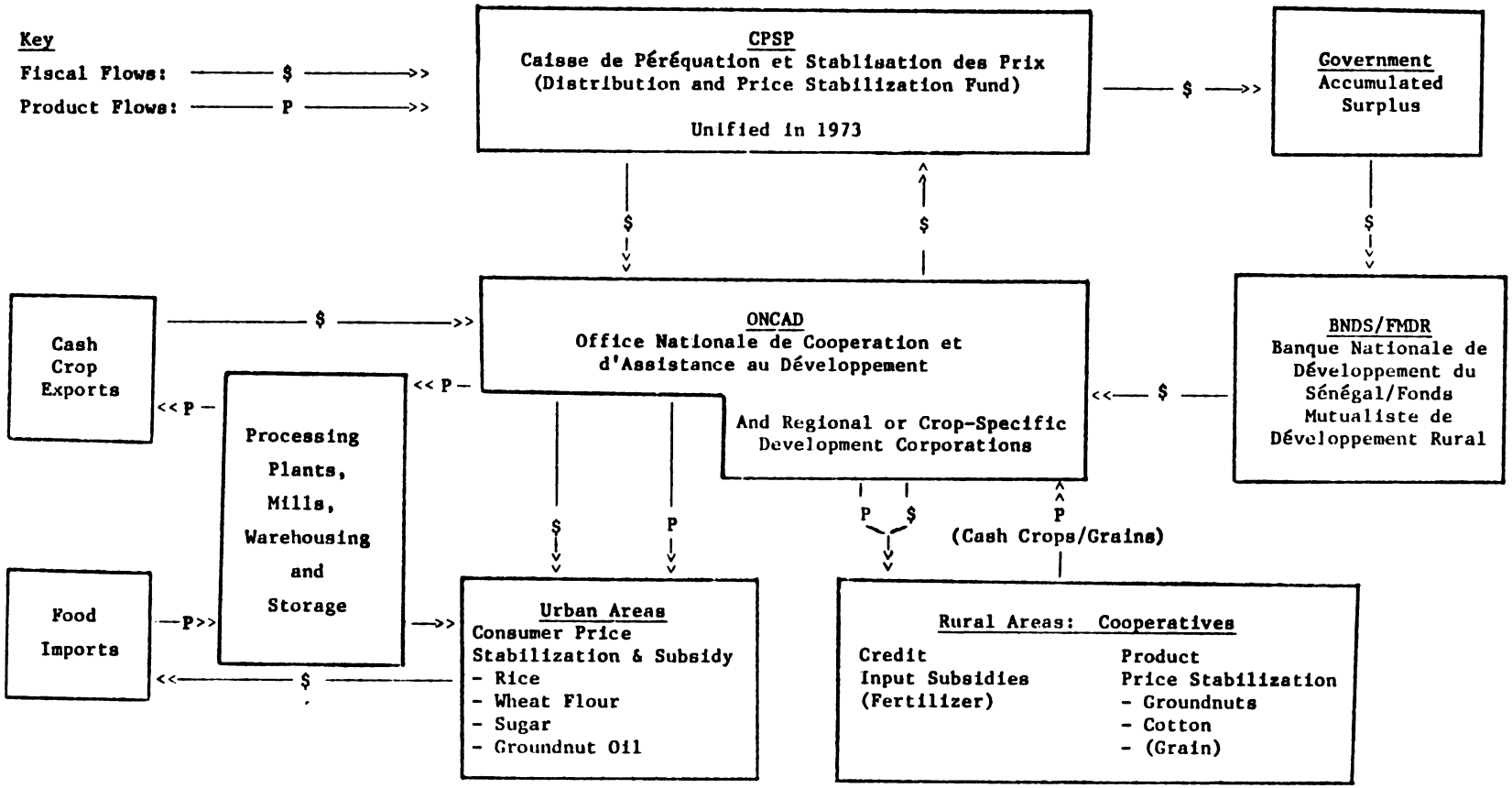

FIGURE VII-1

SELECTED FISCAL AND PRODUCT FLOWS FOR SENEGALESE GOVERNMENT ACTIONS IN FOOD AND CASH CROPS

two technological innovations, the growing success of millet/wheat bread and the development of a processed millet, instant cous-cous.

Whether these changes represent a new trend in persistent improved terms of trade for rural areas or, as in past eras, a temporary improvement associated with the installation of a new set of extractive structures, is not clear. What is clear is the complicated role ONCAD plays as the government middleman in cash and food crop trade. Given past experiences this may not bode well for the establishment of more independent, locally-controlled grain stock mechanisms to benefit all sectors of the Senegalese political economy. One suspects that incentive structures and operating procedures formed during the years when the groundnut trade was almost the exclusive concern of the organization may be less than optimal for a grain marketing and storage program even if handled by a newly formed special section of ONCAD. Although ONCAD has received outside technical assistance financed by IBRD since 1969, it has been persistently criticized for lack of financial autonomy, for related financial mismanagement and poor timing in forwarding operating funds to buying agents in the field, and persistent overstaffing and other civil service related problems.

ONCAD's direct experience with coarse grain storage and marketing is quite limited. Between the 1965/66 and 1973/74 marketing seasons it purchased total millet and sorghum ranging from only 21 tons to about 30,000 tons. Before 1974 these were simply seasonal purchase/resale stabilization operations. With official buying and resale prices set at 17 and 22 CFA per kg, ONCAD was estimated to have incurred losses of about 6 CFA per kg which were met through funds from

groundnut reserves. These inappropriate price structures provide partial explanation for its limited activities in grain markets.

The physical means at ONCAD's disposal to engage in more extensive grain storage have also been limited. While it has a large, well-maintained fleet of about 250 to 300 owned and rented trucks used primarily for input supply and groundnut marketing to oil plants and the Dakar port, its warehouse storage facilities, particularly in rural areas, have been very limited. According to available information, ONCAD largely has used rented storage both in the Port of Dakar and in rural areas. In Dakar where about 100,000 tons of commercial storage is available, ONCAD has maintained rolling stocks of about 35,000 tons of rice for urban consumption but cannot begin large-scale coarse grain storage in these facilities without jeopardizing the cargo handling capacity of the port. Both in Dakar and in rural areas where small commercial storage facilities are used, storage losses through excess moisture and insect infestation are reported to be unusually high.

In order to meet the storage needs associated with its commercial grain marketing, ONCAD in 1975 proposed a $10 million plan to construct a three level 50,000 MT storage system for coarse grains with facilities at the producer, cooperative and center levels (25,000 MT capacity for Dakar and seven regional facilities of 1,000 to 3,000 MT capacity each). To a limited extent ONCAD has begun to implement this storage construction plan but the bulk of it awaits foreign donor financing. In addition to these buffer and pipeline stocks, preliminary plans for a 50,000 MT emergency reserve stock have been discussed. This, of course, would require even more

storage since the previously proposed capacity would be used to handle annual and inter-annual urban supply and buffer flows.

Chad

Responsibility for food grain marketing and storage in Chad is vested in the FDAR (*Fonds de Développement et d'Action Rurale*) which was created in 1967, and specifically in its *Département Céréalier* (D.C.) which was organized in 1969. The FDAR/DC is part of the Ministry of Agriculture and Land Management[6] and has a quasi-commercial charter and some financial autonomy which make it similar in structure to the other Sahelian marketing boards. In addition to grain acquisition, storage, price stabilization and emergency distribution, FDAR has other tasks such as rural well drilling and some rice milling and marketing. The drought period, particularly after 1972, and the relief efforts it brought provided a major impetus in the expansion of the organization and the development of its operational capability.

FDAR/DC has the most limited cereals marketing and storage experience in the Sahel except for Mauritania and its organizational and infrastructural capacity is equally limited. Nevertheless, it has received an increasing amount of technical assistance and fairly intensive study in recent years.[7] For the first five seasons FDAR

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[6]Formed by the merger of two Ministries in a government reorganization in June 1976.

[7]These summary observations on FDAR/DC are based on a surprisingly rich documentation becoming available including: Auffret [1974], Borsdorf [1976], Republic of Chad [1973], Creupelandt and Corbett [1974], Levac [1974], Maxon [1976], Naim [1976] prepared for the *Club des Amis du Sahel*, UN/FAO [1973f and 1974f] and USAID [1975b].

engaged in limited intraseasonal stabilization in N'Djamena and several regional towns. In the capital it bought cereals directly from commercial traders, stored them and resold them during the "hungry season" in an attempt to moderate the seasonal price increase. In smaller towns the administrative "sous-préfet" was the designated FDAR buyer. These latter actions were not felt to be too effective even on a local basis, because government officers are not always the most qualified grain buyers and stock managers, are not administratively responsible to FDAR, and because "hungry season" sales have often been made only to government bureaucrats and their families, a practice which has its roots in traditions of colonial privilege.

In 1969 an operating fund for cereals purchasing was constituted through the sale of food aid provided by the World Food Program, later supplemented with direct capital grants and FAO technical assistance. Cereal purchases on local markets have never exceeded 2,000 MT. From 1972 through 1974 FDAR/DC largely functioned as a relief distribution agency and abandoned all efforts to buy on local markets. With greater financial and material backing FDAR/DC used three mobile buying teams to buy cereals directly from farmers for the first time in 1975. In addition about a fifth of total Chadian rice production of some 35,000 MT (milled) is processed by FDAR's rice mill and in 1976, for the first time, FDAR planned to market the entire output of the mill itself. Official producer prices for rice and wheat have tended to keep most marketed surplus out of government control since better prices could be had in the private market.

Experiences in the delivery of relief supplies point up some of the difficulties facing FDAR/DC in its storage and marketing programs. First, for grain imports, Chad is the Sahelian country furthest from the sea, reached by very expensive and time-consuming combinations of rail and road transportation through Nigeria and Cameroons. Creupelandt estimates that six months is a reasonable time interval between initial donor notification concerning food shortages and the actual delivery of relief supplies in Chad.[8] This includes the concentrated use of the national transport monopoly, the CTT (*Coopérative des Transporteurs Tchadiens)*, which handles most external trucking to railheads in neighboring countries but only about 10 percent of internal traffic.

Second, storage facilities, with their placement and arrangement, represent another critical bottleneck. About 10,000 MT of a total capacity of 18,000 MT is located in or near D'Djamena and used for operational or pipeline stocks. Various plans have been drawn up to increase this capacity to 25,000[9] and even to 50,000 MT.[10] However, this raises realistic concern that too much of the storage may be located in N'Djamena, further emphasizing the urban bias of FDAR emergency stock and stabilization efforts. For example, FAO proposed, and the government accepted, an emergency reserve stock plan which would place 9,000 MT (of the total 10,000 MT) in N'Djamena and 1,000 MT in Abéché on the opposite eastern side of the country under the ostensibly plausible reasoning that this would promote more efficient

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[8]Creupelandt [1974, pp. 11-13].

[9]Naim [1976, p. 33].

[10]Maxon [1976, p. 36].

storage and permit easier supervision. However, in addition to ignoring the populous southern and chronically deficit north-central areas of the country, this seems to ignore the logistical advantages of dispersed placement of relief supplies given Chad's huge distances and very poor roads which are largely impassable after the first rains when the need for extra grain supplies can be the greatest.

Third, attempting to use a small, highly centralized organization to operate a grain stock program in a decentralized economy will, as we have seen in other economic sectors, tend to channel funds, infrastructure, jobs and incentives to a few urban centers. This is shown in recent FDAR funding proposals made to USAID which focus on construction of new administrative structures and storage facilities and opening new sales points in N'Djamena while, in rural areas, only increasing the number of buying points to feed this urban appetite. Given the multiple objectives possible for a grain system this particular set seems to be rather heavily skewed in favor of potentially profitable commercial sales and urban consumer price stabilization while ignoring producer price supports and incentives, and making stabilization and relief supplies more readily available in rural areas. USAID, to its credit, has resisted these proposals and suggests instead funding a pilot program of FDAR field administration of grain storage at the *sous-préfecture* level.[11]

Finally, overcentralization of storage and market actions in a few urban areas tends to increase per ton operating costs and this, coupled with pressures on the Chadian government to enhance its very

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[11] Maxon [1976, pp. 25-39 and Appendix H].

weak political control by forcing FDAR/DC to distribute food supplies at substantial economic losses to certain urban and regional constituencies, leads to increased dependence on outside financing to meet the rapidly inflating budget needs of a national food program for "self-sufficiency".

Mali

Mali's experiences in cereal storage and marketing are, for a number of reasons, perhaps the most important in the Sahel in terms of their pedagogic value. First, during colonial times and even into independence Mali was considered a surplus production area and made substantial exports to neighboring areas. While it still has some export trade, particularly of a clandestine nature, and has begun to export officially by way of its grain board, it is clear that aggregate cereal production has dropped for reasons other than drought and population migration alone. Second, Mali has made the strongest attempts since independence to break colonial and neo-colonial relationships, has intervened most heavily in all sectors of the economy--with decidedly mixed results--and has tried the widest range of grain storage and marketing institutions and policies. Third, the government marketing agency, OPAM (*Office des Produits Agricoles du Mali*), part of the Ministry of Commerce and Finance, is the largest in the Sahel in terms of its personnel, facilities and experience in cereals marketing. OPAM, as a result of a growing realization that a combination of government policies was leading to increased stagnation in commercial food production and marketing (compounded by the adverse effects of the drought) and as a result of its inability to achieve even a part of its own stated objectives with the means available is,

like most of the other Sahelian cereals boards, undergoing a period of extensive study and reorganization.[12] A National Commission to restructure OPAM was formed in 1976 and its policy recommendations are expected in the near future.

The basic geography of local cereal surpluses and deficits helps explain a good part of the major operational activities of each Sahelian cereals board. In Mali the zones of chronic cereals deficit are those involving the larger cities (e.g., Bamako, Kayes, Mopti) and the Sixth Region, a vast area abutting the Niger border around the desert town of Gao (see Figure III-1 in Chapter III). Regions of surplus production are generally located in the south-central part of the country. OPAM's infrastructure and personnel are distributed primarily to facilitate the seasonal transfer of this domestic surplus and, as we will see, are less optimally located to serve the local needs of producers in areas of balanced production and consumption. The staff of OPAM consists of administrative, warehouse, transportation, purchase and sales personnel who, numbering about 750, have been given a theoretical monopoly on all domestic marketing of coarse grain in addition to the fairly minor export of fruit and vegetables.

The annual "marketing campaign" is a complex process and will be described in some detail since it is typical in many respects of procedures used in the other countries. It begins with regional OPAM

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[12] In this chapter it is impossible to do justice to the wealth of documentation on cereals marketing and storage in Mali, some of which is a product of this very recent study and reorganization planning. For somewhat older background information see Food and Feed Grain Institute [1970], Panhuys [1973], Robbins and Garvey [1972] and UN/FAO [1973b, 1974b]. For more recent information, see Haik, et al. [1976], IBRD [1975c], Richard and Van Den Berg [1975], Steedman, et al. [1976] and USAID [1975b].

advisory councils summarizing local stock levels, likely regional cereal surpluses and deficits and estimated needs for operating funds from the central government. These calculations are forwarded to OPAM central offices in Bamako where they are to be used in the regional allocation of available credit and personnel and to plan needed inter-regional cereal transfers. This information, along with forecasts of cereal availability, market conditions, etc., are theoretically used to set official grain price spreads in the marketing channels between the producer and the urban consumer. There is very little evidence, however, that Mali, or any of the other countries, uses anything beyond the crudest notions of supply and demand, a rough national averaging of operating costs and past "rules of thumb" in setting these price levels. The setting of the consumer (i.e., urban) price has usually received the greatest attention and is subject to great political sensitivity. It is often alleged that, within certain limits, the price setting process proceeds as follows: a "reasonable" consumer price is selected, rough cereals office per ton operating costs (and anticipated government subsidies) are subtracted, both of which produce, in turn, a "practicable" producer price.[13] A schedule of these marketing margins, called a *barème* in French, is established and published by decree at the beginning of the harvest season. The 1974-75 Malian seasonal *barème* for millet is illustrated in Table VII-1.

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[13] In Niger, OPVN officials reported a similar process and when it produced a producer price that was "too low", various categories of intermediate operating costs were simply reduced by 50 percent to produce a more "acceptable" price structure.

TABLE VII-1

MALIAN "BAREME" (MARKETING MARGINS) FOR MILLET, 1974-75

	Malian Francs Per Ton
Producer price	32,000
Transport costs (producer's)	2,150
Transport costs (cooperative's)	2,900
Purchase cost to OPAM	37,050
Losses	800
Finance costs	2,130
OPAM tax (management fee)	5,000
OPAM's transport costs	5,000
Wholesale price	49,980 (rounded to 50,000)
Retail margin	1,500
Retail price	51,000

SOURCE: Haik [1976], quoted in Steedman, et al.[1976, p. 110].

The seasonal financing implied in the *barème*, particularly funding for payment of the producer price and local transport costs, is obtained on credit from the Development Bank (the BDM) and forwarded in segments through the administrative hierarchy (*circles, arrondissements*) to the local level. The timing of these funding disbursements is critical, particularly if the agency is trying to mount a credible price support effort at harvest time. Unfortunately, the monies often do not arrive on time and delays in second or third disbursements can interrupt the rhythm of a buying campaign.

Two further elements enter into the buying campaign. First, OPAM purchases are made by using the intermediary services of two other structures which are important in Malian development policy, a series of regional development agencies--known as *Operations* or *Actions*, and the extensive system of marketing cooperatives in rural areas. Secondly, a system of purchase quotas are assigned to the village cooperatives. Quotas will not be discussed here except to offer the observation that some producer cooperatives have had to go into the open market and purchase grain in order to make their required quota delivery to OPAM buying points.

There are at least thirteen separate *Operations* and *Actions* in Mali in addition to the existing central, regional and local government administrative structures. *Operations* cover economic or agricultural regions rather than administrative areas and have a certain measure of financial and administrative autonomy. Some are more general purpose in nature and promote both food and cash crops while others focus more specifically on single crops (e.g., rice: *Office de Niger, Operation Riz Mopti, Operation Riz Segou;* millet: *Operation*

Mil Mopti, Operation Mil Kaarta, etc.).[14] In areas where these organizations are active, they act as purchasing agents for OPAM, which allows them, in somewhat traditional fashion, to deduct principle and interest payments for previous credit in kind from the farmer's gross crop receipts. There is often some reluctance on the part of the *Operations* to increase their cereals marketing activities since the *barème* often does not permit a full recovery of costs, particularly those for transportation. This is illustrative of the kinds of problems induced by the fixed cost and price margins of the *barème* when account must be taken of real differences in local transport and operating costs. Fortunately, there is some adjustment made in urban retail prices to account for higher transport costs to more remote areas.

Outside the effective areas of the *Operations* which have strong grain production activities, cereal purchases are conducted using Mali's extensive system of rural cooperatives which have been correctly called "para-administrative organizations",[15] rather than true cooperatives since they perform little more than marketing functions to facilitate the work of state agencies. As we have seen money advances are forwarded through the administrative hierarchy to the cooperative and the *barème* includes fixed margins to cover producer transport costs and the cooperative's overhead and transport costs to the *cercle* level where grain goes to OPAM warehouses or buying points. Often the transportation allowance is apparently not paid to the farmer and the cooperatives may face difficulties in covering costs

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[14] See Steedman, et al. [1976], particularly pages 32-39, for a good description of the *Operations*.

[15] Panhuys [1973, p. 6].

if the distances involved are substantially greater than the average. Cooperatives are not allowed to store any OPAM grain at the local level for subsequent resale. Instead, it is transported to the *cercle* level and then back to the local level with a very small re-transport allowance (1,500 MF per ton) generally not adequate to cover costs. At the *cercle* level, stocks in excess of the local resale quota are shipped to regional OPAM storage or transshipment facilities.

OPAM was able to purchase an estimated 15 to 50 percent of the marketed surplus of cereals in pre-drought years which left the rest of the market to the commercial sector which has often been forced to operate clandestinely. Experiments to license various types of traders to permit them to earn a fixed margin in purchases in areas not covered by OPAM have largely failed. Among the problems which have arisen, failure to respect the official producer price, speculative misuse of advanced funds, and participation only when OPAM has provided higher prices than the open market, have been most frequently cited.

OPAM's own transportation capacity is quite limited and it largely relies on services obtained from Mali government river, rail and road transport companies (i.e., COMANAV, *Companie Malienne de Navigation;* RCFM, *le Régie des chemins de Fer du Mali;* CMTR, *Companie Malienne des Transports Routiers),* as well as licensed private truckers. Again, it is often difficult for both the private and government hauler to adjust his costs for variable road and load conditions given flat kilometer per ton rates for paved and dirt roads.

