DECISION MAKING PROCESS OF AFRICAN FARMERS: A THEORETICAL APPROACH

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The undersigned, appointed by the Dean of the Graduate Faculty, have examined a thesis entitled

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and hereby certify that in their opinion it is worthy of acceptance.

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Chapter 1

INTRODUCTION

THE PROBLEM

In a paper published in 1968, William A. Niskanen stated that:

> "Economics does not now provide a theory of a maximizing bureaucrat. The currently dominant approach to public administration is to provide the organizational structure, information system and analysis to bureaucrats who, for whatever reason, want to be efficient".[1]

This remark became even more pertinent when a theoretically paradoxical situation of high inflation and unemployment crippled the American economy. Both neo-Keynesians and neo-classists found themselves incapable of formulating a comprehensive theoretical apparatus to guide the American President's policies. Nixon engaged himself in a gambling scheme of phases.[2]

At first, it seemed like politicians were to blame.

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[1] William A. Niskanen, "Non-market Decision Making: The Peculiar Economics of Bureaucracy," American Economic Review, LVIII, No. 2 (May, 1968), p. 293.

[2] Up to date, the American economy has had Phase I, Phase II, Phase III, Phase III 1/2, and Phase IV. All indications point to the fact that Phase 100 is simply a matter of time.

Economists pretended that it was the non-economic logic of the political decisions that accounted for their failure. However, by the time Phase III was underway, the truth became more and more apparent:

> "Basically, the failure was not one of the politicians, but of ideas. To the question of how to maintain full employment and price stability, no school of economists had any viable answer. ... the present system is unworkable; it is without a conceptual base and without coherent and accepted values in reference to which essential judgments can be made".[3]

In this author's opinion, the axiom of this paradoxical situation is simple: the economic theory is not intertemporally valid. That is to say, ideas and concepts from Adam Smith and Keynes are relatively of little use in contemporary economic situations. The trouble with economists stems from their failure to recognize this axiomatic truth. This failure is essentially due to the existence of a cast of conservative theorists who define, mold, and censor all economic concepts:

> "But in place of old censorship has come a new despotism. That consists in defining scientific excellence as whatever is closest in belief and method to the scholarly tendency of the people who are already there. This is a pervasive and oppressive thing not the less dangerous for being, in the frequent case, both self-righteous and

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[3]Robert A. Solo, "Organizational Structure, Technological Advance, and the New Tasks of Government," Journal of Economic Issues, IV, No. 4 (December, 1972), pp. 131-32.

unconscious".[4]

A second axiom, which is even more perplexing and motivated this study, is that the inter-spacial validity of economic theory is almost zero. Hence, the use of the existing theoretical apparatus to cast judgments about other societies around the world is entirely pretentious.

For instance, Development Economics was born out of the frustrations of the "World War II" and its aftermath on the relationship of domination existing between Western Europe and the rest of the world. Also, it developed as a child of the resulting Cold War between East and West. The issue of who would control the world was evidently at stake. For example, in his stages of economic growth, Rostow states:

> "Essentially we in the non-communist world ... must demonstrate that the underdeveloped nations--now the main focus of Communist hopes--can move successfully through the preconditions into a well established take-off within the orbit of the democratic world, resisting the blandishments and temptations of Communism. That is, I believe, the most important single item on the Western agenda".[5]

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[4]Kenneth J. Galbraith, "Power and the Useful Economists," American Economic Review, LXIII, No. 1 (March, 1972), p. 2.

[5]W. W. Rostow, The Stages of Economic Growth (2d ed.; Cambridge, Mass.: Cambridge University Press, 1971), p. 134.

Subsequently, Rostow states this agenda in the following terms:

> "If we and our children are to live in a setting where something like the democratic creed is the basis of organization for most societies, including our own, the problems of the transition from traditional to modern status in Asia, the Middle East, and Africa the problems posed by the creation of the preconditions and the take-off--must be solved by means which leave open the possibility of such a humane, balanced evolution".[6] [underlined by us]

This ideological and cultural agenda was supported by an economic theorizing which, mutatis mutandis, claimed universality. Hence, from ideological and cultural agenda (and mostly because of it) other societies of the world were termed non-economic societies. Non-economicity and underdevelopment became respectively cause and effect. To reach the last one has to rid oneself of the former:

> "A country's economic growth may be defined as a long-term rise in capacity to supply increasingly diverse economic goods to its population, this growing capacity based on advancing technology and the institutional and ideological adjustments that it demands. All three components of the definition are important."[7]

Subsequently, Kuznets will contend that only a certain portion of the world is capable and hence has the appropriate culture of fulfilling all three requirements of

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[6] Ibid, p. 165. The democratic creed is here equated to "humane, balanced evolution". It is opposed to any other cultural values which, by implication, are "inhumane" and unbalanced.

[7] Simon Kuznets, "Modern Economic Growth: Findings and Reflections," American Economic Review, XLIII, No. 3 (June, 1973), p. 247.

economic growth:

> "These countries, so classified because they have managed to take advantage of the potential of modern technology, include most of Europe, and Japan--barely one quarter of world population".[8]

It is extremely difficult to substantiate the causation process in economic growth. Are technological innovations cause or effect of ideological and institutional innovations? Is there any theory of technology which presents factors determining its origin? To what extent did modern technology originate in Western Europe? These are questions which have not been investigated.[9]

This ideological and cultural foundation of development economics (and economic theory in general) has given rise to frustrations and disappointment in countries which have attempted to mold their social and economic organizations on the Western model. Many development programs and planning have been a complete failure. As for the failure of the Phase gamble, this one also is due to the arrogance of a cast of economists who pretend that their formulations are universally valid. This failure, if anything, points to the uselessness of

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[8] Ibid., p. 248.

[9] It is true that by instituting a system of licenses, patents, etc. Western countries have registered many inventions as originating from within their boundaries. However, most inventions find their origin in Eastern cultures, as well as, African culture. For instance, government organization and structures originated in Egypt when it was completely ruled by Africans.

such arrogance.

> "No arrangement for the perpetuation of thought is secure if that thought does not make contact with the problems that it is presumed to solve".[10]

From an African viewpoint, the problem this ideological and cultural agenda of economic development poses is this: how can one objectively disassociate oneself from those preconceived ideas and study a different society in such a way that its development strategy logically can be derived from within rather than from without? If this question is relevant, then the failure of development programs is not attributable to some imaginary social or institutional obstacles. Rather, it is attributable to a lack of concepts (independent of those developed in Western culture) that can render a given social organization logically consistent, and, from which a logical set of development strategies (consistent with the conceptualization of the society) can be derived. This, unlike the Rostow agenda, is the number one challenge to the economists of the so-called underdeveloped world, especially of the African economists.