OPAM storage, the primary infrastructural component of its marketing and stock system, is the most extensive available to any

Sahelian cereals board. In addition to the relatively minor use of rented warehouse space, OPAM, in 1975, had 91,500 MT of storage capacity available, most of it in the major urban deficit areas and in about half the *cercle* seats. (The other half of the *cercles* must relie on rented facilities often not entirely suitable for grain storage or incur costs by exporting and then reimporting cereals into the local region.) There are few if any official inducements to hold farm-level or village (cooperative) stocks which, for certain stock objectives, would provide a much cheaper alternative to increasing the number of centralized government bag warehouses. However, it is also clear that if OPAM is going to attempt to hold emergency, buffer and pipeline stocks, its storage capacity and utilization procedures will have to be improved in order to meet at least some part of the various combinations of storage requirements that differing aggregate supply and demand conditions would produce. It has plans to approximately double its capacity within the next few years, again with disproportionately large amounts of the new capacity going to urban areas.

Niger

Until 1970 the Niger government attempted to augment sorghum and millet supplies and stabilize prices in Niamey, the capital, through a limited buying program which was hampered by insufficient operating funds and overly restrictive margins between producer and consumer prices which resulted in chronic financial deficits. Since 1970 cereal storage and marketing in Niger has been the responsibility of *l'Office des Produits Vivriers du Niger* (OPVN).[16]

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[16]Information in this section comes from a review of numerous Government of Niger and USAID documents and the following: Becker

The primary objectives of OPVN have been price stabilization, inter-regional grain supply management and collaboration with other cereals boards in neighboring countries. The creation of OPVN was made possible by a multinational technical and capital assistance program channeled through the *Conseil de l'Entente*, one of the region's relatively weak political unions.[17] In recent years, due to a relative improvement in producer prices for cereals versus cash crops (groundnuts primarily), a larger percentage of OPVN's cereals purchases has been made through the assistance of the marketing cooperatives of the UNCC (*Union Nigerienne de Crédit et de Coopération*) which until a recent decline in world prices had concentrated its efforts almost exclusively on groundnuts.

Niger's geography strongly affects the location and logistical requirements of any cereals storage and marketing program. Most cereal production and marketing is spread over a relatively narrow east-west belt which follows the country's southern border between Chad and Upper Volta. The recently completed paving of the "highway of national friendship and unity" has effectively linked the major towns across this belt but transportation is still very difficult in the isolated deficit areas in the northern part of the country. Niger would clearly be the country most favorably located to take advantage, on a decentralized basis, of cereals trade with northern Nigeria.

[1974], Burke, et al. [1971], IBRD [1975c], Jomni [1975], Republic of Niger, OPVN [1972, 1975], Pattinson [1975], Reed [1974], UN/FAO [1973d, 1974d, 1975b, 1975d], USAID [1975b, 1976b] and Wilcock [1976a]. In addition, many useful insights were gained in unpublished reports and in personal interviews with OPVN officials conducted in Niamey in November 1975.

[17] See the following section on regional stock efforts for more detail on this program.

Niger, among Sahel countries, was one of the most severely affected by the recent drought and, along with Mali, it received the largest total shipments of relief grain. After one year of operations, when it worked quite successfully with a very limited infrastructure of several trucks and almost no storage capacity, OPVN mushroomed in size as it became primarily a relief distribution agency to the relative abandonment of its cereal price stabilization efforts. Relief distributions were handled in cooperation with the *gendarmerie nationale* and the magnitude and urgency of these operations led to a general erosion of accounting accuracy, vehicle maintenance and the ability to stabilize local markets through selective buying and selling. OPVN's truck fleet grew rapidly to about 80 vehicles by 1975 but it has been hampered by repair problems. Similarly, storage capacity grew from about 4,000 MT in 1971 to 35,000 MT of warehouse storage in 1975. (Currently modern warehouse capacity is being increased and, in addition, there are about 3,000 MT of mud-brick local storage facilities which are used but inadequate.) In general there is a strong tendency to increase physical infrastructure even before a consolidated buffer and emergency stock program has been devised.

OPVN's first buying campaign, 1970-71, was fairly successful despite deficiencies in equipment, infrastructure and personnel. This was due to the fact that the agency began with a sizable and *readily available* operating fund created through the sale of PL480 grain and the fact that it employed a flexible system of *regional pricing* which permitted variable transport and operating costs to be reasonably covered. There is good evidence that the limited purchase/resale operations it conducted in 1970/71 had observable impacts in

increasing producer prices at harvest time and decreasing "*soudure*" prices, particularly in urban areas.[18] Over the next four years, however, a combination of drought relief activities and erratic, politically-based official price policies produced institutional repercussions from which OPVN is perhaps only beginning to recover and which frequently seemed to have had a destabilizing and disruptive effect on national grain markets and production patterns. First, other OPVN market activities were overshadowed by the magnitude of the relief distribution task which handled 10 to 20 times as much grain over the 1972-73, 1973-74 and 1974-75 seasons. Second, official prices, set by an interministerial *Comité de Céréales*, were fixed at uniform national levels which eliminated previous regional differentials. This, combined with chronically insufficient margins, caused OPVN to accumulate operating deficits on its nonrelief market activities.

A third by-product of inappropriate and ad hoc policies and widely fluctuating relative prices were the effects of these factors on the allocation of farmer production resources and the distribution of benefits. For example, during the 1973-74 season when grain supplies were shortest, producer prices were increased to 25 CFA/kg in order to try and attract greater supplies, largely to no effect. Then during the 1974-75 season aggregate levels of production were greatly increased but prices remained at 25 CFA/kg. Traders who were acquiring most cereal supplies at the village level at 12 to 15 CFA/kg resold them to OPVN at the official price. As a result it has been estimated that about one-half of the three billion CFA operating fund was paid to private traders who realized an estimated net profit of

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[18] USAID [1976b, pp. 27-28].

about 700 million CFA.[19] Reduced harvests in the next season, 1975-76, reversed this pattern with traders making very few deliveries to OPVN since unofficial market prices were running substantially higher than 25 CFA. This was compounded by the fact that much of the cereal trade had moved out of public market places because of police surveillance of prices making OPVN's consumer protection task virtually impossible to accomplish. Even here there was an exception as official prices for *Niébé* (cowpeas, profitably exported for several years to northern Nigeria) were far higher than prevailing domestic market prices with some evidence of substantial diversion from cereal production.

These costly and destabilizing actions and the growth of a larger and less productive OPVN bureaucracy illustrate the risks of overly rapid institutional growth which, under highly unstable market conditions, tend to benefit traders and selected groups of powerful urban consumers much more than producers. This is confirmed in the stern conditions being imposed on OPVN operations associated with additional FAO coordinated assistance for the institution of an emergency stock system and the reestablishment of a reduced but more financially viable and efficient buffer stock program.

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[19] Jomni [1975, p. 3]. These negative distributional impacts are almost completely opposite to the conclusions reached by USAID [1976b], which felt that most of the benefits had gone to producers.

Considerations for Sahel-Wide Grain Storage Efforts

There are good arguments to be made for Sahel or West African regional cooperation in grain storage and marketing programs. These are due to similarities and complementarities in production patterns, high transport costs for imported grain, large volumes of grain smuggled across borders to take advantage of significant differences among market and official prices, similarities in institutions and types of government intervention in grain markets, and a strongly expressed desire to enhance food self-sufficiency. Patterns of correlation in production variation reported in Chapter IV indicate that, in normal years, there are intra- and inter-national variations in grain supplies which are potentially off-setting. In addition, relative comparative advantage and traditional patterns of multi-national grain trade indicate strong possibilities for cereals trade for mutual benefit. Exchanges among cereals offices have occurred on a small-scale, ad hoc basis in the past few years but there are very few operational mechanisms to facilitate the necessary flow of information and grain supplies. There are, however, a number of new institutions which might serve as vehicles for this type of regional economic and institutional cooperation. For example, a francophone West African economic union, CEAO (*Communauté Economique de l'Afrique de l'Ouest*) with headquarters in Ouagadougou, has recently been formed, joined by an even newer and larger organization, ECOWAS (the Economic Community of West African States) which also includes the anglophone states, most importantly Nigeria. In addition, the Sahelian organizations of CILSS and the *Club des Amis du Sahel* (described in Chapter I)

might be in the position to promote regional cooperation through coordinated technical and capital assistance programs.

We should not, however, be overly optimistic since there are strong traditions of lack of cooperation in West Africa even where mutual interest is fairly obvious. Some of this may be casually attributed to differences between anglophone and francophone traditions and to the seemingly necessary development of competitive nationalism. In contraposition, we have also seen strong inherited patterns of deliberate or functional/structural fragmentation of the Sahelian periphery in order to enhance colonial rule and trade. These traditions reinforce the fact that boundaries facilitate differential flows of productive resources which are vital to the process of unequal capital accumulation in center-periphery structures. This certainly has been true in West Africa with the materially advanced states such as Senegal and the Ivory Coast being more hesitant to participate in any structure which would impinge on their position as regional economic centers. This bleak assessment, however, need not be that discouraging. The most important lesson which can be drawn from the relative success of economic unions in different parts of the world is that functional integration for mutual gain is much easier to achieve and lays the needed groundwork for considering political union at a later date. Grain storage and marketing may be one of these functional areas where a series of flexible bilateral and multilateral arrangements might be built between cereals offices, under the auspices of a larger, less-focused regional grouping.

We may benefit from an examination of the experience gained in one "regional" grain stabilization project and Nigeria's plans for

a comprehensive grain marketing and storage system. We must, of course, also evaluate factors such as the effects of road improvements on international transport costs and the desirability and feasibility of coordinating stock movements and producer prices. These will be covered in later chapters.

Conseil de l'Entente Stabilization Project

As earlier mentioned, Niger and Upper Volta have received technical and commodity assistance from a multinational aid project (contributions were primarily from France, Canada and the United States) channeled through the *Conseil de l'Entente*, a regional organization with its headquarters in Abidjan, Ivory Coast. The following summary observations on this regional grain marketing and storage project may be instructive for future efforts.

First, the choice of regional organization is critical and can greatly influence the nature of the interaction possible to undertake. The *Conseil de l'Entente* includes only two Sahelian countries in its five members (Benin, Ivory Coast, Niger, Togo and Upper Volta) and has no anglophone participation. There seems to be very little reason for its existence other than historical circumstance, particularly given the limited range of activities it promotes (primarily sponsoring infrequent Presidential summit meetings and operating a loan guarantee fund) and particularly with more broad-based, functionally coherent alternate regional organizations now taking form.

Second, the Entente Stabilization Project was originally designed to include all five Entente partners and Ghana which they encircle.[20]

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[20]See, for example, Checchi and Company [1970], Food and Feed Grain Institute [1970] and USAID [n.d. and 1976b].

Although there was substantial attention devoted to functional interstate exchanges this admirable regional focus was quickly abandoned. Ghana never seriously participated in the scheme and the three coastal countries apparently did not have as great a need or interest in the establishment of food grain stocks and new patterns of food market intervention. This left Niger and Upper Volta in the picture. Several Entente personnel admitted that virtually the only remaining rationale for channeling funding through that organization was to circumvent limitations on the number of bilateral aid agreements individual countries, particularly the United States, could enter into at that time.

Third, patterns of "inter-office" interaction established under the project have not always been the most productive. Virtually no functional contact or systematic information exchange between the two offices was promoted or, seemingly, even contemplated. Contact and coordination, when it occurred, were often through the intermediary of the Entente office in Abidjan. These procedures did not promote functional interaction and seemingly only added another layer of costly administration between the cereals offices and sources of needed assistance.

Fourth, the Entente Regional Cereals Office, which received much of the available project technical assistance, was placed in Niamey and, as a consequence, OPVN received a highly disproportionate share of the training, planning and operational assistance which certainly did little to strengthen OFNACER, already hampered by inappropriate institutional and financial structures and arrangements. While the location of regional institutions lends itself to the host country

receiving a larger share of total benefits, other mechanisms might have helped diffuse available assistance more evenly.

Finally, donor dissatisfaction with certain national policies--particularly with Upper Volta's granting of monopoly buying powers to the ORD's--hampered the operation of the entire program by delaying the project's second phase funding in an attempt to pressure Upper Volta to rescind this objectionable policy. The resulting delays in obtaining needed material and technical assistance further weakened the capacity of both offices to begin to adjust to more normal operations in the years immediately following the drought. These conflicts have been resolved, however, and the project has been continued under a reduced level of funding. In summary, the Entente Grain Stabilization Project was one born of admirable intentions whose effectiveness has been blunted by attachment to a weak, highly political regional organization, by the participation of only two Sahelian countries in the scheme, by the disproportionate concentration of project resources with one board, and by the failure to build more functional or operational interboard contacts.

Proposals for Nigerian Food Security

In the past five years, Nigeria, particularly in its northern areas, has faced food production and marketing problems similar to those in the Sahel. Food production, particularly sorghum and millet was hard hit in 1973, the worse drought year, but this only represents an exaggeration of prevailing trends in declining per capita output. Similar phenomena of rapidly growing urbanization, aggregate market food demand and food imports have also been quite apparent.

The federal government of Nigeria has decided to try and meet this problem in several ways. First, it is placing increasing emphasis on augmenting private and public sector food production through efforts in its university agricultural research centers and through programs such as the National Accelerated Food Production Program (NAFPP). Second, it is establishing a National Grains Production Company (NGPC) with wide terms of reference to stimulate private and begin public production of grain as well as engage in grain procurement, storage, distribution, processing and marketing. Recently, a Nigerian Consultative Group and an FAO Food Security Mission completed a major joint study of the situation with recommendations concerning the operation of the NGPC, other facilitating agricultural sector policies, and specific measures which need to be taken to maximize the viability of the national grain storage program. In the latter program the federal government is committed to the installation of a minimum of 250,000 MT of grain storage facilities to be coordinated with those planned by state governments amounting to an additional 350,000 MT.[21]

In terms of an overall food security program the report first recommends that the state and federal emergency and buffer stock actions be carefully tied to each other, and to the NAFPP and NGPC programs to provide farmers with increased assistance in production technology and in farm level storage. Second, it recommends that *pre-planting* minimum producer prices be instituted in certain regions on a pilot basis. These prices would be set on a flexible regional

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[21]Nigeria, Federal Ministry of Agriculture and Rural Development [1976].

basis following the recommendations of a proposed Federal Agricultural Price Commission and would be payable to farmers at numerous state and federal grain depots and storage points.

Intra-seasonal price stabilization would be largely the responsibility of state storage and marketing authorities who could call on federal back-up support if need be. Inter-annual price stabilization is a much more demanding task and would require much larger amounts of storage capacity, some of which is now slated for emergency stocks; this activity is therefore largely confined to the future to be built on experience in handling yearly stabilization and emergency stock turnover and storage losses.

In addition to very detailed recommendations on the structure and functioning of the MGPC, the report makes several specific recommendations relevant to this study. First, it recommends that the agency's storage functions be considered by the federal government as a service whose full operating cost should be covered by appropriate prices and margins. Second, it recommends that new stock facilities be of proven, uniform design for bag storage (except for two bulk storage facilities to be maintained for training and experimental purposes until the costs of this system can be effectively reduced), and that they be built by one contractor carefully supervised by inspection and auditing teams. It also recommends the installation of centralized grain drying facilities at several key locations so that grain can be dried, stored and profitably salvaged. The training of decentralized storage facility management and warehouse personnel receives heavy emphasis.

A third major set of recommendations deals with improving farm level storage through improved extension services and an expanded

program of providing technical storage inputs to producers. A fourth and final point is a strongly expressed desire to promote a regional emergency and buffer stock coordination program with "neighboring states, especially those in the drought-prone Sahelian zone".

It seems clear that Nigeria will offer a major opportunity for the Sahelian cereals office to profit both from a strong regional supply source and from the lessons of a food security system conceived and executed along somewhat different lines than their own.

Sahelian Food Grain Marketing and Storage Institutions and Policies: A Summary

In this review of Sahelian cereals marketing and storage institutions and policies, we have seen a number of common recurrent features which are summarized in this section. We have also seen that the physical environments of the different Sahel countries, while sharing certain common characteristics, also differ substantially in detail which helps to define specific physical, logistical and institutional food security problems and possible structural and functional remedies. Among these cereals offices the oldest has been in existence for only about ten years and their collective recent history has been marked by the destabilizing effects of massive drought relief activities.

The overall performance of grain boards in the Sahel has been quite poor to date. The offices have not exercised much real influence in cereals markets and their actions have often contributed to the misallocation of production resources leading to negative distribution consequences as urban consumers and private traders have often been the chief recipients of program benefits. In contrast to this bleak assessment, however, the potential of cereals marketing

and storage institutions to promote greater food production, reduce producer risk as well as stabilizing urban grain supplies has been selectively demonstrated. The objective now should be to help identify the structural and functional elements of the present system of grain marketing and storage programs which are amenable to change. The following summary is designed to provide insights and lessons which can be used to improve food security institutions in the Sahel.

Institutional Structure

1. The grain boards are often hampered in the accomplishment of their various objectives by inappropriate institutional structures. In some cases marketing and storage responsibilities are divided among various agencies with coordination problems and duplication of effort resulting, particularly if these agencies are in different ministries. This may also occur if there are a number of agencies *along* the food channel between producer and consumer leading to unnecessary and costly grain exchanges. Further, the negative effects of suboptional structural arrangements are exacerbated by a lack of coherent food policies.
2. All the cereals offices, like other Sahelian institutions, are structured administratively or "from the top down" leading generally to disfunctional overcentralization in what are still decentralized economies. Attempting to force such structures onto the localized cereal economy leads to very high operating costs and negative distributional effects in favor of the urban population.

3. Several of the offices are weakened by having to fill multiple and sometimes conflicting missions. This is particularly true for those organizations which are responsible for cash crop as well as food marketing and storage and the provision of credit and inputs to producers. While there are often savings in logistical costs when one institution handles multiple roles, problems stem largely from differing institutional behavioral norms associated with accomplishing these tasks.

4. In some cases, the structures and patterns of incentives which characterize intermediate regional development organizations and local cooperatives are largely extensions of patterns of top-down, administrative bureaucracy which serve to channel upwards expropriated agricultural surplus to support urban sectors, functionally linked to the developed Center of the internatonal economy. Again, what one could call "cash crop thinking" is applied to food crops, particularly as supplies increase with the "deepening" of urban food markets.

5. Ineffective official monopoly powers only make governments look foolish, anger certain donor agencies and often put even greater financial benefits into the hands of the private commercial sector.

6. Similarities in structure, function, objectives and statutory powers of cereals offices should serve to facilitate direct regional inter-office contacts and cooperation although very little of this has yet occurred. This can largely be attributed to the functioning of "feudal interaction structures" (see Chapter II) focused on each country's frail center and thus linked to the

outside world. There is a tendency for any formal international contract to pass through and be limited by the common denominator of the degree of inter-state *political cooperation* which is generally very low. There is room for the promotion of direct *functional* contacts among cereals offices particularly as infrastructural improvements take place. The coastal countries are vital to the structure and functioning of evolving West African regional economy and thus must be included in any viable regional food-security strategy, particularly Nigeria which produces about one-half of West Africa's millet and sorghum.

Objectives

1. All the boards have similar formal objectives for their cereals marketing and storage activities. As we have seen, these include establishment of readily available emergency reserve stocks, facilitating internal grain transfers (including development of market infrastructure as food markets "deepen" with urbanization), and the intra-annual and inter-annual stabilization of both producer and consumer prices and incomes.
2. We have also seen that particularly within a center-periphery framework there are inherent contradictions among these objectives. Given these conflicts in stated objectives, some "modernizing" institutions, controlled by the urban sector have largely looked to the top of vertical marketing channels. In some respects the offices have functionally been a part of an integrated system which results in the transfer of agricultural surplus to urban areas in a manner which does not promote balanced economic growth. The activities of the offices have in some instances specifically

benefitted only government officials and their families in urban centers and smaller towns in ways reminiscent of colonial patterns of forced food deliveries.

3. The most fundamental conflict of objectives is between supporting producer (rural) and consumer (urban) interests. This conflict is seen in two forms in the functions of Sahelian cereals offices and related food policies. One is the choice between stabilizing (and often subsidizing) urban food prices versus stabilizing and " subsidizing" producer incomes through localized food stocks and higher prices for food transferred to urban areas. The second is the use of a food marketing and storage system for revenue generation versus its use as a risk-minimizing productive service provided to different sectors of the economy "at cost". This conflict is seen, for example, in Senegal's ONCAD making money in its food transactions and, as we will see in the next chapter, the ORD's in Upper Volta hoping to generate operating revenues through their agricultural marketing activities.
4. Finally, there has been some tendency for governments to use food marketing and storage for direct political ends through urban food subsidies and special below-cost food deliveries to specific urban and regional constituencies where political support is weak. This undermines the operational viability and integrity of the cereals offices.

Means to Implement Objectives

1. There are four main ingredients to the operation of a cereals marketing and storage program: storage facilities, transportation, trained personnel and operating funds. In all respects,

the Sahelian systems are urban-oriented, overcentralized, and top heavy in terms of being able to achieve some balance in the standard range of objectives assigned to them. Sahelian cereals offices have often increased in size and infrastructural capacity at a rapid, discontinuous pace so that very little "learning by doing" (which characterizes the private grain trade) takes place. This leads to excessive waste, equipment maintenance problems and chronic budgetary reliance on outside funding.

2. Storage facilities are generally centralized in the capital city and a few larger urban centers. This facilitates the commercial sale of grain to the urban consumer and will be useful in the handling of emergency stocks donated or purchased from the outside. It is less optimal in helping to dampen intra-annual and inter-annual supply and price variation for the majority of the population, rural producers. Large-scale bag storage facilities have been favored over improvements in farm-level or village storage technology. Modern bulk storage is generally not used although it has been advocated for the holding of permanent emergency stocks in centralized locations.

3. Transportation is an obvious problem with all of the offices. The centralization of stocks can lead to unneeded rehauling to the village level if resale to rural people is part of the program. Improvements could be made in the use of available transportation facilities. Farmer transportation to grain office buying points is a major constraint on a viable price support, storage and inter-regional transfer system.

4. There has not been adequate training of personnel in techniques of grain storage and in market intervention strategies. More seriously, the structure of incentives tends not to support operating efficiency. Most office employees are "civil servants" whose loyalties and career incentives are not functionally dependent on operational success. Further, at the local level, there are virtually no means of producer or other local control over the hiring and promotion of office employees at that level; all of these decisions "descend" administratively.
5. Operational funding is controlled at the center and "allocated" to local areas for a given purpose. While theoretically having financial autonomy, the offices are often dependent on a flow of funds from agencies (development banks, etc.) frequently controlled by other ministries. Funds are chronically late in reaching the field, allowances for producer or local transport are often not paid, and the level of funding is usually unsufficient to purchase available supplies. Very often this situation plays into the hands of the commercial sector which is more capable of efficiently managing its operating capital.

Price Policy

1. Price policy is undoubtedly one of the biggest constraints on the successful operation of grain marketing and storage programs. Deliberate buying experiments and the occasional high producer price effectively administered at the village level clearly demonstrate that farmers will respond to price incentives. The opposite situation is more often the case, however, and when

conditions are bad enough farmers will simply withdraw from the market to the extent possible.

2. The timing and composition of the annual cereal *barèmes* are of utmost importance. Cereals offices are forced to accept margins between producer and consumer prices which often cannot cover costs, particularly when costs are higher than need be through bureaucratic bloat and operational inefficiency.

3. The rigidity of uniform *barème* price levels (themselves functionally more necessary with a high degree of institutional and financial centralization) is compounded by fixed transportation and other cost allowances which do not allow for reasonable regional variation. This can lead to a misallocation of productive agricultural resources and it hamstrings the offices by denying them the flexibility to take quick market actions and to renegotiate prices (to institutional buyers for example) under changing supply conditions. It also encourages smuggling to take advantage of wide official price differentials (e.g., in the 1976-77 buying season substantial quantities of grain were reported moving from Niger to northern Nigeria to take advantage of official prices which were about twice as high, most likely due to Nigerian purchases for emergency stock constitution). Various "intermediate" pricing systems such as offering uniform producer prices at government depots but covering actual kilometer transportation costs for village cooperatives might be administratively feasible.

2. The timing and support of offical prices is also critical. Prices are generally set well into the harvest season, thus providing

little incentive to the producer and injecting needless delays into operations. When prices happen to be attractive to farmers, the marginal credibility of government organizations may be further eroded by the lack of funding to purchase all offered supplies or by not getting funds to buying points until too late in the season.

Relief Efforts

1. The international drought relief effort which centered on the years 1973 through 1975 provided the Sahelian countries with almost 1.24 million metric tons of pledged and/or delivered grain worth an estimated $410 million.[22] This effort undoubtedly saved many persons from starvation and helped reduce the risk of severe malnutrition for an even larger population. It also provided the Sahelian governments and donor agencies with some valuable lessons in relief coordination and management, and helped provoke international responses such as the FAO World Food Conference in 1974, FAO food security emergency stock programs and improvements in global early warning systems for food shortages. The relief effort, however, was not entirely without controversy both in the "developed world"[23] and in the Sahel, some of which has been reflected in the cereals offices.
2. The lack of usable transportation and storage infrastructure provided very serious bottlenecks in the efficient distribution of Sahelian relief supplies. Major problems occurred in:

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[22]For more detail see USAID [1976a].

[23]For example, see Sheets and Morris [1974] and Glantz [1976].

a. Keeping grain traffic moving through coastal ports (primarily Dakar, Abidjan, Cotonou, Lagos, Port Harcourt) particularly those in Benin and Nigeria;

b. Time consuming sacking and handling in the ports of bulk-shipped grain;

c. Transportation to the four inland countries (and interior distribution in Mauritania) which absorbed a very large part of available government and private hauling capacity;

d. Transportation from internal distribution points to village consumption areas.

Measures such as increasing port capacity, finally paving all of the key West African road arteries, and the current installation of greater storage capacity should help alleviate these problems in the future.

3. Distribution costs were extremely high for some of the relief supplies due to the use of ad hoc methods such as air lifts and truck convoys across the Sahara from Algerian ports. This provides a strong argument for improving infrastructural capacity and for financing the recurrent costs of properly managed emergency stocks. This will be discussed in greater detail in the next chapters of this study.

4. Various institutional combinations were used to carry out relief supply distribution. In some cases this was done by the Army and the *Gendarmerie Nationale* using their own logistical capacity supplemented with donated trucks and airlifts. In other countries, some or most of the relief distribution responsibility went to the cereals office which was then converted from a market

participant into a distribution system which required and produced a new set of cost structures, standard operating procedures and performance norms. This seemed to have a long-run adverse effect on several of the offices suggesting that special use of predesignated organizations such as the army or the police (or the Federal Government in the case of Nigeria) may be more appropriate *but only* if carefully coordinated at the national level with the cereals office so that confusing and destabilizing situations do not occur. It is important that emergency distribution mechanisms be seen as temporary and that they be dismantled as soon as possible so that cereals offices can resume their normal functions.

5. In addition to "destabilizing" the cereals offices relief supplies also served at times to disrupt what remained of local markets, particularly when unusally large grain supplies were dumped at low prices or provided free of charge (which was required of some donated grain). There have also been numerous instances cited in which farm level planting patterns were substantially modified due to the presence or expectation of continued low cost grain availability. Many of these instances can, of course, be eliminated through improved market intelligence and crop reporting services and better stock flow management.

CHAPTER VIII

UPPER VOLTA: A CASE STUDY IN THE IMPLEMENTATION OF GRAIN MARKETING AND STORAGE PROGRAMS IN THE SAHEL

Introduction

This study has moved forward developing and applying a center-periphery structural dependency model to general trends in economic change and to more specific food grain marketing and storage problems in Sahelian West Africa. This process continues in the present chapter as Upper Volta is examined as a case study of the complex problems faced in the development and implementation of national food grain storage and distribution programs. The analysis here will focus on the practical constraints faced by administrators attempting to build new structures and operating procedures on the existing infrastructural and institutional base and within limits permitted by the political-economic environment.

To accomplish this end the chapter will incorporate the following topics: (1) a brief review of the major elements in Upper Volta's rural development strategy, (2) an analysis of the institutions involved in government grain marketing and a preliminary assessment of their performance over the past several years, (3) a description of the first two years of application of FAO food security assistance to the holding of Voltaic emergency stocks, (4) a review of current

proposals for the institution of a village buffer storage program and the linkages between that program and urban supply stabilization, (5) an analysis of the cost of alternative storage and transportation components in a national system, and (6) an outline of an integrated national foodgrain marketing and storage program for Upper Volta which will synthesize the other topics and offer several suggestions for institutional reform.

Elements of Voltaic Rural Development Strategy

As stressed in previous chapters, Upper Volta has neither the mineral wealth, the large-scale irrigation potential nor the strategic coastal position of some of its West African neighbors. It does, however, have a considerable potential in its large population of small-scale farmers many of whom have migrated to coastal areas on a seasonal or permanent basis in recent years. Several key elements in the country's emerging rural development strategy have focused on improving the productive resources and product markets available to this work force within Upper Volta.

Since independence the overall direction of Voltaic development politics has been a moderate one, falling between the attempts at more rapid radical transformation practiced in Guinea, Mali and Ghana and the more neo-colonial policies of neighboring Ivory Coast. Reflecting the ambivalence of those persons and institutions "caught in the middle" of center-periphery relationships, Voltaic rural development strategy is a combination of imaginative attempts to stimulate local participation in self-directed change and policies which have survived virtually unchanged from the colonial post.

The most important component in the overall effort to increase agricultural output and promote rural change is the national system of Regional Development Organizations (ORD's) created in 1966; the ORD's divide the country into eleven geographic regions and have very wide powers and responsibilities including all farm extension activities, livestock veterinary care, agricultural credit and rural cooperative formation, rural education and adult literacy, and agricultural marketing as well as being empowered to operate a wide range of commercial enterprises such as agricultural processing plants and gas stations. One of the rationale for the system is to bring under one controlling body the various rural development services which tended to be competitive rather than cooperative at the local level; another is to decentralize rural development program planning and implementation so these would would be better adopted to particular local conditions. This is consistent with patterns of regional decentralization observed in the other five countries but represents the strongest attempt to combine both rural development administrative coordination and economic development actions into one regional organization.[1]

A potential criticism of the ORD or any of the other regional development schemes is that the decentralization of decision-making may not extend much beyond the regional capitals, simply creating a larger number of jobs in a bigger, center-dominated administrative system. Partly in recognition of the inherent limitations to a "top-down" form of rural transformation, the Government of Upper Volta has adopted a specific policy of promoting "community development" at the

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[1]See Gregory [1974] and Eicher, et al. [1976] for more information on the ORD system.

village level. The village as a whole or voluntarily constituted subgroupings would, at the provocation of the ORD extension agent, decide what its goals, needs and capacities are and then be able to call on the agencies of the central government and its regional branches to provide the complementary technical and material support needed to complete its rural development actions. In essence this would be an attempt to build upon and "modernize" traditional structures of labor mobilization and discipline.

This is a new policy for Upper Volta with its initial implementation coming in 1974. Each ORD was asked to select an initial five "community development villages" to receive more intensive study and extension services. This is in addition to the normal charge of promoting cooperative on "precooperative" groups of farmers for joint production and marketing ventures. While the implied decentralization of decision making and the "federal" cost sharing structure is laudable there have been as yet few other basic changes in government structure and incentives which would functionally reinforce the community development philosophy.

Experience in various parts of West Africa has shown that one of the tasks a system of village groups can first engage in is input and product marketing. These marketing activities, if successful, can then be incrementally followed by other collective activities which have greater organizational, logistical and distributional complexity. This has been reflected in Voltaic development thinking and will be explored in later sections of the present chapter.

A number of specific policies can be grouped under the general strategy of providing greater resources to the Voltaic farmer. First,

and of great importance in a semi-arid country, are efforts to increase the supply of water available over the entire year. This is being accomplished through effective local labor, food-for-work programs of well-digging and the building of small dams for surface water storage undertaken by the Voltaic government and private aid agencies. Second, a major effort is being made to provide more land to farmers through population resettlement from the densely populated central portion of the country to "new land" in major southern river basins which had previously been sparsely or totally uninhabited due to onchocerciasis (river blindness) infestation. Finally, there is a general acceptance in numerous government programs of the somewhat controversial idea of concentrating resources in particular areas or activities in order to constitute a minimum "critical mass" needed to achieve self-sustaining change. This can take place on a geographic basis through the creation of special rural development zones or it can take the form of providing a range of complementary inputs and services required in the production and promotion of particular high-value crops, usually for export. The latter example, of course, risks falling into patterns of export crop production which do little to encourage rural transformation but rather rely on the exploitation of a very low effective rural wage rate maintained through the general control of prices, input and consume good supplies, and output marketing services.

A final element of Voltaic rural development strategy which is shared at least in part with all of its Sahelian and West African neighbors is a commitment to participate actively (if not dominate) agricultural markets, ostensibly to benefit the rural population. The net effects of this market participation are open to specific

empirical analysis but there seems to be little doubt that government agencies will continue their marketing activities. This is explored in greater detail in the following section but first, however, it should be stressed that the reader should not overestimate the impact of these government programs on the lives of the majority of the Voltaic rural population. While there are few people who are not reached by private markets and government tax collection mechanisms, it is safe to say that large numbers of rural citizens have had no contact with ORD extension agents nor benefitted from government price support programs. This is another indication that a truely widespread effort at rural transformation will have to further abandon costly patterns of "administrative rural development" and concentrate on employing the existing institutional structures and resources readily available to the rural population.

Government Grain Marketing in Upper Volta

Much of what the Government of Upper Volta has attempted in agricultural marketing, most specifically in the field of grain marketing and storage, is very similar to actions undertaken in neighboring countries. However, while many of the institutional structures and price policies seen in Chapter VII in the other Sahelian countries apply to Upper Volta, there are specific differences in application and performance which merit our attention.

As in Niger, Upper Volta engaged in limited grain marketing and stabilization projects in the 1960s, most of which met with little

success.[2] As part of the multilateral Entente Grain Stabilization and Marketing Project, described above in Chapter VII, the government of Upper Volta created in 1971, within the Ministry of Commerce, *l'Office National des Céréales* (OFNACER), and gave it semi-autonomous financial and administrative powers and functional objectives similar to those of other Sahelian grain boards.[3] Through drought relief activities undertaken in Upper Volta, OFNACER has also benefitted from aid in addition to that provided under the Entente project. Its storage capacity has increased in the past few years to about 50,000 MT (and new capacity is being financed by the German Federal Republic) and its vehicle pool has also been strengthened.

In addition to OFNACER, there are a number of other government institutions involved in food grain marketing in Upper Volta. The roles of these various institutions have evolved rather haphazardly in response to changing circumstances in government policy and in national cereals markets.

First, and of most importance, the above-mentioned national system of ORD's has participated actively if erratically in food grain marketing and has been given the general task of making initial cereal

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[2]Local level grain stabilization and forced cereals collections were practiced in the colonial era with the empty concrete silos which dot rural Upper Volta standing as mute reminders of these abandoned practices.

[3]Information on Upper Volta cereals storage and marketing is based on interviews conducted in Upper Volta in November and December 1975, and October 1976, consultation of numerous unpublished government memoranda and reports, and on the following published materials: Aithpiard [1974], Eicher et al. [1976], Gregory [1974], IBRD [1975b, 1975c], UN/FAO [1973g, 1974g, 1975e], Republic of Upper Volta, Ministry of Rural Development [1975a, 1975b, 1975e, 1976a, 1976b, 1976c, 1976d], SEDES [1973], USAID [1975b, 1976b] and Wilcock [1976].

purchases directly from farmers or from first handlers. The ORD's on two occasions have been granted total monopoly cereal buying powers and these are still legally (but not practically) in force although several government statements have indicated that this was intended to only be a "monopoly in principle", designed to protect producers from the alleged predatory practices of commercial traders. The total failure of the first granting of monopoly powers in the late 1960s led to various attempts to license private traders to buy grain at official prices for resale to the ORD's and to OFNACER. In 1974, with considerably more planning, the primary purchasing monopoly was given to the ORD's for a second time and, due to a new set of unforeseen circumstances, this again produced unsatisfactory results for reasons which will be analyzed below. In addition to lack of success this attempt also had the further negative effect of angering foreign donors providing technical and material support to OFNACER which resulted in aid cutbacks and delays. In fact, by 1976 the general results of ORD participation in national food grain marketing campaigns had been so bleak that many ORD's were no longer interested in large-scale cereals marketing.

Second, in addition to the ORD's, there are at least three other institutions within the Ministry of Rural Development which have roles in food grain marketing and storage. There is, first of all, *Le Comité National pour la Constitution et la Gestion des Stocks de Céréales de Réserves*,[4] created in 1976 as a precondition for the receipt of FAO-coordinated aid in creating a national system of emergency grain stocks.

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[4]The National Committee for the Constitution and Management of Reserve Cereal Stocks.

The functions of the *Comité National* will be discussed in the next section on emergency reserves. Also within the same Ministry are the Direction of Agricultural Services, responsible for the reconditioning and treatment of the grain in emergency stocks, and a previously created *Sous-Comité de Lutte contre les Effets de la Sécheresse*[5] which is charged with distributing grain stocks under certain severe emergency conditions. The "*Sous-Comité*", primarily composed of military personnel and logistical support, was created during the period of massive distribution of drought relief supplies to supplement the meager logistical capacity of OFNACER.

Each year major financing for cereals purchasing, aside from an initial OFNACER operating fund provided by the sale of US PL480 grain, comes from a third major institution, the *Banque Nationale de Développement* (BND) in the Ministry of Finance. Funds have gone directly either to the ORD's or to OFNACER for distribution to the ORD's to buy grain on its behalf. Delays and problems in the complex financial and accounting arrangements between the various cereals institutions and the BND have caused the latter to withhold needed financing at key points in several buying campaigns.

Fourth, Upper Volta also has a stabilization fund (*Caisse de Stabilisation des Prix des Produits Agricoles*) which provides the ORD's with cash crop purchasing funds which are also channeled through the BND. The fund fixes a reference export price and requires that licensed exporters repay the difference between the actual world market price and the reference price to the fund. Even though Upper Volta's

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[5]"Subcommittee to Combat the Effects of the Drought".

cash crop exports are relatively small, since 1968-69 the differences in the two prices for groundnuts, sesame, sheanuts, and cotton have produced relatively large surpluses for the fund even during the worst drought year of 1973-74. Contrary to the ONCAD pattern in Senegal, the fund does not deal with staple foods, but there is a srong relationship between the two because they are both handled by the BND (which has blocked cash crop advances to ORD's due to failure to repay cereals advances from the previous season) and both are administered at the village level by the ORD's in competition with private traders.

In conjunction with several of the above described institutions, OFNACER, in at least the first four buying seasons, was notably unsuccessful in filling its assigned program, primarily that of urban grain supply and price stabilization. The reasons for this failure are many and complex, often not the fault of the institution itself. A number will be specifically highlighted. First, the agency received only a small part of the technical assistance it needed to correctly begin operations, partly due to the malfunctioning of the Entente Cereals project as described in Chapter VII.

Second, and most important, OFNACER was caught in a complex web of institutional duplication and conflict with no distinct national food grain market intervention strategy or authority available to help resolve these conflicts. For example, three ministries had to make a coordinated input into the annual buying campaign: Commerce (OFNACER), Rural Development (the ORD's, the *Comité National*, the *Sous-Comité*, etc.) and Finance (the BND). Differences of opinion and political loyalty and a lack of policy guidance helped sabotage buying campaigns by delaying the arrival of funds at buying points,

by the ORD's selling to special relief organizations (*Sous-Comité*, World Food Program, FAO/ORSO, etc.) at prices higher than what OFNACER could legally pay under poorly designed official price levels, and finally by OFNACER not being able to sell grain in chronic deficit areas at the official retail price because the above-mentioned drought relief organizations were releasing subsidized grain at lower prices. Some recent measures, such as the ORD's buying grain on OFNACER account and the allocation of grain purchase quotas, have alleviated these conflicts somewhat but there still remains the overarching problem that too many distinct institutions are involved in grain transactions leading to superfluous exchanges between producer and ultimate consumer, each of which adds to total cost in grain marketing channels.

In addition to increasing costs, institutional conflict and lack of organization, when they prevent any purchases from taking place, contradict the objective of assisting producers with better prices. In effect, the "monopoly in principle" is handed to private traders who are in an even more advantageous position due to the disorganization of government agencies.

A third problem area, related to the second, has revolved around the composition and timing of the price *barème* (or schedule) for the buying season. There has been no regional differentiation in buying prices and these prices seem to have been set with little regard to either market conditions or the financial constraints of the various participants in grain marketing channels. This is particularly critical for the ORD's which are under pressure to try and generate operating funds from their cash and cereal crop marketing. The *timing* of price decisions is another area of difficulty. First, producer

and consumer prices have been announced at the same time (often well after the harvest has begun) and the buying and selling activities of grain agencies overlap. Thus, grain is being sought and sold concurrently at two different price levels. Second, if the "soudure" *consumer price* were fixed later in the year OFNACER and other institutions would have the chance to calculate their real operating costs per kilo and have that information enter into the price setting process. This would help improve their financial viability as well as help get funds to the field for purchasing on a more timely basis.

Finally, a general problem is that of overly rapid organizational expansion which causes personnel to be poorly trained, equipment to be misused and not adequately repaired, financial controls to be sacrificed to the urgency of the moment, and elimination of the idea that cereal office expansion would come about incrementally as a result of its proven capacity to intervene successfully in the cereal market place. This was perhaps inevitable under the circumstances of the drought relief program and the growing flood of foreign aid and technical assistance which followed. As we will see, some moves have been taken to tighten operating controls and institute retraining programs for existing personnel.