It is hard to conceptualize and believe that the African continent is incapable of producing concepts and ideas which can be subjected to logical analysis and empirical verification, and on which development programs can be based. We have set out to attempt this concep-

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[10] Galbraith, loc. cit.

tualization in the work that follows.

THE OBJECTIVES AND LIMITATIONS

The objective of this dissertation is to derive an economic decision rule from the given set of underlying concepts of social organization of African societies. The small cultivator is used as an example to illustrate the rule.

Like any other theoretical construction, this dissertation uses an idealized cultivator and an idealized community. It is true that some of Africa's cultivators may not fit this construction. However, these are exceptions which do not invalidate the essential patterns to be reckoned with.

A communal decision rule, based on an extended family system is derived. This rule, as any other, is entirely subjective. From this communal framework is constructed a system of production, consumption and exchange. Under some reasonable assumptions, this system does satisfy the Pareto criteria.

A speculative scheme of development policy implications which is consistent with the derived system is then developed.

This study is limited in three respects: first it deals only with cultivators who are called "traditional". Second, it does not provide a broad range of empirical test simply because no data have been collected to achieve

this purpose. Finally, the study is highly theoretical, even though personal experience and intuition have made it possible to draw some empirical implications.

METHODOLOGY

In a scientific analysis of societies, at least two approaches are admissible: the propositional or axiomatic approach, and, the causal approach. The first consists of at least four steps: (1) construction of a completely closed deductive theoretical system, (2) choice of minimal set of propositions as axioms, (3) deduction of other propositions from those axioms by purely mathematical or logical reasoning, and (4) generation of testable hypotheses.

The second approach, on the other hand, follows at least three steps: (1) collect some observed data as produced by a certain underlying mechanism (2) organize these data in a systematic model, and (3) derive an empirical measure of relationship as a set of theoretical propositions corresponding to the observed facts or measures so that the underlying mechanism can be easily determined.

In the context of a wide range of data availability, a great probability exists for the two approaches to converge. One can be used to verify the other. It turns out however, that, even in this case, the second approach does not explain how the underlying mechanisms generate the

measurement process itself.[11] Secondly, this approach deals only with quantitative predicates. As will be seen later, the theory of choice makes it necessary to consider qualitative and comparative predicates.[12]

This study adopts the propositional approach. In Africa, quantitative attributes occupy a relatively minor place in the process of decision making. By means of this approach some testable relationships can be derived which do not rely on quantitative attributes alone.

PLAN OF THE WORK

Aside from this introductory chapter, the work has seven other chapters. In Chapter 2, a tight review of the literature is provided. Chapter 3 gives a brief exposition of what the African continent is all about. Views of different authors and their prejudices are

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[11]For example, the effort to standardize units of measures and adopt the metric system comprises a whole syndrome of political, economic and diplomatic discussions. The use of meters does not take into account these discussions. Similarly, the production of a certain good is a process comprising interrelations between the owner of the firm, the manager, and the worker, and the use of a simple quantitative measure of this commodity does not tell us anything about these relationships.

[12]The following works reflect both of these approaches. Hubert M. Blalock, Theory Construction: From Verbal to Mathematical Formulation (Engleworth Cliffs, N. J.: Prentice Hall, 1969); Robert Dubin, Theory Building: A Practical Guide to the Construction and Testing of Theoretical Models (New York: The Free Press, 1969).

analyzed, using a concept called "freeze-in-effect".

Chapter 4 gives a conceptual framework of a system and its mechanism. Also the concept is applied to the African farming system whose characteristics are briefly given.

Chapters 5, 6, and 7 develop a theoretical scheme appropriate to the African behavioral patterns. Some selected evidence is provided on this in the last section of Chapter 7.

Finally, Chapter 8 gives some conclusions and policy recommendations which follow from the model developed in earlier chapters. The recommendations are subdivided into the Fundamental and the Piece-Meal recommendations.

Chapter 2

REVIEW OF CURRENT LITERATURE AND RESULTS

APPROACHES TO AFRICAN "FARM SYSTEMS"

The concept of farm management as well as the functions of the farm manager are neither unequivocally defined nor unanimously agreed upon in contemporary literature. For some economists such as Castle and Becker, farm management is concerned with the decisions that affect the profitability of the farm business.[1] For others, it is a problem-solving approach through budgeting and dynamic marginal analysis.[2] In more recent works, it is generally conceived as the force within the firm (business firm) that directs resource use after interpreting the wants, needs, and desires of those owning

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[1]Emery N. Castle and Manning H. Becker, Farm Business Management (New York: MacMillan, 1967).

[2]Lawrence A. Bradford and Glenn L. Johnson, Farm Management Analysis (New York: John Wiley and Sons, 1953).

or controlling the production resources.[3] These different approaches can be respectively termed "normative" and "positive". The former analyzes farm management with deterministic models while the latter analyzes it as it really is. As will be shown in this study, a systems approach to farm management is capable of comprehensively covering both of these conceptions. To the extent that it can be distinguished into categories, literature on African farm management can be divided into three groups: studies primarily concerned with a description of the agricultural economy, as well as individual holdings using ex-post analytical models; studies concentrating on gathering data for use in forward planning, using ex-ante analytical models; and studies which concentrate on single enterprises (farm) and attempts at labor measurement.[4]

However, these studies have some common characteristics which deserve attention. First, they are essentially normative in the sense that African farmers

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[3]This approach can be found in the work by E. T. Shandys and Truman Nodland, "Biography and Performance", The Management Factor in Farming (Agricultural Experiment Station NC-59 North Central Regional Research Publication 184, 1969), pp. 17-24.

[4]Malcolm Hall, "A Review of Farm Management Research in East Africa", Agricultural Economics Bulletin for Africa, E/CN. 14/AGREB/12, Addis Ababa, F.A.O. (June, 1970), pp. 11-24.

and systems are analyzed with techniques, models, and objectives which they neither identify with nor recognize. Second, these studies conceive African farms as simple and single economic units while in reality they are complete and integrated "systems". Third, almost all of these studies are concerned with highly selected units which are in the cross-road between traditional systems and commercial units.[5] This selection is dictated by data availability as well as special functions accomplished on these farms rather than the relative importance of the selected farms in explaining African farms and their behavior.

Due to the above characteristics, there has not emerged a comprehensive, integrated, and rigorous analysis of the small farms decision-making based on their own conceptualization of the economic and social world, much less that of their functioning mechanism. This is evidenced in the next section where farmers' problems are presented by different authors as isolated issues.

PROBLEMS OF SMALL FARM MANAGEMENT

Farm management problems are uncountable in number.

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[5]Most of farms analyzed were selected by F.A.O. Addis Ababa planning authority and charged with the production of cash crops (coffee, tea, tobacco, etc.). In some cases, the so-called non-cash crops were being simultaneously harvested as "insurance against famine". This system thereby establishes a "managed" duality in the same unit, and by essence recognizes the absence of a feedback relation between the two contiguous systems.

They vary with time, space and the types of decisions with which the manager is concerned. Most essentially, they also depend on the kind of economic system in which he operates.[6]

For analytical simplicity, these various problems can be reduced to five subjects.[7]

1. Changes in prices or lack of information concerning existing prices.

2. Lack of information concerning existing production methods.

3. Changes in production methods.

4. Changes in personalities and lack of information concerning personality.

5. Changes in economic, political, and social institutions and lack of information concerning the existing institutions.

A more condensed classification reduces the above problems to three main categories:

1. Problems of input acquisition.

2. Problems relative to inputs and activity combinations.

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[6]Later the concept of economic systems will be approached by way of its attributes, measurements, and decisions will be conceived as a choice over attributes and/or their values. In this context, production will be conceived as a consumption of attributes in the creation of other attributes. (see Chapter 6)

[7]L. A. Bradford and G. L. Johnson, op. cit.

3. Problems relative to the selling of farm products.[8]

One should keep in mind that these various problems confront the farmer in his activities and decision-making which optimize a certain objective function, say profit. A primary methodological problem which confronts us in comparative farm management studies relates to how two or more farming systems, operating on different valuation procedures and attribute systems can be assessed with a common measurement? Or, does such a measurement exist at all? This issue has been neglected perhaps due to the fact that the theory of measurement is relatively new and has not penetrated economic and farm management analysis.

More specifically, for both methodological and operational considerations, it would seem questionable that small-sized, African non-commercial farmers can be analyzed and their problems identified by means of concepts, methods, and techniques used in large, western commercial farms!

Assuming this issue away or simply ignoring it, many authors have identified various problems in farm management. We only report the most important of them.

Problems of Input Acquisition and Quality

Most important problems faced by farmers within

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[8]This classification was suggested to me by Dr. Albert Hagan during our discussions on this subject.

the African context relate to land and labor inputs. The role of capital in many instances is not very important and increases in output have occurred in many African areas even though the level of money investment has been very low. In some cases, money investment has been significantly increased with almost no increase in per capita output.[9]

Land is a public good and, in most cases, it does not constitute a limiting factor. As Jameson has shown, plenty of land is available in the unoccupied areas because actual cultivation covers only about 18 percent of the land assumed available for agriculture.[10] However, there are exceptions in settled areas such as Rhodesia and some East-African countries where immigrants have occupied most of the available land. This last case is illustrated in Appendix 1. In general, and as a working hypothesis, one can state that land is not quantitatively a substantial problem, even though some land tenure institutions may pose an obstacle from the viewpoint of comparative land tenure systems.[11] However, the acreage of cultivated

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[9] Montagne Yudelman, Africans on the Land (Cambridge: Harvard University Press, 1964).

[10] T. D. Jameson, Agriculture in Uganda (London: Oxford University Press, 1970).

[11] African land tenure systems constitute a relative obstacle and not an absolute one, i.e., it becomes irrational if assessed from and with an outside systems analysis method. In this respect, the assessment can only be normative.

land remains very small, explaining the limiting effect of labor input.[12]

In some instances, it was suggested that the use of fertilizer and/or tractors was a management problem faced by small farm managers. However, available evidence has shown that use of these inputs on the land failed to increase productivity to a meaningful magnitude. Even if these inputs were proved economical, most small farm managers do not have cash incomes that permit them to save and accumulate enough to purchase them. Nor do they have much in the way of collateral to offer as security for loans from commercial sources. In some cases, where funds have been accumulated through some type of traditional cooperatives, no real incentive mechanisms are generated for the purchasing of these inputs.

Labor is the most important and most limiting factor in small farm management both quantitatively as well as qualitatively. Our understanding of the quantitative aspect of labor limitation does not deal with the demographic approach to rural population. Rather, we are concerned with the quantity of labor energy that a farm manager can allocate of that same input. As will become clear in the course of the study, farm management in our sense, is equivalent to "systems management" such that farm activities are but a subset of the total decision or

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[12] For instance, in the Republic of Zaire only 1.5% of the cultivatable land is actually under cultivation.

choice set from which the manager chooses.[13]

The quality of labor input is a function of both formation and information of the manager. Small farm managers possess relatively good technical education and information in a closed system. However, "qualitative measurement" supercedes "quantitative measurement" such and so much that, it becomes relatively difficult to store, substantiate, analyze, and improve systems information and the educational network of African village economies.

Another problem with labor quality is apparent in open, small farm systems. Not only is the flow of information outside the farm system difficult to monitor, but also the information-exchange process is very inefficient. This difficulty is increased when the two systems make use of different indexes in information characterization and in decision-making processes. For example, a small farmer uses a non-price index to value the production decision on his farm. A small shoe manufacturer uses price index to value his decision. If there is no common index between the small farmer and manufacturer, not only is it impossible to exchange information, but it becomes operationally impossible to compare the decision making process in these two systems. Analysts have neglected this issue and it has no place in the current farm management litera-

[13] In Chapter 6, energy allocation by crops will be used to illustrate the decision making process by African farmers. In that chapter the system approach is also defined.

ture.

A third problem in the limitation of labor quality in small farm management is the absence of a feed-back "sub-system" between small farmers and the rest of the economy. For analytical simplicity, the above concept is sometimes called "isolation", while some operationally-oriented development economists have called it "dualism". However, these studies, unlike ours, do not systematically integrate their concepts into a systems analysis and measurement framework necessary to the understanding of the small farm management context. It is not clear how "isolation" and/or "dualism" affect decision-making of the small farmer and what limitations they impose upon his ability to decide.[14]

One famous instance where the lack of a proper information network and feed-back subsystem led to a wrong assessment of the small farmer decision is illustrated here. It is commonly found in Africa that a small farmer does not accumulate enough crop seeds to be used in the next planting season. Instead, he sells all his crops at very low prices only to buy them at a very high price three or four months later. At first glance, such a decision sounds irrational and has been used as evidence against African small farmers' ability to

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[14]It will be shown in Chapter 6 that the gap between wants (desired attributes) and production (created attributes) is the main source of lethargy of small farmers.

rationalize. However, this conclusion ignores completely the cost of crop storage to the small farmer, which if taken into consideration proves that such a decision is perfectly rational from the small farmers' standpoint.

The feed-back mechanism becomes much more crucial in the area of education of the small farmer. It seems to be the consensus among writers on African farming systems that an African farmer cannot be effectively educated without physically removing him from his environment.[15] At the same time, the criterion for selection of small farmers to be removed and settled is based on the level of education already attained and this pre-existing education is used to explain the management ability as in Appendix 2 of this study. If Appendix B conveys any information at all, it is essentially equivocal. Assessment of that system will depend on what "measurement" the researcher chooses to consider as indicative of the role of education in increasing the well-being of the small, physically removed farm manager.