Emergency Grain Stocks in Upper Volta

In Upper Volta, as in most of the other Sahelian countries, the decision to hold separate grain stocks solely for emergency use stems from the 1972-75 program of drought relief activities, from the 1974 World Food Conference and from the resulting "International Undertaking on World Food Security" and the FAO Food Security Assistance Scheme,

described in Chapter VI. The government of Upper Volta has adopted emergency stock program objectives similar to those outlined in Chapter VI and, by late 1976, it had reached provisional agreement with FAO/FSAS concerning operational rules and the provision of technical assistance to the program.[6]

Emergency Stock Implementation: The First Two Years

Upper Volta's current emergency program thus traces its origins to the second FAO Multi-donor Mission to the Sahel in 1974 when the government presented a proposal for a 20,000 MT emergency stock. While the rationale for this stock level may have been derived by ad hoc calculations of the type illustrated in Chapter VI, this was not detailed in any FAO/FSAS reports on Upper Volta or in any of the emergency stock documents available to the author.[7] The World Bank investigation of Sahelian emergency stocks accepts this figure probably because it seemed to represent a "reasonable" percentage of estimated normal sorghum/millet production of about 950,000 MT and the estimated quantity of marketed surplus of between 105,000 MT to 122,000 MT.[8]

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[6]UN/FAO [1976a].

[7]See UN/FAO [1973g, 1974g, 1975e, 1976a] and Republic of Upper Volta [1975a, 1975b, 1976a, 1976b, 1976d]. The last report does discuss a partial explanation for the stock level in which the population at risk is defined as that approximately 1.8 million population living in the northern one-third of the country above the "normal" 800 mm rainfall isohyete. Using an average consumption of 180 kg per capita and an estimated 5 month lead time required to receive outside emergency supplies, a gross shortfall of 135,000 MT was calculated. It was then stated, however, that actual practice has shown that a total crop failure and no stored "carry-in" are extremely unlikely and that, therefore, a substantially lower figure would be "reasonable".

[8]IBRD [1975c, pp. 26-32].

Thus, once launched, the 20,000 MT figure took on a reality of its own with later reports quoting earlier ones to substantiate its authenticity.

In any case, a formal request for the funding required to purchase this amount of grain (estimated at about $2.7 million) was made to FAO/ORSO in early 1975. Acting very quickly, the German Federal Republic provided about one-third of this amount and some technical assistance and buying began in March of 1975. Even though the buying program got off to a late start, 5,802 MT were accumulated from March through July of 1975. The average purchase price--reflecting seasonal price rises--was about 30 CFA per kg compared to the 1974-75 official buying price of 22 CFA per kg. Average transportation, handling and storage costs over the first few months added an additional seven CFA per kg and this exhausted available funding.

Coming directly after the drought relief distribution experience of 1973-75, these purchased tons were placed in those areas felt to be of potentially greatest need, an arc of small villages in Northern Upper Volta between the town of Ouahigouya and the isolated village of Sebba (see map in Figure VIII-1 which follows). In this first phase, several of the villages were chosen because they are cut off from road transportation during the rainy season. Older bag warehouses of small small capacity (mostly of 300 m^2 surface area which can be filled with 1 to 1.6 MT per m^2) were available and put into use but losses have been quite high due to leaky roofs, poorly fitting doors and other openings which permitted rain water, termites and other insects easy entrace.

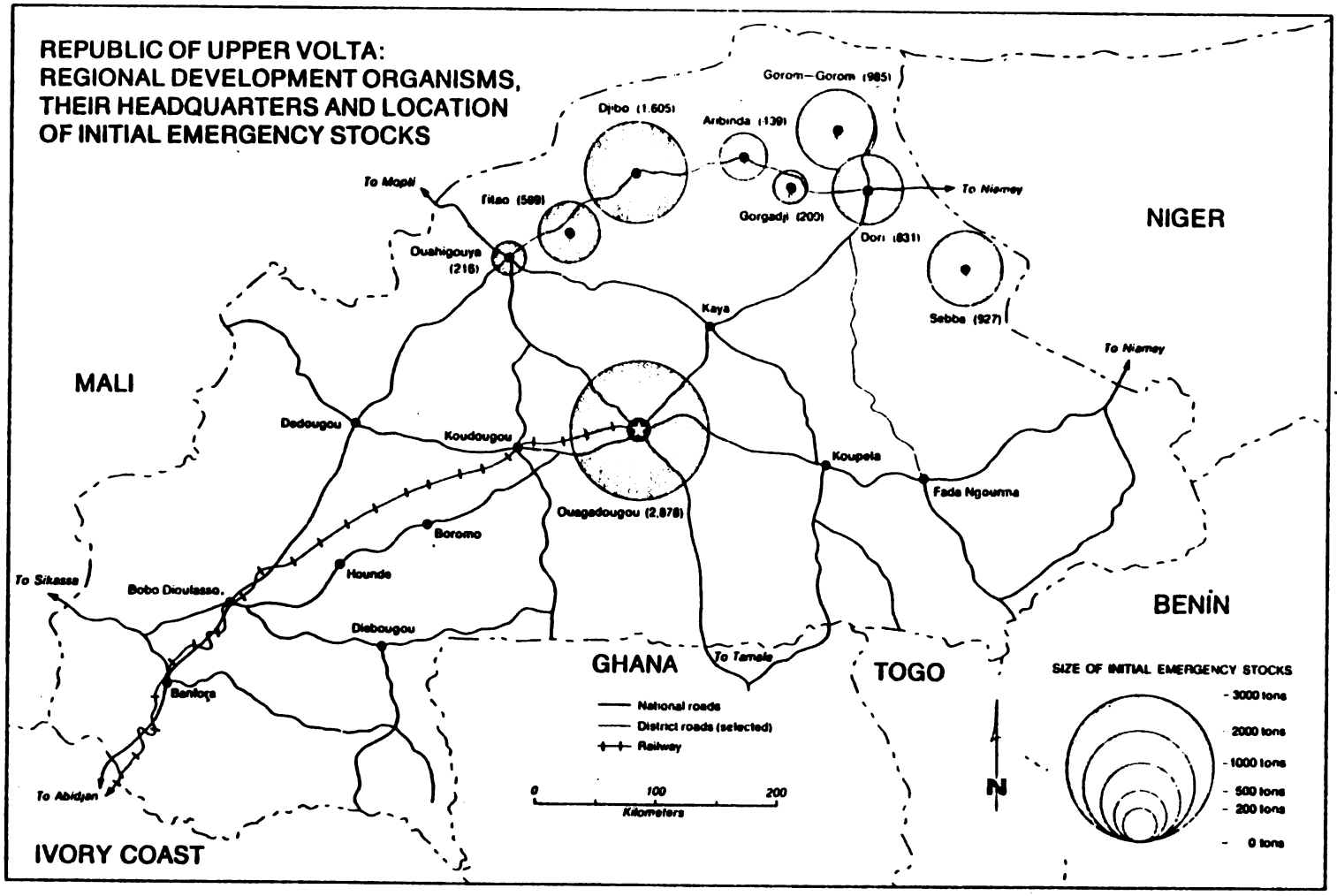

Figure VIII-1

The second phase of the FAO/ORSO project planned to buy the remaining 14,198 MT and consideration was given to storage of most of the grain in Ouagadougou to facilitate stock rotation. Early planning in 1975 called for a total expenditure of about $2.5 million to acquire, transport, handle and store these remaining tons at a cost of about 40,000 CFA per MT. An appeal for funding was launched to donors but no operating funds reached the ORD purchasing agents until late March 1976, by which time an estimated 90 percent of surplus grain was already in the hands of the commercial sector. Due to the untimely arrival of funds, a smaller harvest than the previous year, etc., only about 2,900 MT (of a reduced target of 7,000 MT) were delivered to the *Comité National* and OFNACER by mid-July 1976. Flexible transportation reimbursement procedures helped facilitate cereal movements since the ORD's could contract with private haulers who were reimbursed at the official government rate of 17 CFA per ton per km.

Thus, by July 1976 the emergency stock had grown to 8,700 MT. However, of this amount 1,400 MT had physically deteriorated to the point where it had to be disposed of in order to prevent total loss. This quantity was to be transferred to OFNACER to sell on the open market in one *sous-préfecture* to stabilize *soudure* prices. As required in FSAS programs, the receipts from these sales are to be deposited in an account to be used to defray the costs of stock reconstitution.[9] To end phase II of the project, an additional 5,000 MT was proposed for purchase from the harvest in the fall of 1976. This would

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[9]It should be pointed out the Upper Volta has adhered fairly closely to the FSAS emergency stock operating principles outlined in Chapter VI. This will presumably be further reinforced when a formal assistance agreement is signed with FAO/FSAS.

leave at least 7,700 MT to be purchased from the 1977 harvest in Phase III for the emergency stock project and would bring the total stock to the desired 20,000 MT with about 5,000 MT held in the northern villages and 15,000 MT in Ouagadougou.

In actual fact the 1976 harvest was below "normal" with parts of southern and eastern Upper Volta and northern Ghana experiencing drought-like rainfall conditions similar to, and in some cases worse than, their 1973 levels. Due to actual shortages, intense speculation and some trafficing of grain to markets in neighboring countries, grain prices in Voltaic urban and regional markets soared to 60 to 90 CRA per kg even when purchased by 100 kilo sack. Because of these conditions the *Comité National* requested OFNACER to first sell the emergency reserves held in the Sahel and in July 1977 to then sell the 2,900 MT Ouagadougou reserves. As a result of these actions, OFNACER provided the *Comité* 35 CFA per kg for the Ouagadougou stocks, 31 CFA per kg for the Sahel stocks sold where stored, and 27.50 CFA per kg for those which were transferred before sale. These funds will be added to monies unspent during the 1976-77 harvest for an attempt to reconstitute the entire emergency reserve during the 1977-78 harvest. In addition, OFNACER disposed of its own remaining sorghum and millet stocks and three year old maize stocks originally purchased in Ghana.

Lessons and Possible Changes

A number of lessons can be drawn from the first several years of emergency stock holding in Upper Volta. One, this has been an ad hoc, iterative process which has been slower and more costly than foreseen partially due to the late arrival of funding, unexpected

variation in harvest size and unavailability of supplies on local markets for ORD purchase. Second, however, even within this period of less than three years, there is evidence of significant institutional and personal "learning" with respect to the adoption of procedures for minimizing storage losses with existing infrastructure and the development of viable normal operating procedures for buying, transporting, exchanging title, storing and recycling millet and sorghum. Third, total costs per MT have been fairly high due to this learning process, the use of inappropriate facilities and the costs of constructing more adequate storage.

A fourth conclusion is that although progress has been made in diminishing structural conflict through better coordination of OFNACER, ORD, and *Comité National* activities, there is still great room to eliminate costly institutional duplication and overlapping areas of responsibility. This is discussed further in the final section of this chapter.

Fifth, the initial strategy of stock location may have been called into some question during 1976-77 harvest and "soudure" period as shortages in some southern and eastern parts of the country have been more severe than those in the north. Further, although limited in terms of total tonnage, some grain supplies in the isolated villages of Sabba and Aribinda have not been sold due to adequate local supplies but cannot be moved further south since the roads are not passible during the rainy season. In any case, it is clear that these conditions call for a further, more comprehensive study of (1) the optimal size and location of emergency stocks under a wider range of possible sub-national shortfalls, (2) a more precise

identification of the population at risk, and (3) defining more detailed, flexible trigger mechanisms to be used in conjunction with a practical "early warning" system which can provide relevant data to decision makers in Ouagadougou.

A sixth and final point relates to the type of storage recently constructed and proposed for future construction. In both cases, this is a combination of prefabricated bag warehouses and silos. In almost every project document there are statements concerning the longer term desirability of using bulk storage silos. For example, the latest progress report notes that,

> Upper Volta Government and project personnel share the opinion . . . that silos to minimize attacks by insects, mold, rats, etc., as well as the transmission of heat to the grain, should be solid, hermetic structures, of either a subterranian or semi-subterranian type . . . Sack storage silos are only considered an intermediate solution . . . A program of long-term storage will necessitate, after detailed study, the construction of 18,000 MT of silo capacity in Ouagadougou (for example, 12 semi-subterranian silos of a type used on Cyprus and in Kenya which each have a 1,500 MT capacity). In the areas not accessible during the rainy season (e.g., Sebba, Oudalan, Aribinda) it will be sufficient to create a 2,000 MT capacity in each location by putting 200 MT metal silos inside existing bag warehouses. In this way, the advantages of both kinds of silos will be combined.[10]

While this statement contains much of interest, it completely ignores the financial and economic costs of alternative storage systems and the integration of the emergency stock program into an overall system of food grain marketing and storage. See the final sections of this chapter and particularly Appendix B for more details on relative costs of alternative storage systems.

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[10]Upper Volta [1976d, p. 19].

Buffer Grain Stocks

Operations to Date

As we saw earlier in this chapter, Upper Volta's efforts to play a stabilizing role in urban and rural cereal markets on either an intra- or inter-annual basis have had very little systematic success to date. Where producer prices have been increased or consumer prices held down, it has been on a very localized basis and largely attributable to the chance coincidence of available funds or supplies and an appropriate official price structure.

In Chapter VI the objectives of buffer stock holding were discussed and we noted that in the Sahel there are three principle target groups for stabilization actions: sedentary farmer producer/consumers, rural non-producer/consumers (largely nomadic herders), and "urban" non-producer/consumers who live in the country's cities and small towns. Special actions are required to provide quantity or price stabilization "services" to each of these groups. Upper Volta is moving toward an increased ability to provide such services through proposed village storage programs and improving overall OFNACER/ORD coordination to facilitate intra- and inter-regional grain transfers.

Proposed Village Grain Stock Program

In this section, I discuss the major elements in a proposal for the creation of a cooperative village grain stock system which was developed in the Office of the Permanent Secretary of the Rural Development Coordinating Committee of the Ministry of Rural Development and presented to FAO for consideration in late 1976.[11] The

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[11] See Upper Volta [1976c].

Rural Development Coordinating Committee and its Permanent Secretary are responsible for the policy, infrastructural and material coordination of the ORD's discussed earlier in this chapter. The ORD's, in turn, are charged with coordinating and assisting the second basic unit in Voltaic rural development strategy, the *groupement villageois*, or local village "pre-cooperative".

The proposal expresses concern with three main factors affecting rural life:

1. The distributional effects among farmers facing relatively free local labor and product markets who have differential ability and motivation to deal in those markets

2. Farmers' obvious need for a source of credit in kind or in cash, particularly if they are to adopt new technologies to increase productivity

3. The connection between local grain stocks and national programs to constitute emergency and buffer stocks.

What is proposed is a system of village stocks, employing traditional stock technology, owned and managed by the village group or later by a more institutionally advanced service cooperative. The proposal states that the stock program will have three objectives:

1. To buy millet and sorghum from group members who have surplus to sell at prices which will be between commercial market prices and the government's official buying price (the latter apparently is assumed to be higher)

2. To offer at least part of these supplies to national grain marketing institutions (or a higher bidder) which will be made possible by bulking the supplies of individual farmers

3. To use the stored value of grain to offer credit in money or in kind to members during the *soudure*, repayable in kind at the next harvest.

The program is based on the use of the *groupments villageois*, and their number is to be increased to 3,000 over the five year life of the initial program. This means that the ORD's will have to provide

the *groupements* with greater technical and financial assistance to facilitate accomplishing this and other "self-directed" tasks.

The program proposed using and perhaps improving the various types of traditional farm storage structures which are estimated to be capable of holding about 2 MT on the average. This will promote local employment of available resources and reduce construction costs. The program has an initial goal of regularly marketing 12,000 MT of cereals from the village stocks through the ORD's to OFNACER. This will require some expansion of ORD bulking warehouse facilities and perhaps the regional implantation of grain drying and treatment facilities.

Financing for silo construction will initially be provided to each village group as well as an initial operating fund for use in making stock purchases. External funding will be sought for these two functions under grant or IDA loan terms. It will be possible for the village stock to loan grain at a nominal interest rate which would be repaid in kind at the next harvest. Surplus stock sold to OFNACER by way of the ORD's will earn the village group a portion of the marketing margin between the producer price and the OFNACER acquisition price.

The proposed program is based on a system of hierarchical coordination where the village groups would hold the stocks and receive assistance from ORD 'Community Development Agents" (ORD sub-sector and sector chiefs, with each sub-sector chief supervising a number of village extension agents) whose activities would be under the supervision of eleven regional ORD Cooperative Supervisors who, in turn, would be coordinated by the national head of the Rural

Institutions and Credit "Cell" in the Permanent Secretariat of the Rural Development Coordinating Committee. The ORD's would thus play a critical role in the success of the entire program with their extension activities aimed at "sensitizing" farmers to potential program benefits, facilitating group formation, providing management assistance, bulking surplus supplies for sale on the account of the village groups, and holding credit funds at the regional level for program operation.

Other national cereals organizations would also have key supporting roles in the program. OFNACER would be obliged to buy grain supplies first from the village stock system before making commercial purchases from traders. To the extent that the *Comité National* controls national emergency stock operations it would support the village stock program by replenishing those stocks by way of purchases made through the ORD's.

The proposal stresses the need for systematic *rural mobilization* in order for this program to succeed in altering patterns of grain marketing and storage to the benefit of all segments of the rural population. This emphasis is supported by the analytical conclusions reached in application of this study's conceptual framework. If multi-sector structural and behavioral change is not promoted simultaneously, well-meaning programs in one area may deviate from their stated objectives. This emphasis calls for major efforts to educate government cadre as well as farmers and some of these training requirements are detailed in the village stock proposal. Increased extension activities would be supported by a system of audio-visual aids including

radio broadcasts, simple films, printed tracts and posters, all in local languages.

The cost structure of the proposed program, while probably meant to be illustrative, is oversimplified and unrealistic given other West African stock experience. It includes over a five-year period:

1.	12,000 grain storage facilities (in 3,000 village groups) at a cost of 4,000 CFA per facility	=	48,000,000
2.	Operating funds: 3,000 groups x 144,000 CFA (8 MT grain at 18,000 CFA per MT)	=	432,000,000
3.	Training and propaganda costs	=	67,550,000
	Rounded Total		550,000,000 CFA[12]

A more complete assessment of alternative storage cost structures is presented below and, in the final section of this chapter, the integration of the village stock program into a national grain marketing system is discussed.

Grain Price/Supply Stabilization for Non-Producers

Grain supply stabilization for non-producers in Upper Volta will be simplified if any or all of three facilitating conditions are met. First, this task will be easier to accomplish if the village stock program is successful in promoting increased grain supply stabilization at the village level and if it leads to a net increase in the aggregate amount of grain held under the control of producers who make up about 80 percent of the Voltaic population. In addition to more grain being disposable by producers in local market and

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[12] $2.2 million U.S. @ 250 CFA per $1 U.S.

nonmarket exchanges, there would also be relatively greater supplies available to the ORD's for intra-regional stabilization transfer and to other ORD's and to OFANCER for intervention in urban grain markets and for emergency storage.

The second facilitating condition would be met through controlling the growth of the non-producer population largely through slowing the rate of urbanization. Meeting this condition, of course, involves a range of policies much wider than just those affecting grain marketing. In general such a set of policies would serve to refocus part of the social and economic reward and incentive structure on the rural rather than the urban population.

The third facilitating condition would involve diminishing the destabilizing effects on Voltaic grain supplies of divergent price and stock policies and other governmental market interventions in neighboring countries through efforts at improving grain policy coordination, information flows and actual grain supply transfers among the Sahelian countries and their coastal neighbors. In general, Upper Volta's major surplus grain supply areas are in West and Southwest (around Dédougou, Bobo Dioulasso, Banfora, Diébougou) which are influenced by supply and price conditions in Mali, the Ivory Coast and Ghana or in the East and Southeast (around Zambré, Tendodogo, Koupela, and more remote parts of the Fada N'Gourma ORD)[13] which are similarly linked to northern Ghana, Togo and Benin and to major grain markets in Western Niger (see Figure VIII-1). This is not to say that Voltaic grain surpluses should not leave the country, rather that these

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[13]See Eicher, et al [1976] for a more detailed description of these conditions in the Eastern (Fada N'Gourma) ORD.

movements could be anticipated and planned for with greater cooperation among the various national grain boards. This type of flexibility has been recently attempted in Upper Volta with the Eastern ORD officially permitted to directly export grain surpluses to OPVN, the Niger grain board.

Direct program actions to enhance supply stabilization for non-producers can be divided into two groups, those which are directed at rural, pastoral non-producers and those aimed at the urban and small-town populations. Initially, at least, these actions must be seen as enhancing or supplementing the performance of the private grain trade simply because management of a total grain distribution system is far beyond the institutional capacity of the Upper Volta Government.

With respect to the nomadic, pastoral population the major feasible actions would largely be within the jurisdiction of the ORD's. Each ORD, through its coordination of intra-regional grain transfers, storage and stabilization, could attempt concerted actions in those geographical areas and markets most heavily used by the pastoral population. This could involve three types of actions: supplementary stabilization efforts during the "soudure" in those regional grain markets most heavily used by pastoralists; programs to facilitate improved patterns of economic exchange between pastoralists and sedentary farmers (e.g., increased livestock or livestock herding services in exchange for grain in conjunction with increased *groupement* activities among both groups); and the longer term facilitating organization of pastoralist *groupements villageois*.

With respect to the urban non-producer population, grain supply stabilization actions would be the responsibility of OFNACER and the

ORD's working in close collaboration. Again stabilization efforts should *supplement* the working of urban grain markets. OFNACER should be capable of intervening, under certain supply price conditions, in the largest urban markets. For example, OFNACER could potentially be responsible for supply stabilization in the three largest cities in Upper Volta, Ouagadougou, Bobo-Dioulasso and Koudougou, which are all served by the Abidjan-Niger railroad which might permit the use of a relatively cheap, efficient bulk-handling sub-system in conjunction with the recycling of the major portion of the centrally held emergency stock and larger inter-annual buffer stocks. Such a limited stabilization program is within the foreseeable institutional and financial capabilities of OFNACER and would be capable of affecting market prices faced by at least 10 percent of the total population or about half the non-producer population.

Intervention in other urban areas and smaller towns could come under the jurisdiction of the various ORD's whose grain market actions and transfers would be coordinated with those of OFNACER. In surplus regions the major ORD actions would focus at harvest-time market intervention to influence producer prices and facilitate the transfer of grain to deficit regions. In deficit regions, particularly the northern ORD's of Kaya, Ouahigouya and the Sahel, the ORD and/or OFNACER would have greater responsibility for stabilization intervention to dampen the "soudure" price increase and maintain adequate supplies in regional markets. ORD ability to function in this capacity will be strengthened if they receive greater financial and operational autonomy in grain market intervention and pricing. The entire system of rural and urban grain supply stabilization will be facilitated through:

(1) improved roads and market infrastructure; (2) improved communications, particularly a simple market price information system which is critical to both buffer and emergency stock actions; (3) increased price policy flexibility (including a quota and supra-quota price system) and regional autonomy; (4) the introduction of limited, low cost bulk handling components where appropriate; (5) more adequate provision for surplus grain disposal through international trade, concessionary sales, livestock finishing, etc,; and (6) improving the planning of minimum grain transfers and quotas. These will be examined in the final section of this chapter after a brief description of some of the economic and financial costs to alternative storage and transportation components in a complete grain marketing and storage system.

Costs of Alternative Storage and Transportation Components

In formulating practical plans for an integrated grain marketing and storage system two of the key variables to consider are the costs of alternative storage infrastructure and transportation services. While political and economic objectives, indirect costs and benefits, employment and distribution effects and so forth may ultimately be more important in deciding what to store and when to do it, once these decisions are made there are still significant economic and financial cost considerations regarding alternative technologies. In what follows I provide a summary of available information on major alternatives. With some refinement this type of information could provide the cost coefficients to be used in conjunction with price and non-price objectives and constraints in a linear programming, cost minimization modeling exercise.

In Sahelian grain storage there are three major technologies which are or can be used within a total grain marketing system. These are (1) farm level storage which generally involves small, locally built silos which hold grain either on the head or in threshed farm; (2) the traditional commercial storage system of masonry bag warehouses; and (3) bulk storage systems which can involve numerous alternative silo structures.

The cost of the latter two alternatives are compared in detail in Appendix B. Here observations on the relative costs and advantages of all three systems will be summarized. In terms of costs we must consider the initial investment costs associated with a particular type of structure, its annual operating cost (per metric ton for purposes of rough standardization) and the associated costs incurred in integrating the particular type of structure into the total grain marketing system. Benefits are assessed both in terms of the direct protection of stored grain from deterioration and its availability to meet demand on a timely basis and the indirect effects stemming from employing a particular type of structure (employment, use of local resources, divisibility and other locational advantages, etc.).

Evidence from recent but geographically scattered economic studies on two key items in the financial cost of storage, initial construction costs and annual per ton operating costs, are summarized for the three systems in Table VIII-1. This secondary information, standardized to extent possible, is quite fragmentary but still indicative of the magnitude of relative costs.

Most evidence points to the initial costs of traditional storage as being at least two to three times cheaper per ton than either the

TABLE VIII-1

COMPARISON OF PER TON STORAGE CONSTRUCTION AND ANNUAL OPERATING COSTS

	Construction Costs Per MT	Annual Operating Costs Per MT
1. Traditional farm level storage		
a. Northern Nigeria	$22.80/MT	$5
b. Northern Ghana	$15.50/MT	--
c. Upper Volta	$12.00/MT	--
d. Chad - CARE program	$73.00/MT	--
2. Bag warehouse		
a. Chad	$81-$192/MT	--
b. Mali	$60/MT	--
c. Niger	$48-$68/MT	$10-$23
d. Sahel	$110	$17
3. Silo storage		
a. Mali	$240/MT	--
b. Mauritania	$82/MT	--
c. Niger	$40, $107, $227/MT	$26

SOURCES: Traditional storage: Hays [1975], Nyanteng [1972], Republic of Upper Volta [1976c] and Maxon [1976]; bag warehouse and silo storage: Appendix B.

bag warehouse or silo systems. Similarly bag warehouse storage is generally somewhat cheaper to build per ton than silo storage when amortized over equivalent time periods. However, there are smaller, less mechanically complex silo systems with lower initial costs than some more elaborate warehouse systems. Traditional graneries also have substantially cheaper annual operating costs than the other two systems if we count the same number of grain movements into and out of each system. This is partially due to the need to include at least part of the cost of a permanent salaried staff, chemical treatment, electricity and the cost of sacking and handling in the latter two systems.[14]

The costs of integrating the different storage technologies into an overall grain system depend upon the ease with which each technology can be employed in the performance of the three major tasks required of the total system, storage of local production for local consumption, annual storage and interregional transfer to deficit areas, and interannual stabilization and long-term emergency stock storage in a limited number of centralized locations. It is clear that each of these technologies, under the right conditions, can provide the least cost solution for the accomplishment of at least one of these system activities. Traditional storage is, and will most likely remain, the

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[14]Grain losses are included in these annual cost estimates with the general observation that each technology, when correctly employed, will generate approximately the same small percentage of annual grain loss. Under ideal conditions, hermetically sealed underground bulk silos should be able to produce the smallest losses but actual losses under these three technologies, particularly when they are employed suboptimally or under stress conditions, need to be further studied (e.g., using a traditional storage technique under different eco-climatological conditions, use of bag warehouses without correct palettes and fumigation, or use of bulk silos with abnormally high temperatures, overly moist grain, etc.).

most efficient, least cost method for grain storage at the farm and village level when significant bulking and transfer is not required. When these latter conditions hold bag warehousing will remain most efficient given the large number of intermediaries, the variety of transportation methods used, the acceptance of the sack as a unit of measure and its easy use in transport and bulk breaking operations. When grain has to be stored in sizeable quantities over a number of years with minimum storage losses, bulk silos become more cost efficient particularly if they can be linked to bulk transportation and handling components to and from wholesale buying and selling points.

The benefits of alternative storage technologies, in addition to time, place and quantity utility, can be assessed in terms of direct price stabilization and income effects and indirect effects associated with employment generation, use of local resources (or the saving of scarce foreign exchange) and the type of "learning" associated with alternative ownership and management structures.

The cost and availability of transportation infrastructure and services will directly influence the relative cost of incorporating alternative storage technologies into a national grain system. In Upper Volta, as in the rest of the Sahel, most farmers do not have motorized transportation available at the "farm gate", necessitating the use of headloading or transport by animal, cart, bicycle or motorbike. From those points accessible by motor vehicle the major determinants of cost are road conditions and vehicle carrying capacity. Even under the best of conditions truck transport costs are high due to the use of entirely imported technologies and sources of energy.

Upper Volta currently provides reimbursement to private transporters for grain hauling at the official rate of 22 CFA francs per kilometer-ton. This is approximately equal to most other recent estimates for large volume truck (10 MT and over) transport costs on primary Sahelian dirt roads. In neighboring Mali the government recognizes the heavy cost of using vehicles on dirt roads by permitting freight charges approximately equal to 13 CFA francs per kilometer-ton on paved roads and 26 CFA francs on dirt roads. Further, estimated economies of size are striking in truck transportation. For example, on good roads in Mali the breakeven point per kilometer-ton was estimated for different truck sizes as follows: 5 tons or less, 24 CFA per kilometer-ton; 10 tons or less, 17 CFA and for 25 tons and over, 12 CFA.[15]

Several general propositions stem from the high cost of transport. First it increases the economic viability of a diffused grain storage system and would cause more grain to be optimally stored than in a system with better transportation possibilities. Similarly, improvements in transportation infrastructure and services will increase the economic return to the more centralized storage of larger quantities of grain. Third, the optimum storage/transportation "mixture" facing farmers, commercial traders and government institutions along major road and rail links will be substantially different than that faced along secondary axes or in areas with no modern transportation at all. These facts should be actively incorporated into the planning or a grain marketing and storage system. Thus, in Upper Volta this means taking

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[15]Steadman [1976, pp. 51-53].

better advantage of the existing road and rail infrastructure[16] in planning the location of central stabilization and emergency stocks, in programming recurrent shipments among regions, and in the use of a more flexible transportation schedule which would more accurately reflect real costs. These generalizations concerning transportation and storage costs are reflected in the following section.

Toward a More Integrated National Food Grain Marketing and Storage System

Overview of a Possible System

An integrated food grain marketing and storage system can play an important role in Upper Volta'a attempts to increase food self-sufficiency and promote a more self-directed, independent path toward economic modernization. To counter inevitable weather-induced variation in supply, direct action must be taken to place more grain efficiently in storage to meet a constant or increasing per capita demand over time. Indirectly supply can be increased as farmers will have greater incentive to produce when facing a more stable market providing them with higher effective floor prices. This type of system is attainable through the progressive and incremental modification of current Voltaic private and state institutions. Further, this can be done in such a way as to increase the use of locally available resources (both physical and human), increase the participation of the rural population in the development of community controlled institutions contributing to modernization, increase or at least maintain

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[16]Estimated kilometer-ton rail freight charges on the Abidjan-Niger line are approximately one-half truck freight rates but to this point in time recurrent OFNACER interregional grain shipments (e.g., Bobo-Dioulasso-Ouagadougou, etc.) have been almost exclusively made by truck instead of rail.

distributional equity through allowing all segments of the population to enjoy the benefits of increased food grain availability, and counter the trend of Upper Volta's increased political and economic dependence as it is gradually incorporated into the world economy. Clearly, improving the grain marketing and storage system will not in itself bring all of this about but making more effective use of existing and potential food resources is a good place from which to begin.

To do so we must look for those feasible changes in economic infrastructure and method which will minimize the cost of additional grain storage and transfers in the accomplishment of: (1) improved storage of local production for local consumption, (2) facilitating food transfers to permanently deficit producer and non-producer populations, and (3) most efficiently storing emergency stocks to offset severe production shortfalls. To meet these objectives in the Voltaic economy a multilayered system involving local, regional and national components is required. However, a system which is ultimately dependent on the productive output of its peasant producers cannot hope to meet these objectives if official food marketing and storage institutions continue to focus on the interests of a small proportion of the urban, non-producer population.

Thus, the base for building an improved Voltaic grain system must rest on the further development of on-farm and village storage and increasing the access of all farmers to the benefits of increased storage capacity. Marginally improved traditionally storage technology can be owned and managed by village groups in a "grain insurance system" by which the costs and risks of holding larger amounts of grain are collectively borne.

With 80 percent of the population facing a larger, more stable supply of grain, recurrent transfers to deficit regions and the urban population and surplus storage against unusual shortfalls become more manageable tasks. At the regional level the ORD's can potentially provide village groups with training and technical assistance in improved storage methods and in planning as well as incrementally increasing their own ability to transfer grain within and beyond each region. The particular ORD actions required will depend on the relative surplus or deficit nature of the region, its existing road and storage infrastucture and the size of the non-producer population.

Interregional transfers, the supply of urban areas, centralized holding of stabilization and emergency stocks, and coordination with similar institutions in neighboring countries should be the responsibility of one national institution, such as OFNACER, whose activities must be closely coordinated with those of the ORD's. Overall policy must be coordinated to support each institution in the accomplishment of its "federated role". A flexible price policy supporting these actions is perhaps the most important required modification of national policy. Other incentives must be logically structured to promote a stable, self-sufficient production and consumption base which can afford a certain level of food grain transfers to non-producers and inter-annual storage adequate to meet a fixed percentage of maximum likely shortfall. This means that there will have to be some modification in existing urban-oriented incentive structures which are basically in conflict with the promotion of increased farm production and the stable evolution of the Voltaic rural population.

Practical Measures to Improve the Existing System

Assuming that the system described above is desirable and can be approached through incremental change in existing practices and institutions, the following are specific recommendations for improving Voltaic grain storage and marketing.

Overall System Development Strategy

With commitment to the basic idea of holding increased grain stocks for the common good it will be possible to realistically develop an improved grain marketing and storage system over time. Technically efficient, cost effective methods can be discovered and perfected if the system is developed in a phased, incremental way, adopting and refining proven techniques. This means that the collective methods used will have to begin (and may well continue) in competition with private commercial trade. Emphasis must be placed on the elimination of major system contradictions and on the structuring of incentives to functionally support practical food security.

Promotion of Local Grain Storage and Food Self-Sufficiency

The base of an improved system must rest on the decentralized increase in local collective storage, primarily in rural areas but also in urban neighborhoods. The collective or cooperative nature of the storage system is required to increase the participation of all segments of the population and to maintain or improve distributional equity which is not the case under either private trade or selective government participation in grain marketing to the almost exclusive benefit of a small proportion of the urban population. In Upper Volta this could be done through:

1. Expansion of the program of village grain storage described earlier in this chapter. This should be done incrementally, adopting marginal improvements in traditional storage techniques and village group structures. Emphasis should be on village ownership and control of grain supplies (to avoid the almost inevitable inefficiency and corruption which accompany the decentralized management of centrally owned grain stocks) and guarantees of equal access of the entire rural population to this system.
2. Implementation of the village stock program could be coordinated through a special working group or office in the Ministry of Rural Development which would work closely with the ORD's and OFNACER (which should be transferred to the Ministry of Rural Development as described below). This group would channel capital resources, coordinate technical assistance and conduct localized research to promote:
   a. Locally adapted, collective least-cost structures for increased grain storage.
   b. Incentive structures (material and non-material rewards, etc.) to promote such a system.
   c. Studies of traditional storage technology to isolate the causes of storage loss and make marginal corrective changes.
   d. Provide over time a flexible, locally controlled system of personal credit against the collateral of stored grain and administered by the village group.
   e. Strengthen village groups focused on self-directed modernization, including a guarantee of equal access to these structures.

f. Investigate the feasibility of neighborhood groups in urban areas holding similar small-scale stocks of grain if assisted in storage construction and group formation.

3. Key support for the village group stock program must be provided by the ORD's and OFNACER as described below. The latter should give priority to making minimum quota purchases from village groups in surplus production regions in order to provide greater financial incentives to participate in the system and increase surplus grain production.

Strengthen ORD Capacity to Act at the Regional Level

1. The ORD's, with coordinating and planning assitance from OFNACER, should assume an increased role in intra-regional transfers. Their precise role will be determined by the aggregate net production capacity of the region, its transportation infrastucture, etc. More intensive marketing activities will be required in both surplus and deficit regions than in regions where production and consumption are in closer balance.

2. The ORD's, through their marketing, credit and extension services, can assist village groups with technical problems, transportation services, investment credit and the planning of local cereal needs and surplus production potential given fixed quota and supra-quota price structures and likely alternative supply situations. The ORD's would also produce aggregate regional grain supply projections and transfer plans.

3. The ORD's must be provided with financial and reward structures which are keyed to their support of the village grain stock program and to providing agreed upon quotas into the national system.

This will require additional training of ORD marketing staff and it may necessitate increases in ORD warehouse storage and transportation capacity as well as the provision of centralized regional grain drying and treatment facilities to reduce aggregate losses within each region.

Strengthen OFNACER and Free It From Institutional Conflict

1. To complete the layered national system, one national institution is needed to coordinate interregional transfers and supply quotas, manage stabilization, pipeline and emergency stock storage facilities, and pursue facilitating contacts with similar institutions in neighboring countries.
2. Structural conflict with the ORD's and other national institutions could be minimized by choosing OFNACER as the sole national cereals institution and placing it within the Ministry of Rural Development. This would permit abolition of the superfluous *Comité National* and other food-security organizations such as the *Sous-Comité*. All foreign food-aid assistance should be provided through OFNACER.
3. A standard methodology for assessing regional production, surplus and storage potential should be developed by OFNACER working in conjunction with the ORD's. The adequacy of regional storage infrastucture can thus be assessed and priorities for investment determined.
4. The annual program of interregional transfers, storage, stock turnover and reconstitution and minimum quotas would be developed with the ORD's. The full costs of the system should be covered by an adequate consumer price with minimum transfer or stock quotas assured at a reasonable floor price. Under shortage conditions

additional supplies could be encouraged with a supra-quota incentive price while, in surplus years, stock disposal arrangements (transfer to neighboring countries, livestock finishing, etc.) must be provided. It is essential that an agreed upon, quota planning feedback mechanism be instituted to prevent chronic under or over-production.

Specific Actions to Improve Emergency Stock Operations

1. As we have seen the national program to hold emergency stocks has operated reasonably well given inadequate storage facilities, adverse supply conditions and the late arrival of funds in the first two buying campaigns. The operating rules are basically conservative and sound and the entire operation would be more easily assured if placed under OFNACER in the Ministry of Rural Development so as to be coordinated with the ORDs which would supply a large portion of the grain to be stocked.
2. The first several years of experience have demonstrated that the emergency stock system could benefit from a more thorough and systematic re-examination of the population at risk and the optimal size and location of stocks given improved information on surplus and deficit regions, transport costs, available markets for grain turnover and changes in the overall system which might eventually result from the village stock program. Further, there is need for greater precision in the definition of stock release trigger mechanisms.
3. At the aggregate wholesale level it may make economic sense to employ bulk handling and storage techniques in the receipt of

emergency grain imports, the supply of the largest urban wholesale markets on the rail line and principle paved roads, and in storage over periods of several years or more. This should receive careful technical and economic analysis.

Grain Supply Stabilization

1. Improvements in local supply stabilization, in the coordination of interregional "pipeline" supply transfers and in the management of the emergency stock will go a long way toward introducing greater stabilization in overall grain supply. Further, experience in the component activities involved in intra-annual stabilization will improve the capacity to engage in inter-annual stabilization.
2. The capacity of Voltaic institutions to rationally increase their participation in national grain markets will be facilitated through the collection of better data on regional production, supply and market prices. This would be a major assignment for a sorely needed national office of agricultural statistics.
3. It is important to note that grain supply stabilization must be developed incrementally through trial and error methods in order to be self-sustaining and avoid the massive failures of the past. This means that specific actions must be mounted in competition with private trade with the latter providing valuable clues as to the likely limits of possible intervention. Only over time can collective local, regional and national institutions begin to replace the private grain trade if that is the course of action chosen by the Voltaic political process. However, in that

case specific attention should be given to the ease with which partial solutions can be undermined for private gain.

Price Policy: A Key Variable

1. Intervention in grain markets will be facilitated under a more flexible price policy not manipulated to maintain the support of the politically vocal urban consumer population. Producers must be provided adequate price incentives to increase food grain production and the economic costs of storage and interregional transfers must be fully covered in the long run. A commitment to these principles will probably of necessity imply an increase in consumer prices which will provide a true test of political resolve.
2. It is clear that counterproductive situations such as allowing different arms of the government to be currently selling grain at different prices should not be allowed to continue.
3. The key political-economic decisions involve the setting, timing and rigidity of the total price and expense reimbursement schedule or *barème*. It is strongly recommended that an incentive price applicable to predetermined minimum surplus quotas be fixed before the planting season with flexible authority to set higher supra-quota prices if needed at harvest time. It also makes sense that the ultimate setting of the basic consumer price for non-producers be set as a function of expenses incurred during the buying season within a politically predetermined range and, if necessary, in conjunction with triggered releases from emergency stocks. Consumer prices in insolated areas should reflect a reasonable transportation premium.

Additional Facilitating Conditions

Although it is well beyond the scope of this section to discuss these in detail, it should be clear that an improved grain system such as proposed here for Upper Volta will be easier to realize if accompanied by factors such as a believable, locally-adapted ideology of self-directed rural modernization, supporting practical actions which demonstrate a commitment on the part of the government to restructure incentives in favor of rural areas, and concrete measures taken to slow the attraction and rate of growth in urban areas. In short, the system proposed here will be more likely to succeed under a political system committed to eliminating or hampering the further development of the structures of political and economic dependence described throughout this study. Finally, it goes without saying that a stabilization and storage program will be facilitated by agronomic advances in grain varieties with greater drought resistance and higher productivity.