If return to family labor indicates the system's performance in terms of manager's well-being, education has very little effect. More education tends, at best, not to be positively associated with higher labor returns.

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[15] E. S. Clayton, Economic Planning in Peasant Agriculture (Uganda: Wye College, 1963).

This can very well signal a higher efficiency for non-formally educated farmers compared to more educated ones. We note that all these assessments remain conjectural in nature and are provided here to illustrate some difficulties in systems analysis. Furthermore, since there are no comparative signals on both ex-ante and ex-post removal, no evidence can be and has ever been provided to substantiate the physical removal policy from the farm manager's standpoint. However, use of force and other coercive measures may suggest that a preference for "on-the-spot-education-systems" rather than "settlement-systems" of the small farm manager's interest is pursued by such policies.[16]

The implications of such a system is that it completely disregards small farm systems valuation axioms as well as its dynamic potentials. Both the diversion effect and output-confinement effect may not be compensated for by the cyclical labor migration benefits stressed

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[16]It appears that settlement policies are used as a means whereby "cash crops" can be adopted. This approach seems to neglect the market potential for the so-called "non-cash crops" which constitute the bulk of the small farmers' production. By doing so, a suppressive mechanism is introduced by both labor diversion and product confinement. The first indicates an allocation of labor "out-of-system" activities while the second limits the output of the system to a minimum level called "famine level" by Clayton. Within the terminology of this dissertation, physical removal is equivalent to the interruption, in the functioning of the system, of the relationship between desired attributes and produced attributes.

in Gulliver.[17]

Problem of Input and Activity Combinations

Strictly speaking, the types of problems a farm manager confronts in his day-to-day decisions with respect to input and activity combinations are of two categories:

1. Physical or natural problems.
2. Environmental or man-made problems.

Physical problems deal with such factors as hardware, equipment, machinery, or more precisely all natural and real factors or artifacts. In particular, a natural or physical problem exists if it grows out of natural processes. Climatic and terrain conditions are typical natural problems with which the farmer must deal. In reality, however, these physical attributes are often given some kind of social characterization.

Environmental or man-made problems are those in which man has made, or is making, a contribution to the ongoing state through the system's objects, attributes, or relationships. For instance Debreu has defined the state of an economy E an an (m + n) -tuple of points of R for each non-empty and completely pre-ordered subset

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[17] P. H. Gulliver, "Labour Migration in a Rural Economy", Readings in the Applied Economics of Africa: Volume I (New York: The University Press, 1964), pp. 58-66.

$X_2 \in R$ (i=1,...,m) and each non-empty set $Y_j \in R$ (j=1,...,n) where X and Y are respectively consumption and production sets, and R is a Euclidean Space.[18] Two aspects of the foregoing definition are significant. First, both X and Y are physical quantities (Physical Predicates). In this respect a small manager of the African type, as well as the large manager of the western type, face equivalent problems in the following sense:

$$\text{if } E_a \in P \rightarrow X_a \in X,\ Y_a \in Y$$

$$\text{and } E_w \in P \rightarrow X_w \in X,\ Y_w \in Y$$

where P is non-empty, and subscripts designate respectively African and American states.

From the above definition, it is not necessarily on an a-priori basis to attribute special problems to these farmers based on physical considerations.[19] This is so because physical states deal with basic physical laws such as the Newtonian law of gravity, the law of conservation of mass, the law of conservation of energy, the law of conservation of momentum, the different laws of thermodynamics, etc. The similarities of physical states is the keystone assumption in the pure theory of production as well as International Trade. In this sense

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[18] Gerard Debreu, Theory of Value, Cowles Foundation Monograph 17 (New Haven: Yale University Press, 1959).

[19] In Chapter 3, it will be shown that physical characterization of Africa is full of preconceived value judgments that have little scientific content.

comparative managerial productivities have an unambiguous meaning.

The second aspect of Debreu's definition comes into play when both X and Y are converted into a decision or man-made state. A problem in a man-made state emerges if, due to his action and/or inaction, physical laws supersede man's state-creating choice and will. Or more rigorously, if $[x^*, y^*] > [x, y]$ and only the subset $[x, y]$ is attained. The system E has a problem.

Note that to discover a problem, we have introduced the sign >. As will be shown in Chapters 4 and 5, this sign has introduced a preference relation possibility or procedure in purely physical states. The valuation of this preference relation is the source of very significant importance in systems analysis and most immediately in management decision making, where man-made decisions affect the system's performance.

For instance, it is suggested that the basic objective of the farm manager is to combine inputs in such proportions that for a given "measurement" (price) the Cartesian Product of the sets L and Y is maximized, i.e., $\prod_{i=1}^{L} Y_i$ is a maximum. Where L is a price measurement and Y_i is output, L_i, $Y_i \in R$.[20]

The basic problem of a small farm manager in Africa

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[20]This is the idea conveyed by Castle and Becker, op. cit., as well as Bradford and Johnson, op. cit.

is the lack of a systematic, unique and quantitative measurement set. To this manager, the problem of valuation of a subset of X and/or Y is essentially unrevealed and basically qualitative. Most analysts have assessed African farm management problems using the Price Measurement. This procedure, even though scientifically sound, remains questionable and sometimes has no operational meaning if the evaluation system is predominantly qualitative or makes use of non-price measurements.

The second problem facing the African farm manager is the "unadaptivity" of the African systems. This concept is a little similar to that of input immobility or discontinuity in production technology. It cannot be confused with what Pedraza has emotionally termed "unborn conservatism" as this last word has no analytical content. In the systems analysis to be utilized in this study, a system is unadaptive if the proportion of natural or physical factors is to such an extent greater than the proportion of man-made factors that its rate of readjustment to a new environmental input is very low. The freeze-in-effect developed in Chapter 3 explains most of the inadaptivity of African farming systems.

For instance, a small farm manager with a little education is combining his physical effort (non-intellectual input or man-made input), physical land (the quality of land depends strictly on natural conditions), crop seeds (produced strictly naturally). His

transportation from the farm to his home is by walking (physical) and the road he is walking on was made by himself (physical labor), etc. The rate of readaptation of such a farm system will be very low regardless of whether or not the manager is conservative, and whether or not inputs and/or technology are completely mobile and infinitely divisible.

The above "inadaptivity problem" covers both "output-inadaptivity" and "input-inadaptivity", as well as, valuation-inadaptivity. This last inadaptivity is referred to in current literature as "inability" of African systems and their managers to respond to some kinds of "incentives". With regard to this last point, Yudelman has contended that many African producers or farm managers prefer to leave resources unemployed rather than to increase their labor inputs, because their marginal costs of producing for the market, in terms of foregone leisure appear to rise so sharply after their immediate needs are satisfied that they voluntarily restrict their inputs of effort.[21]

Note that what is called "voluntary unemployment" is completely a different concept even though it apparently attempts to convey the same message. Essentially, the valuation or decision set in Yudelman's model contains only two elements: production for markets and leisure.