Useful Role for Foreign Aid

While the success or failure of this program would largely depend on Voltaic commitment and political determination, there are useful tasks which could be played by foreign donor agencies. For example, of greatest use could be:

1. Monetary grants or food-aid to be sold to generate operating funds to finance village storage construction and initial local, regional and national stock constitution. Recent aid from the German Federal Republic to the Emergency Stock Program under strict FAO/FSAS rules seems to have worked well. Another possibility would be to provide food-for-work assistance to village storage construction during the dry season.

2. The entire system can benefit from infrastructure construction. Of greatest impact would be paving of several of the major Voltaic primary road axes (Ouagadougou and Bobo-Diolasso, Ouagadougou-Ouahigouya, Ouagadougou-Dori, Ouagadougou-Niamey), providing experimental bulk storage and handling facilities and increased bag warehouse transit and storage facilites at the regional level.
3. There is a continuing need for operational technical assistance and training. OFNACER and ORD grain marketing and storage personnel need to be identified for various levels of career training. Of particular importance would be managerial training in logistical planning and coordination, technical training in warehouse and bulk silo operation and management, and launching a full system of recurrent agricultural statistics, particularly providing timely, disaggregated production and yield estimates, and information on grain flows and market prices. The statistical system would be enhanced by a program of periodic economic studies of farm level grain storage and marketing patterns and the behavior over time of traditional private grain marketing channels. The program of foreign aid in technical assistance and training should be for a restricted time period after which time it should be nationally or at least regionally operated.
4. The Entente Grain Stabilization training program provides a useful beginning for promoting badly needed regional functional cooperation on grain storage, marketing and price policy. This model can be substantially strengthened through the choice of a more important regional institutional vehicle (CILSS, CEAO, or ECOWAS for example) and through promoting greater real functional

exchange of information and promoting mutually beneficial inter-governmental grain trade.

CHAPTER IX

SUMMARY CONCLUSIONS AND POLICY RECOMMENDATIONS

This study has focused on meeting two major objectives: the application of a structural theory of political-economic dependence to Sahelian West Africa, and, within this framework, the description and analysis of practical policy issues in the area of food grain marketing and storage.

The structural center-periphery approach has been used because it was felt to provide a useful conceptual "window" through which we could obtain a clearer picture of Sahelian underdevelopment. A concern for development policy demands that we have some understanding of the broad range of social, political and economic variables centrally involved in the past, current and possible future structural transformation of West African economies. I contend that this framework, with its emphasis on socio-economic evolution and the analysis of capital accumulation and socio-economic conflict through the dynamic interaction of structural rigidities and market exchange mechanisms, helps to illuminate broad differences in possible sectoral policy alternatives. I have attempted to draw linkages from this macro-level framework to the specific policy area of food security which, in the Sahel, is fairly congruent with the resolution of problems of grain marketing and storage under conditions of high supply variability. Coming to grips

with the food supply issue will be one of the cornerstones of any attempt in the Sahel to promote self-sustained growth through an egalitarian basic needs strategy.

There is a certain urgency to undertaking a wide-ranging review of these policy issues as well as badly needed, complementary micro-level studies at this point in time. First, West Africa has been undergoing over the past several years a second wave of rather pragmatic "decolonization" as some countries attempt to begin to exert greater economic as well as nominal political independence. Second, for the Sahelian countries there is currently a great increase in the availability of external rural development financing, partly due to humanitarian concern for the effects of the recent drought and partly due to a rejuggling of international political-economic alliances and spheres of influence. The challenge is to examine alternative strategies for the judicious use of scarce capital to promote the realistic attainment of the stated Sahelian goals of "food self-sufficiency and autonomous economic development" and avoiding the very real pitfalls of systematically increasing structural economic dependence and indirectly promoting rural stagnation.

To practically approach the major objectives of this study a set of more specific, operational objectives were enumerated on page 10 of Chapter I. These correspond, in a general way, to the division of the study into its subsequent component chapters. It has been stressed that the analysis in this study moves from the broad macro-level conceptions and descriptions of Chapters II and III through an examination of Sahelian grain production, consumption and traditional trade in Chapters IV and V, to the ultimate focus on the more restricted

topic of government participation in grain marketing and storage in Chapters VI through VIII.

At the broadest level in Chapter II a conceptual framework for addressing the overarching problem of underdevelopment in the Sahel was developed through the application of a general theory of structural systems dependency to the West African region. Within the general theory, a dynamic international political economic system, characterized by pervasive inequality in the distribution, control and ultimate consumption of human and physical resources, is composed of shifting alliances or coalitions of system components (their interaction regulated through structures such as national boundaries, national and international institutions, laws, formal and informal operating procedures and rules, etc.) which, over time, enhance and extend their differential access to power and the derived material benefits which flow from domination over other components. Thus, nations, classes, groups and individuals are linked together in complex relationships of domination and subordination which are structurally legitimized and institutionalized. In geopolitical and power terms the dominant areas in the system are the *centers* (of the system as a whole or of various sub-systems) with the subordinate, dependent areas comprising *peripheries*.

Applied to West Africa a central theme is that the current political economic relationships between that area and the more developed world, while structurally more complex and sophisticated than those of colonial administration, functionally continue to promote the relative development of Center country economies while continuing the greatest relative exploitation of the West African periphery and its peasant farmers.

In its simplest presentation, the center of the Sahelian Periphery--composed of small, westernized "civil servant" and commercial business elites and their institutions (education, laws, methods of doing business, etc.)--serves as the key link between the large mass of peasant producers (the periphery of the Periphery) and principle business and governmental interests in individual developed countries and in various international organizations (collectively, the center of the Center). This is in no way a simple theory of one group of countries systematically exploiting another group. Rather it depicts a multi-layered coalition of structures and groups at various levels of the world system which systematically serve the interests of monopoly concentrations of capital and indirectly the interests of those groups and individuals variously attached to public and private institutions which support and service those capital interests.

The small Sahelian agricultural surplus is aggregated and exchanged for mass consumption items (plastic shoes, cloth, radios, beer, etc.), a very expensive imported life style for small local and expatriate elites, and for imported, facilitating means of communications and transportation. Very little surplus goes into locally-controlled productive investment. The symptoms of economic dependency--rapid urbanization with high unemployment, increasing breakdown of traditional social cohesion, rural stagnation, and recurrent deficits in food production as export cash crop production is maintained--are present throughout the Sahel. Much of the greatly increased development assistance to the area, designed to combat one or another of these symptions, too often serves, instead, to perpetuate and strengthen these dependency relationships and not to promote self-sustained economic change and

development. Thus "underdevelopment" is not the first stage in a possible assent to "development" but it is rather a semi-permanent characteristic of whole segments of the world political economy caught in complex patterns of center-periphery domination and dependence.

Also in Chapter II, a number of exchange mechanisms, which are related to system structural characteristics and through which accumulation of property wealth and capital proceed, were introduced and developed. When narrowly viewed (such as in most conventional presentations of international trade "comparative advantage"), these exchange mechanisms seem to represent normal and equitable trade relationships. However, a broader analysis of their operation in economic trade with rural, agricultural areas in the third world (the periphery of the Periphery) is more instructive. In the hypothesis of unequal trade the Center and Periphery engage in vertical trade across a "processing gap" or gap in levels of technology with the center providing "finished goods" and the Periphery primary products and raw materials. Even if the simple terms of trade are relatively equal, over time, capital and wealth accumulate in the Center due to higher rates of increase in labor productivity in the larger, more integrated economies and due to the fact that the Center generally has multiple, vertical relationships of this type. The Periphery, in contrast, sees little change in labor productivity in its rural production areas and its trade relationships are generally restricted to a few major partners.

The second "ratchet" in the system is represented by the internal trade relationships within the Periphery in which domestic terms of trade run against rural areas except during those periods when major structural changes are occuring, often associated with the introduction

of new production technologies or new cash crops. Periphery rural areas tend to remain materially unchanged and stagnant (de Janvry's "marginalization" of third world rural labor); urban areas in contrast tend to grow rapidly, feuled by the creation of an administrative government aided directly by the Center and through the introduction of capital intensive, "imported" import-substitution consumer goods industries or, in more advanced areas, manufacturing for re-export using domestic cheap labor.

It was clear that the more formal two country, two socio-economic group model of center-periphery economic interaction and change was not adequate to represent the full complexity of West African underdevelopment. In increasing the complexity of the basic model the most important additions suggested are:

1. Including an intermediate or "semi-peripheral" layer of countries between the developed world and underdeveloped areas. This simply permits greater system complexity and flexibility in applying mobile capital to less-mobile labor. (Thus, the Ivory Coast and Nigeria are rapidly developing into intermediate countries in West Africa which can facilitate applying imported capital to imported labor and gaining for themselves some of the material benefits).
2. In similar fashion, including an intermediate socio-economic group to facilitate the extraction of agricultural surplus from rural areas. (This function has been played in West Africa by Lebanese traders, various religious groups, particularly the Moslem Mourides, and indigenous ethnic groups specialized in long-distance trade: the Bambara/Dioula, Haoussa, etc.)

3. Factors such as demographic trends, natural resource position, and geographical location modify the forms some of these mechanisms assume which means the model *must* be specified for each country or region in question.
4. The *expected* presence of contradictory patterns within the main path of system change since systems in evolution contain vestigial pockets of former systems and the conflicting precursors to alternative future systems. It should also be noted that just as these contradictions exist at the macro level they also exist at the micro and even personal level.

The application of the center-periphery model to Sahelian West Africa was completed in Chapter II through a brief description of the historical phases in the evolution of West African structural dependency, a comparison of this model with other trade and economic development models[1] (particularly with "dual-economy" models), and finally an exploration of two general alternative paths for possibly future evolutionary change in the Sahelian political economy. These latter two possible models were rather extremely stated in order to point up major possible structural differences. One model envisions an evolutionary path of increasing dependency and the other a path toward greater independence and self-reliance. Suggestive sectoral characteristics for the two models were spelled out in a final table to begin to shift our focus to application of this paradigm to one important sub-sector, food grain marketing and storage.

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[1]These are more conventional models which deal with the same inescapable observable reality but which are more limited in the system variables chosen for analysis.

It is perhaps easier to see the application of the center-periphery model in West Africa than in other areas because of the overwhelmingly rural nature of those societies, particularly in the Sahel; the recent colonial past; the small political-administrative, socio-economic center groups using imported cultural and linguistic norms, administrative procedures, energy and technologies; and the very low level of material economic development which leaves little short-term choice for this interdependent system but to generate foreign exchange through the export of mineral wealth, cash crops and labor on a regional basis. This is explored particularly in Chapters III and V.

In the economic overview of the Sahel presented in Chapter III a number of topics were briefly discussed:

1. The sectoral composition and low per capita level of Sahelian GNP.

2. The physical domination of the region by broad ecological, climatic belts which place severe constraints on the possible nature of agricultural transformation.

3. The predominant role of trade in Sahelian GNP and its dependent nature as illustrated by its composition (a few export cash crops and/or mineral resources) and its limited number of trading partners.[2]

4. Specific symptoms of center-periphery dependency in the Sahel including:

    a. Extremely wide differentials between non-agricultural and agricultural wages (differentials for the Sahel are three times greater than LDC averages and five to six times greater than developed country averages).

    b. A brief discussion of the terms of trade "double ratchet" working consistently against Sahelian rural areas.

    c. Patterns in development assistance, much of which goes to maintain central bureaucracies.

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[2]It should be stressed that diversification of trading patterns is not a sufficient condition for a more independent trade.

In narrowing the focus of the study still further in Chapter IV, trends in Sahelian grain consumption, production and imports were analyzed with the following conclusions:

1. Grain--particularly millet and sorghum--dominates Sahelian diets although there are some significant differences from one country to another and within each country, particularly by ethnic group, place of residence, and access to animal protein.
2. There are significant differences between "center and periphery diets" with the former reflecting a life style which includes increased amounts of rice and imported wheat convenience foods. There is strong evidence, however, that substitution to domestic from imported food can occur much more rapidly than previously felt under the influence of fairly modest shifts in relative prices.
3. Urbanization does not mean improved diets for all parts of the population as poor urban migrants may have diets which are nutritionally poorer than the semi-subsistence ones they left behind in rural areas.
4. The rate of growth of Sahelian urban areas is among the highest in the third world and most experts predict that this trend will continue. This is a classic pattern which is due partially to the lure of accumulating wealth and a number of very high paying jobs in urban areas, stagnation in rural areas, compounded by the disruption of traditional rural life and agricultural patterns partly caused by the drought and, in some instances, by efforts to provide development assistance.
5. Aggregate levels of cereal production have not kept par with population growth, particularly since 1964. Regression analysis of

aggregate production data showed a general pattern which covered most grain production in Mali, Niger, Senegal and Upper Volta. In it we saw that production levels increased fairly consistently from 1951 to 1964, oscillated around this level for six or seven years, dropped very sharply in 1972-73 at the height of the drought, and climbed back up to about their 1964-70 average in 1974 and 1975. There were, of course, significant deviations from these trends which are explored in detail in Chapter IV. While the drought did cut sharply into grain production and had an even more devastating impact on nomadic livestock production, we can also point to government policies, particularly price policies, which discouraged the production of food crops and encouraged greater output of cash crops.

6. There were no major upward trends in the evolution of estimated yields for grain crops except for rice which is increasingly influenced by yield increases under government programs for its production with controlled irrigation and high fertilizer use.

7. Analysis of variation in production levels from country to country shows somewhat conflicting patterns. However, in sum, it is probably safe to say that in most years severe shortages will probably be fairly localized and it should be possible to shift portions of relative grain surpluses to adjoining regions and countries (assuming, of course, that transport costs do not far exceed the spread in relevant prices between the two areas). It should also be clear that in unusually bad years it may not be possible to count on much assistance in this respect from neighboring

production zones, particularly if two bad years in a row, such as occurred in 1972 and 1973, hit the region as a whole.

8. Food imports have increased dramatically in the Sahel over the past ten years with the self-sufficiency percentage falling to 70 percent in Senegal and 60 percent in Mauritania. Senegal has taken fairly virgorous steps to attempt to reverse this process but the situation continues to erode in Mauritania. The trends in the other four countries indicate a drop below self-sufficiency with increased dependency on commercial food imports and donated relief supplies. In several instances, this has been complicated by inappropriate pricing policies or domestic political instability. It is fairly clear that all four countries could return to self-sufficiency and even produce surplus cereal for export under appropriate policies for food production and marketing.

In the review in Chapter V of existing literature and empirical studies on Sahelian private grain trade we saw that:

1. The vast majority of grain produced stays on the farm for local consumption or later sale with smaller percentages entering traditional non-market exchange patterns or taken to local markets for sale. Under widely varying circumstances complex patterns of periodic markets permit "thin" supplies to be bulked and exchanged for consumer goods.

2. A variety of participants engage in grain marketing activities and, on the local level at least, all studies point to competitive market performance under the many constraints in operation. Longer distance marketing, facing severe transport, credit and

communications barriers, tends to be much more subject to oligopolistic cartelization, a fact which is also confirmed by empirical economic and anthropological case studies. There is a strong tendency to concentrate attention sequentially on the horizontal patterns of market competition at various levels in the market channel and to look at vertical organization and integration in fairly simple terms. This can miss important patterns of concentration and trade restrictions along the dendritic interaction structures which link freer market "islands" of difference sizes. These spatial and temporal structures are dotted with ad hoc and permanent, traditional and modern institutions, rules, borders, boundaries and property rights which only the specialized few can master and which are not completely captured in simple comparisons of inter-market price and cost differentials. The relationship between institutional organization and the arrangement of economic activity over space is of particular importance. A summary conclusion for much of West Africa is that the organization of space for agricultural production and marketing is not optimal for modernizing yet independent, more self-sufficient and locally-controlled economic system.

3. The distributional impacts of staple food grain trading in conjunction with more important cash crop trading are significant in the growth of socio-economic differentiation (i.e., class formation) as rural incorporation into the commercial economy progresses. We saw that, in some areas of communal land holding and small-scale agriculture, relatively better-off farm units (those with more advantageous traditional kin obligations and

relationships, a larger number of active adults, or access to better land, etc.) are more able to store and buy grain at harvest time, engage in supplementary activities (e.g., prepare meals for sale) and sell more grain later in the year. Poorer farmers in order to meet cash needs--head taxes, small consumer items, etc.--have to sell more of their grain at harvest time and earlier in the crop consumption year. This can lead to a depletion or exhuastion of farm unit grain stocks and the need to sell labor services (in the local area or in other regions) for wages or for payment in kind in order to meet food needs at higher "hungry season" prices. These effects can be cumulative with more prosperous farmers (or, increasingly, outside traders or salaried urban residents) better able to take advantage of modern credit and technical assistance packages to produce cash and food crops with improved technology and a greater use of wage labor.

4. It would be safe to say that at least 75 percent of Sahelian grain storage capacity is on farm, that its efficiency in terms of loss prevention is generally good, particularly in less humid areas, and that much higher costs and losses are incurred when grain moves into commercial and government bag storage facilities unless very rigorous management and fumigation procedures are used. Bulk storage, while offering some technical advantages for handling large volumes of grain, is quite costly and inefficient since bulk handling components are isolated in the larger grain marketing system.

In Chapter VI the emphasis of this study moved to grain storage and marketing policy as issues in Sahelian government participation in grain markets were analyzed. After a brief discussion of a conceptual schema for looking at an entire program of possible grain marketing and storage activities, the chapter examined both macro and micro level grain stock policy issues felt to be relevant to Sahelian policy makers. In order to focus on those issues, it was necessary to "hold constant" many other factors through the following simplifying assumptions:

1. National governments in the Sahel are going to engage in grain marketing activities, particularly:
   a. Supplying a part of urban grain needs.
   b. Making physical infrastructural improvements, particularly in storage and transportation.
   c. Holding emergency stocks.
   d. Employing buffer stocks along with other measures to act on supply and/or price variation.
   e. Generally intervene quite extensively in food markets.
2. Many of the conditions required for competitive markets are met, particularly in localized areas. Less competitive conditions, however, often exist in longer distance trade and at higher levels of product aggregation in vertical channels.
3. Short-term policy choices are quite limited but in the longer run, the Sahelian countries can engage in development policies which will promote greater structural and functional dependence or independence.
4. Higher levels of outside funding (with some implicit constraints) will be available for infrastructural improvements, improved data collection and even to cover much of total operating expenses.
5. Objective functions will stress "autonomous economic development and food self-sufficiency". While some trends can be identified which are moving toward the attainment of these goals, the major thrust of Sahelian evolution has been toward increasing economic and food dependency.

Given these simplifying assumptions the following set of fairly pragmatic grain policy issues were discussed:

1. "Macro level" policy issues
    a. The degree of food self-sufficiency to pursue
    b. The costs and benefits of supply stabilization through trade versus storage
    c. Definition of the "population at risk"
    d. Specification of a general food grain intervention
        1) The optimal degree of decentralization
        2) Specification of an integrated food policy
        3) The size and timing of grain stock operations
    e. The nature of personnel training appropriate for such a system
    f. Technical issues concerning physical and institutional infrastructure
    g. Realistic expectations of assistance, cooperation from international and West African regional grain stocks
2. Emergency stock issues
    a. Level of stocks
    b. Location of stocks
    c. Methods of stock constitution and replenishment
    d. Price and non-price trigger mechanisms
    e. Degree of independence of emergency stocks
    f. Strategies for surplus stock disposal
    g. Operation of emergency stock distribution
    h. Regional stock coordination and cost sharing
3. Buffer stock issues
    a. Ownership and operational control of buffer stocks
    b. Reform in price policy

c. Structural reform to minimize bureaucratic conflict and waste

d. Definition of an intervention strategy including:

1) Determination of population at risk

2) Adoption of appropriate trigger mechanisms

3) Balancing intra and inter-annual stabilization efforts.

These issues were further discussed in the concluding portion of Chapter VI which reviewed alternative methods of analysis used in addressing the practical mechanics of grain stock holding. This discussion distinguished between three general levels of analysis: the macro-systemic, the intermediate/policy/oriented and the operational levels. Most modeling efforts reported in the literature have been at the macro-systemic level and most have dealt with major producers of grain for the world trade or alternative schemes for international reserve stock systems. A few modeling efforts have concentrated on specific LDC stock holding problems, particularly in the India subcontinent, and based on preliminary work done in this study. It is quite likely that such modeling research projects could be useful to Sahelian policy makers if carefully designed to meet the environmental and policy constraints of specific countries. It should also be noted that there are significant costs associated with such efforts both in terms of data collection, modeling time and the effort required to "recalibrate" the model to adjust for changing policy and environmental conditions.

In contrast to more rigorous approaches, the analytical methods used in determining what levels of emergency and buffer stocks to hold are crude, pragmatic and reflect the pressures under which policy makers must work and take action given very incomplete information.