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[21]Yudelman, op. cit.

This naive conceptualization is not objectively substantiated and hence is conjectural. Our "valuation-inadaptivity" concept, as that of "technological inadaptivity", is institution-free and is empirically verifiable. It simply means that natural factors weigh heavier in valuation processes than man-made factors. This concept will become clearer as we analyze output selling issues.

The last and sometimes very important problem of farm management is the effect of public policies in input-combination decisions. Many policy decisions made in Africa are unconsequential in nature: they either attempt abrupt right changes or simply seek wrong changes. In most cases, these measures are based on both physical and man-made conditions prevailing in more developed countries and/or in the so-called "commercialized" portion of the African farming systems. Note that monetary policies affect these small farmers only to a very limited extent because of the non-market characteristics of the decision-making process.

Concerning activity combination decisions of the small farmers, to the best of this author's knowledge, no material is available in the current literature. Clayton makes use of linear programming techniques in a strictly different context: planning the introduction of "cash crops" with minimum or "famine crops".[22]

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[22]Clayton, op. cit.

Also he uses the same techniques to compute crop seasonal alternatives. This is decision making from the Planning Office. It is more concerned with the process of commercialization rather than the understanding of the decision-making on the small farm by the small farmer.

Sometimes cost allocation per crop is utilized as an ex-post rather than ex-ante decision variable. This practice is similar to that used to differentiate labor requirements, family labor, and casual labor, as well as to estimate (roughly) some impact of alternative measures (reorganization, introduction of fertilizers...). This lack of adequate techniques is only partially due to the "measurement problem" mentioned above. It is to be essentially attributed to the fact that the existing literature on farm management has not incorporated in its box of analytical tools the allocation-control techniques recently introduced in industrial systems management.[23] In the next section, some problems of concern to the farmer with regard to the selling of his product will be reviewed.

Problems of Product Sales and Marketing

This is one of the most difficult areas for objective analysis. In elementary analysis, it is easy to

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[23]The use of this technique has been recently introduced in Industrial Management.

assume that a rational manager should react to market forces in a manner that maximizes his profit.

Recent research works have brought some new issues to the attention of researchers in the area of farm management.[24] Managerial behavior is the resultant of action and reaction to a complexity of internal conditions (values, goals, motivation, drive, desires, capabilities, performance, attitudes, biography) and external conditions (the dictates of markets, technology change, relations with other agents, weather, and governmental and other organizations). Put in more operational terms, management is a problem solving effort which has to be understood at two different levels of efforts: the problem-solving process itself, and the result of that process.

The analysis of the manager's efficiency by means of market signals (prices, income, profit, etc.) deals with the results (level 2) rather than the process itself (level 1). If these results are used to deduce some behavioral conclusions about the farmer's characteristics, the analysis becomes highly normative and, in most cases, these conclusions reflect the researcher's subjective values.

This subjective analysis characterizes many studies

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[24]Harvey P. Harrington, "Measuring the Managerial Ability of Farmers" (unpublished M.A. Thesis, University of Missouri-Columbia, 1964).

made by western economists on non-western societies as is evidenced by the theory of "Cultural Dualism". This theory is used by Yudelman to demonstrate that the African farm manager is not an "economic man" as the following quotes indicate:

> "He [economic man] is generally motivated by the economic principles embodied in the capitalistic system. He tends to have identifiable growing wants that are beyond his means, and his economic activity is concerned with satisfying as many of these wants as possible. He is concerned with raising his income and to do this he usually sells his labor or products in the market that gives him the highest net return. By the large, economic man tends to be rational about both ends and means, and frequently postpones immediate consumption so as to save and invest in productive goods that will give him a larger profit in the future".[25]

On the other hand,

> "Traditional man has minimal subsistence goals, and low production targets in terms of physical output. Once there was an adequate food supply it became a matter of indifference to him whether output was increased or not, though it seems fair to assume that it was a matter of some concern if increased output could only be "bought" at a price of increased economic activity".[26]

The theory is used to imply that:

> "Many producers [Africans] prefer to leave resources unemployed rather than to increase their labor inputs. Their marginal costs of producing for the market, in terms of foregone leisure, appear to rise so sharply after their immediate needs are satisfied that they voluntarily restrict their inputs of effort".[27]

This behavioral pattern produces what the author calls "cut-off" or "kinked supply curve". The statistical

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[25] Yudelman, op. cit. [26] Ibid., p. 96.

[27] Ibid., p. 174.

evidence is provided by using a linear regression model relating sales to prices, production to prices and finally sales to both prices and output. (See Appendix 3).

The above opinions reflect a certain state of mind rather than scientific ability on the part of the researchers. A tendency toward a generalization of elementary and ill-digested price theory to non-market economies (in the western sense) is characteristic of intellectual laziness. It seems that many analysts turn to "underdeveloped" societies to achieve, almost without effort, the professional or scientific recognition they are unable to accomplish in competitive conditions of their own economies. However, their doubtful intellectual quality has resulted in research work of questionable standard which makes claims to generality.

By their nature, these studies tend to neglect the most intractable technical issues underlying producer efficiency, consumer efficiency, trade efficiency, and the interrelationship among these concepts. In more advanced treatises, conditions under which the relationship between these isolated efficiencies give rise to a unique efficiency are very rare and above all remain theoretical.[28]

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[28]Among other conditions, producer efficiency requires that production be inter-industry and factor connected, and a positive price vector. Consumer efficiency requires that preferences be regular and interconnected. Trade efficiency requires all the above simultaneously plus appropriated topological properties on the trade set itself.

Furthermore, there seems to be confusion between markets and exchange: between market response and strategy. Also, confusion prevails between preference and utility. In more elaborated research, no empirical evidence to more elementary assertions of the kind referred to above is available. This remains true also of research in farm management as mentioned above.

"Economic man" and "rational market response" are nothing but idealized theoretical constructions and cannot be used indiscriminately to draw conclusions about societies of which the researcher has no personal knowledge regarding motivations, history, biography, etc.

Small farm managers do exchange and may be maximizing a certain preference function. The set over which such a preference is defined does not have to be a profit set in order for their decisions to be rational. The measurement used in evaluating these decisions do not have to be chosen or defined over the price set for the man making those decisions to be an "economic man". Exchange does not necessarily imply markets, no more than markets are essential in determining prices.

In the case of small farm managers, markets do not give the right signals. Both the manager's labor and the products of this labor have a very low market (and in some cases zero) value. For example, some African crops which are of very high consumption in the village are not allowed to sell in city markets. Instead, aged canned food is

given a very high market price. A "rational" decision will dictate to this small manager to abandon his production and enter the trade business of reselling canned food. This sound economic decision has given rise to what has been later called "disguised unemployment" and the assertion that its absorption requires the whole economy to become capitalistic.[29]

Another example is the so-called backward sloping supply curve by African farmers in response to market prices. This argument is utilized to justify the very common characteristic of African markets for agricultural goods: price fixing. Also, it is utilized to justify high taxes imposed on small farmers. The argument goes as follows: to force the "non-economic" man to supply more effort one has to keep price down or heavily tax his income. This will prevent his income from increasing and his supply effort from falling.

The above policy adds a new dimension to the price distortions which resulted in less supply effort and decreases further that effort. Price structure in most of the African economies are such that the difference between the price of a necessity and that of a normal good is as much as one to ten. The range of necessary goods which

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[29]Arthur W. Lewis, "Economic Development with Unlimited Supplies of Labor", Manchester School of Economic and Social Studies, No. 28 (May, 1954), pp. 139-91.

a farmer, or a converted farmer (worker), can afford remains below the normal goods. This is due to his monetary income (or salary). Price fluctuations in non-agricultural goods from year to year (even month to month), stay ahead of his income so as to decrease further his attainable range.

The backward sloping supply curve or the "cut-off" point on the supply curve may reflect a very rational decision. Facilities or commodities that cannot be had in the market because of their high prices can be had in a non-market exchange. One such example is medical care which is a luxury in a market economy while almost free in the village economy. This principle can be stated as follows: as prices of agricultural goods and income are kept constant while non-agricultural commodity prices are rising, people (workers as well as small farm managers) tend to turn to agricultural activities and consumption whose evaluation is made on a different scale. To test this hypothesis, it suffices to gather information for a period of stable agricultural prices and/or wages and rising non-agricultural prices and/or wages and regress those with labor migration or agricultural activities. This kind of analysis is planned at a later date.

The above examples were given to illustrate the ambiguity of the conclusions which are drawn by means of an elementary price theory. This theory does not contain tools which can be effectively and indiscriminately used

to analyze the behavior of African small farm managers in in regard to their reaction to market incentives. When some goods produced by these managers do not possess a price in the western-like market place, it becomes difficult to assess the rationality of their consumption, production, and management decisions. This "lack" of price results in under-evaluation of the manager's effort and productivity. This in turn leads to policies that are ill-conceived and produce unsuccessful results.

The second result of an under-evaluation of the farmer's productivity is also an under-estimation of the cost of production. A good which has no price has no cost as follows from elementary theory of competitive markets. Hence, activities such as storage, processing, distribution, and transportation of these products are not valued. Teaching, psychoanalysis, small farm industries, social counseling, medicine, nursing, baby delivery, baby sitting, etc., all these activities possess no price and hence no cost in the western-like marketplace.

In general terms, a question then arises: If elementary economic theory cannot explain the allocation of resources and agents' reactions for 85% of a continent's economy, is that theory relevant to this situation? It is this question that motivated this research.

A group of economists exist who, as we have done above, reject the underlying behavioral assumptions and results of the cultural dualism school. For instance,

on the basis of certain estimates, Davidson claimed that, inter alia, the profitability of peasant small holdings was less than that of large European "land-units". He also claimed that it would seem impossible to obtain a high standard of living from peasant holdings.

In his rebuttal to the above claims, Clayton has shown that the productivity (of all resources) of planned African farming far exceeds that of the arable farming in European areas. Furthermore, as African cash crops come into bearing, the rise in farm income will be even faster. Contrary to the views of the "cultural dualism" school, Clayton seems to recognize the small farmer as an "economic" man. However, the weakness of his approach lies in the fact that it applies only to planned-cash-crop producing farms. In fact, he has maintained that the opportunity cost of a farmer in a cash crop program was close to zero. This conclusion is the same as that of the cultural-dualism school and thus is subject to the same criticism.

In an attempt to look at the problem from the point of view of the cultivator, Kennedy has arrived at more interesting conclusions which he summarizes as follows:[30]

1. An investigation of labor inputs would seem to

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[30]T. J. Kennedy, "A Study of Economic Motivation Involved in Peasant Cultivation of Cotton", East African Economic Review, X, No. 2 (December, 1963), pp. 140-48.

indicate a conflict in labor demands between cotton (cash crop) and food crops (non-cash crops). The risk factor demands that food be given precedence over cash crops. This results in the late planting (if at all) of cotton and the typically small acreage per holding.

2. Planting is generally carried out over a long period of time so that weeding becomes necessary before planting is completed. In deciding whether to continue planting or to weed, since labor is a limiting factor in many cases, the higher returns from extensive rather than intensive applications of labor are preferred, thus giving rise to a generally low standard of husbandry.

3. There is an almost complete substitution of labor for capital in peasant farming and returns to marginal increases in labor are low. This together with the remoteness in time of returns from the point of input, combine to reduce incentive to greater physical effort.

4. Traditional costings (cost/price relationship methods) can be misleading in assessing the attractiveness of one crop as compared to another unless labor is valued at its opportunity cost.

5. Traditional methods of pursuing the end of acquiring recognition within the peasant's own society do not necessarily involve the acquisition of cash.

These findings totally rebuke the "cultural dualism" apparatus. It appears clear that the African economic system has different motivations and behavior. There is

no reason to assume that these motivations and behavior are non-economic. The challenge presented to the analyst by this system is to construct a theoretical apparatus which can explain its mechanism.

The weakness of Kennedy's approach lies in the fact that it does not pose such an apparatus. It does, however, point to a more interesting area of research. This same effort recently has been attempted by Binet [1970] who, quite frankly admits:

> "Our way (western) of understanding economics is not the only one. We give a predominant value to production and consumption, but this is only one out of many possible scales of values. Other peoples will give higher importance to human relationships or to the relationship between man and his gods.
>
> Evidently, our methods are worth to us because they have gotten us to a position of power. But, we must admit the truth that their worth is only relative."[31]

However, his pretension that "a great portion of Africa lives outside an economic life" conveys the same message as the "cultural dualism" school.

The laws of economics are different and so are the conceptions, but this does not, in any case, prove that African economics (or the economic conception) is not "The Economics". These laws and conceptions can be derived from the underlying environment: physical and cultural. In the next chapter, attention is given to this environment

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[31] Jacques Binet, Psychologie Economique Africaine (Paris: Payot, 1963).

in order to better understand and later derive some decision rules from it.