For example, at their best, in determining emergency stock levels, these methods involve probability calculations of the magnitude and distribution of shortfall, estimation of a population at risk, determination of a net shortfall (by allocating gross shortfall to the population at risk by way of food balance sheets, average consumption levels, estimated arrival time for outside relief supplies, and domestic distributional capacity), and arbitrarily comparing these figures to political and financial constraints to fix a percentage of net shortfall as the national emergency stock level. The operational world of successful cereals boards is similar to that of the private grain trader; it involves "learning by doing" and the establishment of ad hoc and "rule of thumb" procedures.

The inadequacy of the policy level analyses described above can be corrected in two ways, either by expending the resources needed to permit more sophisticated analyses to be conducted or by beginning to partially "solve" the problem through a redefinition of the unit of analysis and accounting which would, of course, have to be preceded by reorganization of collective grain storage and marketing activities to that level. We have seen the functional difficulties inherent in trying to operate a centralized grain market operation in a decentralized economy. At least a partial solution could involve a progressive structural and functional decentralization and redefinition of the basic operating and accounting units so that they are more congruent with the underlying base structure of rural production and consumption, the available physical and human resources of the country and stated rural development and distributional objectives. The two solutions, while somewhat contradictory at the theoretical level, are

not incompatible in actual practice as an integrated grain marketing and storage system must operate at different levels to meet multiple objectives. Thus, while the basic food security operational and analytical evaluation unit can be decentralized to the village or village cluster level, other transhipment, commercial sales and storage activities can be more narrowly, but more appropriately, analyzed and instituted on a more aggregate, federated basis.

In Chapters VII and VIII Sahelian governmental grain marketing and storage institutions and their objectives, structures, means of implementation and initial performance over the past three to four years are described and analyzed. Upper Volta is covered in considerable depth in a separate case study in Chapter VIII in which special attention is given to a review of the first several years of the FAO/FSAS emergency stock program and an Upper Volta Government proposal to institute a program of collectively held village level grain stocks to increase local food security. The experiences of the other five countries are covered in a more summary fashion in Chapter VII. The following conclusions and policy recommendations represent a synthesis of the more detailed results presented in those two chapters.

Summary Characteristics of Grain Marketing and Storage Institutions

Objectives

The formal objectives set for the various grain boards are quite uniform from country to country and include establishment of readily available emergency reserve stocks, facilitating internal grain transfers (including development of market infrastructure as food markets "deepen" with urbanization), and the intra-annual and inter-annual

stabilization of both producer and consumer prices and incomes. In contrast to these stated objectives more informal goals for cereals boards have revolved around the selective use of government resources to benefit already privileged urban groups contributing to patterns of disfunctional urbanization, rural stagnation and declining food production.

These contradictions among objectives are predicted and highlighted in the center-periphery framework. The most fundamental conflict is between supporting rural producer (periphery) and urban consumer (center) interests. This conflict is seen in a number of forms in the functions of Sahelian cereals offices and related food policies. One is the choice between stabilizing and "subsidizing" urban food prices versus producer incomes, the latter possible through the promotion of localized food stocks and higher prices for food transferred to urban areas. The second is the use of the food marketing and storage system for revenue grneration versus its alternative use as a risk-minimizing productive service provided to different sectors of the economy "at cost". Finally, there has been some tendency for Sahelian governments to use food marketing and storage for direct "micro-political" intervention through urban food subsidies and special below-cost food deliveries to specific urban and regional constituencies where political support is weak. This of course undermines the operational viability and integrity of cereals offices.

Institutional Structures

This study has placed major emphasis on ways in which inappropriate institutional structures hamper the accomplishment of reasonable Sahelian grain marketing and storage objectives. This problem

can be seen at various levels. First, at a general level, the cereals offices, like other Sahelian institutions, are structured administratively or "from the top down", leading generally to disfunctional overcentralization, ineffective incentive structures, very high operating costs and negative distributional effects as such structures are forced onto the local, decentralized cereal economy. This pattern is also often observed in the growing number of regional development organizations within each country and while this may facilitate the upward channeling of expropriated agricultural surplus to support urban sectors functionally linked to the developed Center of the international economy, it does not promote the development of viable local institutions and farmer controlled agricultural progress.

On a more operational level, two major patterns were observed in the misallocation of national marketing and storage responsibilities. In the most common pattern, there are too many institutions, often in different ministries, participating in grain marketing channels leading to lack of coordination, duplication of effort, and unnecessary and costly supplementary grain transactions. This pattern was examined in detail in the Upper Volta chapter. We have also seen the opposite pattern where one institution is weakened by having to fill multiple and often conflicting objectives. This, for example, is the case for ONCAD in Senegal which is responsible for cash crop as well as food crop marketing and storage and for the provision of credit and inputs to producers. Here the problem focuses on the greater stress placed on cash crop marketing and the inappropriate application of these extractive techniques to food crops.

Finally, similarities in the structure, functions, objectives and statutory powers of cereals offices should serve to facilitate direct regional inter-office contacts and cooperation in many cases but this has been structurally blocked by the operation of "feudal interaction structures" which provide incentives to maintain uneconomic links between each country's frail center and the outside world. Consistent with administrative "formalism", international contact is usually restricted to the lowest common denominator of *political* cooperation while there is substantial room for developing direct *functional* contacts among cereals offices. It has also been repeatedly stressed that the coastal countries are vital to an understanding of the structure and functioning of possible evolutionary paths for a West African regional economy. This means that they must be included, more than they are now, in any viable regional food security strategy, particularly Nigeria which produces about one-half of West Africa's millet and sorghum.

Means of Implementing Program Objectives

There are two main types of ingredients required in the operation of a cereals marketing and storage program: the physical and human components of the system (such as storage facilities, transportation infrastructure, trained personnel, and operating funds) and operational policies (such as price policies) which put these elements together over time and space. These specific elements can only readily be addressed in detail on a country-by-country basis, as they are for Upper Volta in Chapter VIII. A few general patterns, however, can be underlined here.

Storage and transportation infrastructure is generally inadequate for the tasks of holding increased stocks of grain and promoting more self-reliant patterns of rural development. Many infrastructural investment strategies for the Sahel have placed inordinate emphasis on the construction of capital intensive, large-scale storage and transport infrastructure which corresponds to general patterns of increased dependence on imported capital, technology and food supplies since they are not accompanied by serious attention to the improvement of infrastructure and institutions at the heart of the system, the farm and village level. The major grain shortfalls and ensuing drought relief actions, centered on the years 1973-75 and described in detail in Chapters IV and VII, demonstrated both the inadequacy and inefficiency of the macro-level distribution and storage system and the increasing vulnerability of an eroding, stagnant food production base.

In terms of operational policy issues there are two main areas which have received substantial emphasis in this study, price policies and those dealing with the degree of farmer participation in, and control over, grain marketing and storage mechanisms. Price policy is undoubtedly one of the biggest practical constraints on the successful operation of grain programs. Deliberate buying experiments and the occasional high guaranteed producer price have effectively demonstrated that farmers will respond to price incentives. The opposite situation is more ofen the case, however, and when conditions are bad enough farmers will simply withdraw from the market to the extent possible.

The composition and timing of annual cereal price *barèmes* are of utmost importance. Cereals offices are often forced to accept politically influenced margins between producer and consumer prices which cannot cover costs. The rigidity of uniform *barème* price levels is often compounded by fixed transporation and other cost allowances which do not allow for necessary regional variation. This can lead to a misallocation of potential agricultural resources and its hamstrings grain institutions by denying them the flexibility to make quick market actions and to renegotiate prices (to institutional buyers for example) under changing supply conditions. It also encourages smuggling to take advantage of wide differences in official prices among neighboring countries. Finally, prices are generally announced well into the harvest season providing little incentive to the producer and injecting needless delays into marketing operations. When prices happen to be attractive to farmers, the marginal cedibility of government organizations is often further eroded by the lack of necessary funds to purchase all supplies offered or by not getting funds to buying points until too late in the season.

The policies which govern the structure of grain board personnel incentives do not support the key area of local operating efficiency. Most institutional employees are "civil servants" whose loyalties and career incentives are not functionally related to operational success. Further, at the local level, there are virtually no means of producer or collective village control over the hiring and promotion of grain board employees at that level; all of these decisions "descend" administratively.

Performance of Government Grain Institutions

As we have seen in this study the overall performance of grain boards in the Sahel has been quite poor to date. The summary assessment offered in Chapter VII still holds and bears repeating:

> The offices have not exercised much real influence in cereals markets and their actions have often contributed to the misallocation of production resources leading to negative distributional consequences as urban consumers and private traders have often been the chief recipients of program benefits. In contrast to this bleak assessment, however, the potential of cereals marketing and storage institutions to promote greater food production, reduce producer risk, as well as stabilize urban grain supplies has been selectively demonstrated. The objective now should be to help identify the structural and functional elements of the present system of grain marketing and storage programs which are amenable to change.

General Policy Recommendations

The detailed analysis of cereals institutions in Upper Volta in Chapter VIII and its concluding section on suggested structural remedies constitutes an example of such an attempt to propose modifications in existing institutions and behavior to more fully meet national objectives. While it is clear that these prescriptions must be tailored to the specific physical, logistical and institutional environment of each country, the following general set of policy reommendations may be of use in this process.

General Strategy

Pursuit of the objectives of "food self-sufficiency and autonomous economic development" (or more specific, operational formulations such as those suggested on page 14 of Chapter II) given the current environment of Sahelian center-periphery dependence, necessitates following a basic strategy of reducing external cultural, economic

and political dependence and building self-reliance through the satisfaction of basic needs by more fully employing the human and physical resources available at the local level, and by reintroducing more balance between production and consumption at both the local and national levels. Increasing food security both by increasing grain production and by more rationally marketing and storing the grain must be faced at a number of levels at once in order to meet different objectives and to fit into a process of general system transformation. The strategy must begin where most of the Sahelian population lives and produces most of the food--in rural areas.

The foundation of the general strategy is to promote the storage of greater quantities of grain by strengthening village level grain storage capacity to serve the needs of all segments of the rural population for food security and to provide a form of seasonal credit against this store of agricultural value. The village stock system proposed for Upper Volta and described in the previous chapter serves as a useful, if somewhat imperfect, model. The implementation of this model will have to vary from surplus to deficit production areas with the former providing greater average percentages of production to national grain marketing channels.

Above the village level, three additional functions must be incorporated into an integrated system: normal supply of grain to the non-producing population, storage for supply stabilization in urban and rural areas, and the maintenance of strategic emergency stocks which will be available on short notice under predetermined conditions. The precise mixture of all four system components must be specifically determined for each Sahelian country.

It is important that this overall system by structured in federated form so major responsibility for the constitution, ownership, operation and accounting of local stocks can be put under local control with regional and central government authorities providing technical assistance, seed capital and the planning and coordination of transfers from surplus to deficit areas, holding of strategic reserves and some buffer-stocks, and promoting functional contact with similar organizations in adjoining countries. In this way, increased local self-reliance will help reduce one aspect of dependency and promote reasonably-sized village geo-political units linked together to promote self-sustained development from below.

Past experience has shown that attempting to transform top-down administrative, political-economic structures such as the ones described in this study is a perilous undertaking with many seeming reforms turned to further reinforcement of objectionable trends. Thus, change must be coordinated at all levels if success is to be realized and sustained over time. Technically efficient, cost effective methods of grain storage and distribution can be locally perfected if the system is developed in a phased, incremental way, adapting and refining proven techniques. This means that collective methods will have to begin (and may well continue) in competition with private commercial trade.

The type of food security system proposed here will be easier to accomplish if accompanied by facilitating factors such as a believable, locally-adapted ideology of self-directed rural modernization, government actions which demonstrate a commitment to restructure incentives in favor of farmers and rural areas, and concrete measures

taken to slow the attraction and rate of growth of urban areas. In a similar fashion, a locally-controlled system will demand greater flexibility in pricing policies and prices which move in favor of rural areas even if this leads to a temporary drop in outward-oriented indicators such as GNP.

Investment Priorities

While the success or failure of Sahelian grain programs ultimately depends on national commitment and political determination, this is not a proposal for autarchy. Foreign capital and technical assistance can still play a valuable role in supplementing national resources, particularly in the areas of:

1. Village Stabilization. Fairly moderate investment costs will be needed for constructing village storage facilities based on possible modifications in traditional storage technology so that maximum use of local resources and labor can be realized. Monetary grants or food-aid to be used as pay or to be sold to generate operating funds could help finance local construction costs and the constitution of initial stocks.
2. Market and Transportation Infrastructure. The evacuation of village surplus production (and supply of needed inputs and services) will be facilitated through improvements in local road networks and regional grain storage, drying and disinfestation equipment. Much of this infrastructure may be built using labor-intensive, food-for-work type programs. Warehouse facilities should be placed so that shipping costs are minimized and effective service can be offered to the village storage units.

3. Training. Training for management of a coordinated, decentralized grain storage system should be conducted in pilot projects where personnel will be working, be it at the village, regional or national levels. Emphasis should be on a well managed "learning by doing" expansion of grain storage actions operated as "government" (includes local co-ops, etc.) services.

4. Surplus Disposal. Major attention should be given to alternative uses of possible surplus production of grain (particularly until a system of local-determined supply management can evolve). Here there are major possibilities of functional cooperative arrangements with emergency and buffer storage agencies in neighboring Sahelian and coastal West African countries which might be most effectively promoted under an international technical assistance program. Enhancing complementary production systems such as livestock marketing could be encouraged through experimentation in dry season feeding and finishing diets.

5. Emergency Storage. The tightly-run management of limited emergency stocks, operated as a public service and coordinated with village grain stocks, urban supply and stabilization programs, will require a continued infusion of capital from domestic or foreign sources. Hopefully, improvements in storage technology, management procedures for stabilization stock turnover and so forth will continue to reduce the subsidy required for such a system. As described below further applied research into defining the "population at risk", determining optimal emergency storage levels and locations, and the potential use of bulk handling

and storage components, particularly at the wholesale level, should be pursued under an emergency storage program.

Research Priorities

Most of the research priorities are natural by-products of the general strategy and investment priorities listed above. Research priorities should serve the interests of national development strategy, for as Mao Tse-tung noted, "The most important problem does not lie in understanding the laws of the objective world and thus being able to explain it, but in applying the knowledge of these laws actively to change the world."

At the national or macro-economic level the following topics could be usefully explored:

1. The structure and operation of traditional grain marketing systems, with particular attention devoted to patterns of concentration, marketing margins over extended time period, and market components which could be effectively incorporated into a national system.
2. A grain marketing system modeling project which would require country specific data collection and model specification in order to take into account probabilistic sub-national patterns of production, distribution and consumption under alternative sets of constraining policy rules. Once a working model of a particular grain economy is established the effects of alternative price policies, non-price constraints, storage rules could be tested.
3. Within the context of emergency grain stocks, this review of the first several years of Sahelian experience has shown the need

for a more thorough and systematic re-examination of the "population at risk" and the optimal size and location of stocks given improved information on surplus and deficit regions, transport costs, available markets for grain turnover and changes in overall grain system performance which may result from a more widespread village stock program.

4. Top priority should be given to the development of a standard grain planning methodology for the annual assessment of regional production, surplus and storage levels. This will be greatly facilitated through the achievement of badly-needed agricultural statistics units in each country.

At the local operational level there is need for applied micro-economic or anthropologic research and various types of technical experimentation. For example, there is need for greater knowledge of farm level grain marketing decision making and how this behavior fits into the individual farm and village economies. Cheap methods for simplified reproduction of these investigations should be developed for the use of regional program administrators, extension agents and village groups themselves. Further, there is great scope for local level applied "social-engineering" research in devising effective incentives to promote increased local grain storage in urban as well as rural environments.

Technical field research should be focused on the use of energy efficient techniques for the employment of local labor and materials in improved grain storage technology, road and river transportation infrastructure and methods, grain processing, drying, and the

high-nutrition use of traditional grains to promote improved diets and decrease reliance on food imports.

APPENDICES

APPENDIX A

STATISTICAL TABLES TO ACCOMPANY

CHAPTERS III AND IV

TABLE A1

EVOLUTION OF SENEGALESE GROUNDNUT TERMS OF TRADE, 1885-1970

	Production Exported. Annual Average Unshelled Nuts (000 Metric Tons)	Index of Price of 100 kg. Unshelled Nuts in Dakar[a]	Index of Retail Prices of Imported Goods[a]	Commodity Terms of Trade[a]	Real Prices in Terms of Wages[c,b]	Double Factorial Terms of Trade[a,c]	Value of Crop at 1970 Prices (20 f. per kg.). Annual Average. 000 m. CFA Francs	Value of Crop at 1880-1899 Terms of Trade (000 m. CFA Francs, 1970 Values). Annual Average	Surplus Transferred Annual Average (000 m. CFA Francs)
1884-1889	32	20	15	128	--	--	--	--	--
1890-1899	68	18	15	125	346	295	1.4	1.4	0.0
1900-1909	146	22	15	135	339	290	2.9	3.0	0.1
1910-1919	216	35	41	101	(379)[d]	(325)[d]	(4.3)	(4.3)	--
1920-1929	374	114	111	102	255	238	7.5	9.3	1.8
1930-1939	440	75	83	97	109	98	8.8	26.6	17.8
1940-1944	244	192	326	50	119	112	4.9	13.0	8.1
1945-1949	392	966	1,692	57	101	96	7.8	24.0	16.2
1950-1954	435	2,270	1,750	130	68	64	8.7	40.0	31.3
1955-1959	670	2,360	1,600	148	50	47	13.4	84.0	70.6
1960-1964	770	2,420	2,025	120	--	40	15.4	114.0	98.6
1965-1969	750	2,110	2,165	105	--	40	15.0	110.0	95.0

SOURCE: Samir Amin, Neo-Colonialism in West Africa, p. 35.

[a]1938 = 100.

[b]Index of the purchase price of groundnuts as a proportion of the index of average real hourly earnings of labor in France.

[c]The index of the real price in terms of wages as a proportion of the index of productivity in the production and transport of groundnuts.

[d]Until 1914 only.

TABLE A2

CONSUMPTION OF ANIMAL PROTEIN BY FOOD CLASS AND BY COUNTRY, 1970
(GRAMS PER PERSON PER DAY)

Country	Food Classes			
	Meat and Milk Products	Eggs and Poultry	Fish	Total
Chad	7.9	0.3	5.7	13.9
Mali	10.3	0.8	3.6	14.7
Mauritania	31.5	1.0	4.6	37.1
Niger	12.6	1.1	0.5	14.2
Senegal	10.3	0.9	12.8	24.0
Upper Volta	2.8	0.6	0.6	4.0

SOURCE: FAO Nutrition Division.

TABLE A3

SEASONAL VARIATION IN DAILY FOOD CONSUMPTION IN RURAL SOUTH-WEST CHAD, 1965
(GRAMS PER DAY)

Food Type	Seasons			
	Hot, Dry Season 3/15 - 6/15	"Hungry Season" 6/15 - 9/15	Harvest Season 9/15 - 12/15	Cold, Dry Season 12/15 - 3/15
Total cereal (millet and sorghum)	441 (429)	371 (306)	332 (252)	472 (423)
Tubers	36	64	136	105
Oil products	48	64	172	61
Faculents	70	75	112	50
Vegetables	18	103	175	31
Total calories	2,295	2,196	2,841	2,493
Percent of need covered	106	101	131	115

SOURCE: Auffret [1974].

TABLE A4
SAHELIAN MEAN ANNUAL GRAIN PRODUCTION BY CROP AND BY COUNTRY, 1951-1975 AND 1961-1975, AND PRODUCTION ESTIMATES FOR 1974 ('000 MT)

Crop	Chad		Mali		Mauritania		Niger		Senegal		Upper Volta		Sahel (Less Chad, Mauritania)[a]	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Millet														
1951-1975	--	--	737	99	--	--	507	85	--	--	280	72	--	--
1961-1975	--	--	735	119	--	--	538	54	--	--	320	57	--	--
1974	--	--	600	--	--	--	500	--	--	--	370	--	--	--
Sorghum														
1951-1975	--	--	--	--	--	--	281	55	--	--	508	153	--	--
1961-1975	--	--	--	--	--	--	283	58	--	--	593	124	--	--
1974	--	--	--	--	--	--	237	--	--	--	705	--	--	--
Millet/Sorg.														
1951-1975	--	--	--	--	--	--	--	--	441	128	--	--	2754	416
1961-1975[b]	694	191	--	--	78	28	--	--	517	110	--	--	2986	327
1974	523	--	--	--	29	--	--	--	680	--	--	--	3092	--
Maize														
1951-1975	--	--	73	19	--	--	2	8	33	16	92	33	200	46
1961-1975	--	--	81	20	--	--	2	7	40	16	93	35	217	48
1974	--	--	60	--	--	--	2	--	42	--	85	--	189	--
Rice														
1951-1975	--	--	150	29	--	--	18	15	88	32	29	10	285	53
1961-1975	--	--	148	33	--	--	27	13	102	34	36	6	312	50
1974	--	--	200	--	--	--	43	--	114	--	40	--	397	--
Total Cereals														
1951-1975	--	--	960	109	--	--	808	127	562	169	910	234	3239	489
1961-1975[b]	745	189	964	134	83	28	850	102	659	150	1042	183	3516	392
1974	577	--	860	--	34	--	782	--	836	--	1200	--	3678	--

SOURCES: Data for Chad and Mauritania, IBRD and FAO; data for other countries, USDA.