Chapter 3

THE AFRICAN UNIVERSE

THE FREEZE-IN-EFFECT

The objective of this chapter is to provide the reader with some descriptive information on both physical and cultural environment under which the decision-maker operates. There is a relationship between physical characteristics (rainfall, climate, quality of land...) and the kind of crops the farmer decides to grow. Also, assumptions about economic behavior are all derived from cultural values held by the community as well as the ecosystem to which the farmer belongs.

Generally, economists agree (albeit with some value judgments), on the influence of physical conditions on the process of decision making. Certain crops can grow only in certain kinds of climate, soil, etc. Only a limited number of crops (if any) can accept "universal" conditions.[1] This general agreement, when it exists, may

[1]The term "physical conditions" includes also any changes that man may have made to his environment. Such things as the quality of soil, the rainfall, are under some type of man's control through technology.

stem from the fact that economists make use of results constructed by other "hard" or "exact" sciences such as biology and physics. For instance, Samuelson presents his book in these terms:

> "In this respect the book might hopefully be classified with A. J. Lotka's Elements of Physical Biology, which a non-biologist like me found enormously stimulating.... Thus, the parts of Newton's Principis that embalm in chaste geometry his universal law of gravitation are there to be admired."[2]

Since this "exact" science derives "universal laws" that economists admire, the tendency has been to derive economic "universal laws" which can stand the challenge of exactness. As in exact science, these laws and their logical and/or empirical inferences are essentially constructed within a given set of "definitions", "axioms" or "propositions" whose consistency is not logically refutable.

However, the trouble with economic "laws" does not rest on logical grounds. What is important is a thorough grasp of the cultural model to which the "definitions", "axioms", etc. refer. What is at stake here is not so

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[2]Paul A. Samuelson, Foundations of Economic Analysis (New York: Antheneum, 1965). Samuelson emphasizes that "... a scholar in economics who is fundamentally confused concerning the relationship of definition, tautology, logical implication, empirical hypothesis, and factual refutation may spend a lifetime shadow-boxing with reality". (p. 4) This is symptomatic of a "shadow-boxed" comfortable economist who believes that social reality is as universal as physical reality. What Samuelson ignores is that he is shadow-boxing himself with a Western culture from which his definitions, assumptions, axioms, etc. relate. This culture is not universal.

much a matter of methodology, in which many economists find refuge, but the vision or perception of the cultural universe to which this methodology is applied.

Anthropologists have made a remarkable effort to construct some cultural models around the world. They have constructed comparative theories of societies and cultures. They have constructed a theoretical and sometimes empirical institutional matrix of economic decision-making. But since the existing economic theorizing (and its cultural model) is accepted, the main lesson from their studies is limited to showing how those societies that do not follow the pattern of behavior and organization embodied in theoretical economics cannot progress.[3]

The fact that economists stick to their basic assumptions and that anthropologists do not question them has led the debates between the two "scientists" to a "cul-de-sac". The following views are symptomatic of the state of affair:

> "In making a model of a subsistence farm economy, an economist needs no anthropological help in drawing his inferences...it is therefore hard for an anthropologist to see exactly where he can contribute something that his economist colleague does not already know"[4]

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[3]Examples of such works are numerous.. Specific references are given in section 3 (The Cultural Universe)

[4]Raymond W. Firth, "Social Structure and Peasant Economy: The Influence of Social Structure Upon Peasant Economies", in Subsistance Agriculture and Economic Development, ed. Clifton R. Wharton (Chicago: Adline Publ. Co., 1965), p. 23.

With this conviction, the anthropologist reduces his contribution to empty statements such as:

> "Any economic system presupposes a social structure. But the notion of a peasant economy usually links intimately together the economic system and a particular kind of social structure"[5]

Ensured of his accomplishments and comfortable about their universality, the economist rebuffs anthropologist's work with relative ease of language:

> "... the economist has been aware and even accepts as a basic principle in economic analysis that values of the individual, the community, or the society are the criteria by which goals, ends, or objectives are selected or which determine what is done with time and energy and how conduct is organized".[6]

After such a rejection, the economist is left unchallenged on the ground of his underlying cultural model from which his economic behavioral assumptions were derived. He is in the position to make recommendations with regard to the most important factor or economic changes:

> "There is a wide spectrum of economic factors that can affect social change. I would argue that three--transport, communication, and monetization--are the most explosive for changing a society. It is these three that have the greatest impact on developing and creating new ideas--ideas which lead to modernization and "take-off" development".[7]

Here one sees how a recommendation to adopt a given

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[5]Ibid., p. 24.

[6]Abraham M. Weisblat, "An Economist's View of Social Structure Interaction with the Subsistence Economy", ibid., p. 38.

[7]Ibid., p. 18.

"cultural model" is formulated in ambiguous terms "modernization", "monetization", "take-off" development. With respect to Africa, evidence exists to show that these so-called most explosive factors were in existence before major invasions of the 16th and 19th centuries:

> "Africa was, before colonial days, full of people on the move. Because of the ways Africans provided for their own subsistence, and because of social, political, and even religious pressures, Africans moved and kept moving".[8]

With respect to monetization, there is sufficient research findings to support the fact that Africa made extensive use of money.[9] Timbutku, Sanga-a-Lubangu and many other urban communities are not recognized as evidence of urbanization in Africa. If these factors were in existence, one cannot logically comprehend how economists emphasize to such an extent their introduction! Is it a matter of form or substance? If it is a matter of form, to what degree can different forms be recognized as different organizational schemes? Or is it a matter of a "culturally oriented terminology"?

Economists have shadow-boxed themselves with a set of terminology which they have derived from their "Cultural Model". By subtle and perhaps unconscious

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[8]Paul Bohannan, Africa and Africans (New York: Natural History Press, 1964), p. 41.

[9]Various objects such as cowrie shells, metal hoes, copper crosses, etc. were used as monetary units. The power to make money was entrusted to a well defined department of the village or communal government.

efforts, they have generated a "freeze-in-effect" for those cultures that do not operate under the same principles. By doing so, they have, not only frozen in Africans and African societies, but also the generations of young people all over the world who would want to understand the African Universe.

Like ethnologists, archeologists, linguists, historians, botanists, etc., who "worked from the premise that Africa did not have a past prior to the coming of the Europeans",[10] economists believe that Africa does not have economic systems and terminology worth investigating. African economists themselves have come to the same conviction as evidenced by the organization and functioning of the so-called "modern African states".

The "freeze-in-effect" is defined here as the inability to liberate oneself from a cultural model which imposes upon him a terminology (and with it, an approach) that is erroneous and inconsistent with the universe of reality. As was emphasized in the review of literature, the African universe is frozen-in or to quote Bohannan: "The societies within a colony are frozen not merely in time, but in space....".[11] I would add that the freeze

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[10]Thomas R. DeGregori, Technology and the Economic Development of the Tropical African Frontier (Ohio: Western Reserve University Press, 1969), p. 6.