[a]Totals averaged only for four countries due to sparse, exceptionally poor data for Chad and Mauritania.

[b]Data for Chad and Mauritania to 1974 only.

TABLE A5
SAHELIAN MEAN GRAIN YIELDS BY CROP AND BY COUNTRY, 1951-1975 AND 1961-1975, AND YIELD ESTIMATES FOR 1974 (IN KILOGRAMS PER HECTARE)

Crop	Chad		Mali		Mauritania		Niger		Senegal		Upper Volta		Sahel (Less Chad, Mauritania)[a]	
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Standard Deviation
Millet														
1951-1975	--	--	634	102	--	--	407	65	--	--	409	62	--	--
1961-1975	--	--	660	122	--	--	394	17	--	--	426	63	--	--
1974	--	--	500	--	--	--	370	--	--	--	435	--	--	--
Sorghum														
1951-1975	--	--	--	--	--	--	579	112	--	--	530	93	--	--
1961-1975	--	--	--	--	--	--	556	121	--	--	558	105	--	--
1974	--	--	--	--	--	--	484	--	--	--	588	--	--	--
Millet/Sorg.														
1951-1975	--	--	--	--	--	--	--	--	482	95	--	--	507	44
1961-1975	--	--	--	--	--	--	--	--	519	104	--	--	519	46
1974	--	--	--	--	--	--	--	--	756	--	--	--	522	--
Maize														
1951-1975	--	--	823	225	--	--	658	187	897	185	714	237	773	121
1961-1975	--	--	927	240	--	--	586	152	805	138	660	131	744	110
1974	--	--	667	--	--	--	400	--	667	--	625	--	590	--
Rice														
1951-1975	--	--	901	158	--	--	1437	685	1158	208	848	133	1086	200
1961-1975	--	--	866	156	--	--	1841	588	1221	237	884	154	1203	170
1974	--	--	1111	--	--	--	2048	--	1425	--	1000	--	1396	--
Total Cereals														
1951-1975[b]	--	--	786	102	--	--	770	149	846	108	625	79	--	--
1961-1975[b]	672	113	818	117	327	83	844	138	848	130	632	75	--	--
1974	575	--	759	--	211	--	826	--	949	--	662	--	--	--

SOURCES: Data for Chad and Mauritania, IBRD and FAO; data for other countries, USDA.

[a] Data averaged for only four countries due to sparse, poor data for Chad and Mauritania.

[b] To 1974 only.

TABLE A6

SAHEL CEREALS PRODUCTION AND YIELD TREND ANALYSIS: SUMMARY OF REGRESSION ANALYSIS (INCLUSION OF $R^2 > .25$[a])

PART A: 1961-1974 ONLY (DATA: IBRD)

Country	Cereal(s)	Data[b] Transform.	Regression Coefficients		Standard Errors		R^2
			In '000 MT, KG/HA, or Logs				
			A	B	A	B	
Production							
1. Chad	Sorg./Mill.	—	1,021	-44	38	4	.91
2. Chad	Total	—	1,066	-43	35	4	.90
3. Mauritania	Sorg./Mill	—	111	-4	12	1	.43
4. Mauritania	Total	—	116	-4	13	1	.42
Yield							
5. Chad	Total	—	833	-22	40	5	.64
6. Mauritania	Total	—	429	-13	35	4	.47

PART B: 1951-1975 AND 1961-1975 (DATA: USDA)

Country	Cereal(s)	Time Period	Data Transform.	Regression Coefficients		Standard Errors		R^2
				In '000 MT, KG/HA, or Logs				
				A	B	A	B	
Production								
7. Mali	Millet	61	—	868.0	-17.00	53.00	6.00	.39
8. Mali	Rice	61	logs	5.0	-15.00	.15	.07	.25
9. Mali	Total	61	—	1,123.0	-20.00	57.00	6.00	.44
10. Niger	Millet	51	—	431.0	6.00	31.00	2.00	.25
11. Niger	Millet	51	logs	5.9	.14	.11	.04	.30
12. Niger	Rice	51	—	-6.0	1.90	2.70	.20	.83
13. Niger	Rice	61	—	7.0	3.00	4.00	.40	.74
14. Niger	Rice	61	logs	1.9	.70	.20	.10	.77
15. Senegal	Sorg./Mill.	51	—	269.0	13.00	35.00	2.00	.58
16. Senegal	Maize	51	—	17.0	1.00	5.00	.30	.37
17. Senegal	Maize	51	logs	2.5	.39	.17	.07	.59
18. Senegal	Rice	51	—	57.0	2.00	11.00	1.00	.29
19. Senegal	Total	51	—	342.0	17.00	48.00	3.00	.54
20. Senegal	Total	51	logs	5.7	.26	.12	.05	.55

TABLE A6 - CONTINUED

SAHEL CEREALS PRODUCTION AND YIELD TREND ANALYSIS: SUMMARY OF REGRESSION ANALYSIS (INCLUSION OF $R^2 > .25$[a])

PART B: 1951-1975 and 1961-1975 (DATA: USDA) - CONTINUED

	Country	Cereal(s)	Time Period	Data Transform.	Regression Coefficients		Standard Errors		R^2
					In '000 MT, KG/HA, or Logs				
					A	B	A	B	
				Production					
21.	Upper Volta	Millet	51	—	192.0	7.00	22.00	1.00	.48
22.	Upper Volta	Millet	61	logs	5.5	.13	.12	.06	.25
23.	Upper Volta	Sorghum	51	—	336.0	13.00	50.00	3.00	.41
24.	Upper Volta	Sorghum	51	logs	5.6	.27	.13	.05	.52
25.	Upper Volta	Rice	51	—	15.0	1.00	3.00	.20	.65
26.	Upper Volta	Rice	51	logs	2.2	.48	.11	.04	.85
27.	Upper Volta	Total	51	—	639.0	21.00	74.00	5.00	.43
28.	Upper Volta	Total	51	logs	6.3	.22	.12	.05	.49
29.	Sahel (4)[c]	Sorg./Mill.	51	—	2,303.0	35.00	138.00	9.00	.38
30.	Sahel (4)	Sorg./Mill.	51	logs					.45
31.	Sahel (4)	Rice	51	—	230.0	4.00	18.00	1.00	.34
32.	Sahel (4)	Total	51	—	2,707.0	41.00	162.00	11.00	.38
33.	Sahel (4)	Total	51	logs	7.8	.12	.07	.03	.45
				Yield					
34.	Mali	Millet	61	—	773.0	-14.00	59.00	6.50	.27
35.	Mali	Maize	61	—	1,151.0	-28.00	116.00	13.00	.27
36.	Mali	Total	61	—	958.0	-18.00	49.00	5.00	.45
37.	Niger	Sorghum	61	—	695.0	-17.00	53.00	6.00	.41
38.	Niger	Maize	51	—	851.0	-15.00	64.00	4.00	.34
39.	Niger	Maize	61	—	791.0	-26.00	56.00	6.00	.57
40.	Niger	Rice	51	—	515.0	71.00	187.00	13.00	.58
41.	Niger	Rice	61	logs	7.0	.26	.18	.09	.38
42.	Niger	Total	51	—	614.0	12.00	51.00	3.00	.35
43.	Niger	Total	51	logs	6.3	.14	.09	.04	.40
44.	Senegal	Sorg./Mill.	51	—	383.0	8.00	32.00	2.00	.35
45.	Senegal	Maize	51	—	1,096.0	-15.00	62.00	4.00	.37
46.	Upper Volta	Rice	61	logs	6.5	.16	.10	.05	.44
47.	Sahel (4)	Rice	51	—	829.0	20.00	58.00	4.00	.53
48.	Sahel (4)	Total	51	logs	6.5	.06	.05	.02	.24

SOURCES: IBRD, USDA.

[a]Log transformations included only if R^2 greater than that for nontransformed.

[b]Production, yield and time transformed to logs. Regression coefficients and standard errors, for any particular year, can be retransformed by anti-logs. Production equation would therefore be in form: Prod - anti-log (a) * time.

[c]Less Chad and Mauritania.

TABLE A7

PEARSON CORRELATION COEFFICIENTS FOR SAHELIAN MILLET, SORGHUM AND TOTAL CEREAL PRODUCTION, 1951-1975

Country	Cereal(s)	Mali		Niger			Senegal		Upper Volta		
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
1. Mali	Mill./Sorg.	1.00									
2. Mali	Total	.97*	1.00								
3. Niger	Mill.	.28	.24	1.00							
4. Niger	Sorg.	.46*	.49*	.53*	1.00						
5. Niger	Total	.35*	.35*	.95*	.77*	1.00					
6. Senegal	Mill./Sorg.	.03	.12	.42*	.04	.38*	1.00				
7. Senegal	Total	.09	.17	.46*	.09	.43*	.99*	1.00			
8. Upper Volta	Mill.	.07	.11	.57*	.11	.50*	.68*	.68*	1.00		
9. Upper Volta	Sorg.	-.05	.02	.59*	.16	.52*	.70*	.70*	.81*	1.00	
10. Upper Volta	Total	.01	.07	.64*	.19	.57*	.70*	.71*	.90*	.97*	1.00

SOURCE: Computed from USDA data series.

NOTE: Coefficients with "*" significant at .05 or better.

TABLE A8

PEARSON CORRELATION COEFFICIENTS FOR SAHELIAN MILLET, SORGHUM AND TOTAL CEREAL PRODUCTION, 1961-1975

Country	Cereal(s)	Chad		Mauritania		Mali		Niger			Senegal		Upper Volta		
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.
1. Chad	Mill./Sorg.	1.00													
2. Chad	Total	.99*	1.00												
3. Mauritania	Mill./Sorg.	.61*	.64*	1.00											
4. Mauritania	Total	.60*	.62*	.99*	1.00										
5. Mali	Mill./Sorg.	.67*	.68*	.73*	.72*	1.00									
6. Mali	Total	.71*	.73*	.75*	.75*	.98*	1.00								
7. Niger	Mill.	.21	.26	.59*	.60*	.48*	.49*	1.00							
8. Niger	Sorg.	.64*	.67*	.68*	.68*	.69*	.72*	.71*	1.00						
9. Niger	Total	.37	.42	.63*	.64*	.61*	.63*	.94*	.90*	1.00					
10. Senegal	Mill./Sorg.	-.15	-.13	.15	.16	.07	.17	.16	.08	.17	1.00				
11. Senegal	Total	-.09	-.06	.30	.30	.17	.26	.26	.16	.26	.98*	1.00			
12. Upper Volta	Mill.	-.17	-.14	.11	.12	.01	.04	.64*	.29	.54*	.33	.36	1.00		
13. Upper Volta	Sorg.	.14	.15	.20	.21	-.18	-.06	.22	.28	.25	.39	.39	.61*	1.00	
14. Upper Volta	Total	.10	.13	.22	.23	-.08	.00	.42	.35	.41	.39	.41	.80*	.94*	1.00

SOURCE: Computed from U.S.D.A. and I.B.R.D. data series.

NOTE: Coefficients with "*" significant at .05 or better.

APPENDIX B

A COMPARATIVE ANALYSIS OF PER TON STORAGE COSTS FOR BULK SILO AND BAG WAREHOUSE GRAIN STORAGE

APPENDIX B

A COMPARATIVE ANALYSIS OF PER TON STORAGE COSTS FOR BULK SILO AND BAG WAREHOUSE GRAIN STORAGE

The grain storage cost structures analyzed below are based on calculations made by Pattinson [1975] for Niger in 1976. They are derived from alternative plans for a 42,000 MT emergency stock to be held in four locations in Niger: Zinder (6,000 MT), Maradi (5,000 MT), Birni N'Konni (14,500 MT) and Dosso (16,500 MT). Costs are averaged for storage centers of differing size with construction and operating costs also varying by location. These figures are summarized, analyzed, and compared with alternative estimates for illustrative purposes. Actual costs for storage investment in any Sahelian country would have to be carefully calculated to take into account locational differences and changes in construction, equipment and input costs.

Pattinson estimated the overall construction and equipment costs for an underground silo system (silos of a horizontal, semi-cylindrical type, two-thirds underground) widely used in Argentina for wheat storage, and a conventional bag warehouse system. His figures are given in Table B1, accompanied by references to other cost estimates in Table B2 and comments on particular technological components which might be further investigated in given country environments by joint teams of civil engineers and economists. These aggregate costs are

TABLE B1

AGGREGATE INVESTMENT COSTS PER METRIC TON (IN CFA FRANCS PER MT) FOR SILO AND BAG WAREHOUSE

	Silo	Bag Warehouse
Construction	21,983[a]	15,560[b]
Equipment	4,859[c]	1,328[d]
Total in CFA	26,842 CFA/MT	16,888 CFA/MT
Total in $US	($107 US/MT)[e]	($68 US/MT)[e]
Total with Cost of Grain[f]	($227 US/MT)	($188 US/MT)

[a]Includes silo construction, civil works, fencing, electrical hookup, and silo elevator/control tower.

[b]Includes warehouse construction, civil works, electrical hookup.

[c]Includes conveyors, dryer/cleaners, tractor and wagons, telescopic grain elevators, control equipment.

[d]Includes pallets, scales, dollies and electric conveyors for stacking sacks based on 5m stacks and 2.5 MT/m^2.

[e]$US = 250 CFA francs exchange rate.

[f]Assumes grain purchased at 30,000 CFA/MT.

TABLE B2

OTHER COST ESTIMATES

Source	Country	Type of System	Cost/MT
		Silo Storage	
Haik [1976]	Mali	Above ground metal silos with loading elevators	$240/MT
Lopez [1971]	Mauritania	Argentine underground silos (costs adjusted for inflation)	$82/MT
Pattinson [1975]	Niger	a. SOTRAMIL above ground metal silo with full bulk loading equipment	$227/MT
		b. "Cyprus silo" used in Kenya for emergency stocks, costed for Niger	$40/MT
		Bag Warehouse Storage	
Auffret [1974]	Chad	Size of warehouse:	
		400 MT	$91/MT
		600 MT	$86/MT
		1,000 MT	$81/MY
Creupelandt [1974]	Chad	Working average	$96/MT
Haik [1976]	Mali Ivory Coast	Traditional bag warehouse	$60/MT
IBRD [1975]	Sahel	Working average	$110/MT
Maxon [1976]	Chad	Proposed new warehouse construction	
		1,000 MT	$140/MT
		250 MT	$192/MT
Pattinson [1975]	Niger	AID financed bag warehouses (1974)	$48/MT

followed by a detailed, "annotated" breakdown of annual storage costs as estimated by Pattinson, again with references made to alternative estimates and particular technological assumptions which need further study.

Technological Components

There are a large number of possible technologies for both bulk and warehouse storage. These technologies involve differences in the size and spatial configuration of the structure, in construction techniques and materials which can be used, and in mechanical and other operating components to be employed with the structure. In addition to the operating costs of each structure (explored below) as it functions within an entire grain storage system, comparison among alternative systems should take account construction costs, the durability of the structures and associated machinery, and physical performance criteria such as capability to insulate grain from heat, moisture and attack by insects and rodents.

Reflecting a wider range of technological alternatives, there is greater variation in cost among alternative bulk silo systems than there is among alternative bag warehouse systems. (This is true even without taking into account the wide variety of small-scale--up to 10 MT or so--bulk storage techniques employed at the farm or village level). The "Cyprus Silo" technology represents the cheap end of the bulk silo investment continuum for units holding up to 1,500 MT. Above ground masonry or metal silo systems with fixed elevator structures are representative of the other end of the continuum of technologies with respect to initial investment cost. The "Argentine Silo" system

proposed by Pattinson and Lopez appears to be an intermediate system in terms of construction cost and technological complexity.

Conventional bag warehouses capable of holding at least 1,000 MT appear to involve a minimum investment expenditure of $70 to $100 per MT ($190 to $220 including grain purchase costs) at 1976 price levels for the structure and equipment. Pattinson proposes the use of electric conveyors to stock grain sacks in 5 meter piles. While accounting for only 1/5 to 1/4 of the initial equipment investment, this element deserves further study, particularly concerning costs of maintenance, repair and the operational consequences of conveyor breakdown.

Annual Operating Expenses

For both systems the following annual cost categories are included by Pattinson and summarized in Table B4:

1. Amoritzation of capital is calculated on the basis of a loan at 3 percent interest repayable in equal annual installments over 40 years for storage structures and 10 years for equipment. These costs could be eliminated, of course, if the capital were provided on a grant basis.
2. Depreciation costs are based on the following life expectancies: silos--structures and grounds, 40 years; control tower, 25 years; electrical system and fencing, 10 years; grain handling equipment, 10 years; weigh bridges, 7 years; tractors and trailors, 4 years and warehouses--structures and surroundings, 40 years; pallets, dollies and conveyors, 7 years; scales, 5 years.
3. Interest on capital held in stored grain is calculated at 8 percent of the purchase price including transport to the storage site.

4. Management is calculated for the storage center personnel only, and total personnel for 42,000 MT vary substantially between the two systems (see Table B3).
5. Maintenance in both systems is calculated at 2 percent of capital cost per year for structures and 5 percent for equipment.
6. Handling is calculated as the cost of temporary workmen loading and unloading sacked grain either to the silo bulk handling equipment or into and out of warehouses. For the silo system, if a three-year rotation is used, 28,000 MT must be handled each year at 100 CFA/MT and 14,000 MT must be sacked, also at 100 CFA/MT. In the warehouse system a two year rotation with 10 percent resacking every year is assumed using the same costs.
7. Energy costs consist of electricity (at 30 CFA/kw) and gas-oil (70 CFA/liter) for the silo system and electricity costs alone for the warehouse system.
8. Losses are estimated to be 0.1 percent per year for the silo system and 1 percent per year for the warehouse system.
9. Sacking costs for warehouse storage include the opportunity cost of capital invested in sacks and a replacement cost for worn sacks. Although Pattinson does not do so, it would seem legitimate to include some sacking cost for the silo system since 14,000 MT must be sacked for rotation into the commercial grain system. I, therefore, assume a cost of 85 CFA/MT for the silo system.
10. Pest control is necessary for grain in bag warehouses and the costs include chemical (e.g., phostoxin), amortization of fumigation tarpaulins and labor. It is assumed that this is not

TABLE B3

ALTERNATIVE PERSONNEL COSTS

Type of Personnel	Storage System Employed		
	Silo	Warehouse I[a]	Warehouse II[a]
Warehousemen	4	28	8
Mechanics	4	--	--
Weighers	4	--	4
Laborers	8	56	32
Drivers	4	--	--
Watchmen	4	28	8
Total personnel	28	112	52

[a]Warehouse I represents Pattinson's estimates based on one warehouseman, two laborers and one watchman per 1,500 MT. Using four storage centers, Warehouse II represents this author's estimates of alternative annual man-year labor equivalents. These are reflected in costs below.

necessary for silo storage since insects are controlled through asphixiation. The costs for this item appear high to this author.

TABLE B4

SUMMARY OF TOTAL ANNUALIZED STORAGE COSTS (IN CFA/MT)

Item	Silo	Warehouse
1. Amoritzation		
Structures	952	674
Equipment	569	156
Sub-Total	(1,521)	(830)
2. Depreciation		
Structures	514	389
Control Tower	25	—
Electric, Fencing	80	—
Grain Handling	595	180
Scales	263	14
Tractors, Trailors	41	—
Sub-Total	(1,518)	(583)
3. Interest	2,400	2,400
4. Management	165	456
(Warehouse II)[a]	—	(298)
5. Maintenance	683	378
6. Handling	100	110
7. Energy	86	2
8. Losses	30	300
9. Sacking	($85)[b]	260
10. Pest Control	0	375
Total CFA	6,588 CFA/MT	5,694 CFA/MT[c]
Total $US	($26.35/MT)	($22.77/MT)
Alternatives		
CFA	(6,673 CFA/MT)	(5,536 CFA/MT)
$US	($26.69/MT)	($22.14/MT)

[a]Calculated by author.

[b]Calculated by author.

[c]Very close to estimate of 5,800 CFA/MT total annual cost for inter-annual storage derived by Haik, et al. [1976] for bag warehouses in Mali. His estimates of 9,100 CFA/MT for silo storage is much higher but is for a noncompatible technology.

TABLE B5

ANNUAL STORAGE COSTS LESS AMORTIZATION AND INTEREST[a]

	Silo	Warehouse	IBRD
CFA	2,667	2,464	4,150
$US	10.67	9.86	16.60

[a]If items 1 and 3 in Table B4 are removed from the annual costs above, then the resulting totals are relatively low compared to a similar World Bank estimate (IBRD [1975, p. 23]) for annual warehouse costs.

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