[11]Op. cit., p. 18.

continues after independence not merely in time, and in space, but also and more importantly in intellect. It is submitted that this "freeze-in-effect" is the sole most important factor of African economic stagnation. Everyone is victimized by it in some way.

ECOLOGICAL CHARACTERISTICS

The ecological or physical characteristics presented here are illustrative rather than exhaustive. This is not a dissertation on economic geography of Africa. The presentation is directed in connection with the concept of the "freeze-in-effect". That is, existing literature on Africa will be used to demonstrate how the effect has and continues to operate.

The most elementary application of the effect is in the area of climate and fauna. Africa is characterized by inordinately hot weather, forest or jungle with dense undergrowth and poisonous snakes hanging from each tree:

> "... there is no landmass on earth that proportionately receives and equivalent amount of sunshine...."[12]

Furthermore:

> "the combination of African wildlife and untamed environment that is their environment leaves an impression of immensity and grandeur."[13]

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[12]Lucile Carlson, Africa's Lands and Nations (New York: McGraw Hill, 1964), cited by E. Skinner (ed.), Peoples and Cultures of Africa (New York: Natural Science Press, 1973), p. 12.

[13]Ibid., p. 30.

These steaming tropical jungles, together with wildlife of the environment create "docile, happy-going natives who do not have to work because they can live off the lush bounty of nature".[14]

With respect to the soil, the freeze-in-effect is demonstrated by the following quote:

> "Most African soils are typical tropical soils and suffer from the disadvantages that all other tropical soils suffer from ... they are devoid of humus".[15]

What seems a little strange so far is that the proposition of poor soil is combined with the proposition that:

> "Tropical environments ... supply man bountifully with all of his needs merely for the taking. Everything is believed to grow bigger and faster in the tropics."[16]

This contradiction precipitated efforts by researchers such as Gourou to prove that:

> "Forests in the hot belt have a very slow rate of growth. This is said to be 0.22 cubic yards per annum per acre in India--but some strains of conifers in the temperate belt grow at a rate of between 4.2 and 5.3 cubic yards per annum, the average for France being 1.4 and for Belgium 1.7."[17]

Another frozen-in intellectual contradiction is that:

> "the climate of the tropics is unhealthful and inhospitable--the "White Man's Grave."[18]

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[14] Ibid., p. 35. [15] Bohannan, op. cit., p. 39.

[16] DeGregori, op. cit., p. 37.

[17] Thomas Gourou, The Tropical World, trans. E. D. Laborle (London: Langmans, Green and Co., 1961), p. 78.

[18] DeGregori, op. cit., p. 39.

Then the challenge (intellectual) became to explain how the "negro" could live and work in the tropics while the "white" man could not. One such attempt proposes that:

> "Negro was believed to be biologically better able to withstand the heat ... while the European, who was physically unable to perform the work, nevertheless had the necessary intellectual and moral qualities that the negro lacked."[19]

But, to what extent this proposition supports the other which supports the negro laziness and indolence due to the hostile and unhealthy climate is hard to understand.

There is still another frozen-in concept which attempts to explain the effect of a hot climate upon the African man. Rather than putting the blame on his physical conditions (burned skin) this one emphasizes psychic conditions:

> "the tropical climate is monotonous and ... the four seasons of temperature climates are a psychic necessity for whites ... the dark-skinned races have populated the tropics without being noticeably bored, while Europeans suffer fits of depression after being there only a few years."[20]

Probably due to these factors, environmental, biological, or psychic, the story is told:

> "Few tropical peoples have ever had the technology or the knowledge to take the required steps.... Rather they have 'mined the soil of its nutrients'by a method of farming known as shifting cultivation."[21]

These "frozen" ideas have acquired institutional

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[19] Ibid., p. 41. [20] Ibid., p. 43.

[21] Bohannan, op. cit., p. 40.

utility and both African governments and developed countries have embodied them into economic and agricultural policies. The Theory of Labor based on some of the frozen ideas is that "intellectuals" work in air-conditioned white-like offices while others work in the "steaming" heat.

Internationally, the United States and other developed countries have used some of the "frozen" ideas to formulate assistance policies. The main way these countries with temperate climates attempt to aid tropical countries is to export their own agricultural methods. The justification is provided to them by researchers as follows:

> "in those small areas in which European forms of agriculture are practiced ... there is a permanent, rich, alluvially deposited soil, maintained by seasonal flooding."[22]

However, recent research efforts in tropical areas of Brazil[23] have come up with contradicting conclusions. Robert K. Colwell, in a recent report affirms that the export of temperate climate agriculture may not be the answer. He states in part that:

> "[The Western agricultural method] requires broad expanses of agricultural fields planted with the same or similar crops, and the replanting of the same crops year after year. This is not suitable to tropical environments where natural pests can quickly wipe out

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[22]Ibid., p. 41.

[23]Note that Brazilian agriculture was developed by African farmers used as plantation slaves.

whole fields."[24]

According to Colwell, tropical farmers knew somehow what they were doing. He arrives at the recommendation that:

> "The best strategy would be to introduce traditional crops and plant them in small plots interspaced with other crops. Rotating the crops in an unpredictable way would help eliminate diseases."[25]

Still, many "experts" are convinced that despite this evident know-how, tropical soil is irrationally exploited due to some unsuitable practices. One of these practices (and the most talked about) is the slash-and-burn method. It is described as follows:

> "An area that is to be cleared is selected; the trees are killed by one means or another, such as stripping the bark, without uprooting them. The trees and other vegetation are burned, thereby enriching the soil and leaving the roots intact to hold the soil and prevent erosion. The crop is then planted. After a few years the soil is exhausted, and new sites are sought. Sometimes the activities of clearing new plots and using old ones are carried out simultaneously."[26]

The author personally participated in the so-called slash-and-burn practice as described above. My understanding of the method and the conclusions drawn from it do not support those DeGregori advances. In the first place the slash-and-burn practice is selective in the following

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[24]Colwell's report was made at Shaw's Garden and reported in the St. Louis Post Dispatch, May 15, 1973.

[25]Ibid. [26]DeGregori, op. cit., p. 46.

sense: it is confined to the kinds of soil that is not responsive to other practices either in terms of its fertility or in terms of the kind of grass and trees growing on it. As is recognized, this practice enriches the soil.

Secondly, one has to distinguish between the slash-and-burn practice and a disposal of undesirable plantation or grass on the field. In tropical Africa, some plants cannot coexist in one plot of land; the existence of one creates suffocating conditions for the other. When a plot is selected for cultivation, the farmer proceeds first by inspecting the composition of the soil as well as the combination of plants. If it is found that a certain area of the plot carries incompatible plants (incompatible with the crop he intends to plant), that area is burned so that the incompatible plant becomes a source of fertility.

Thirdly, the slash-and-burn method is not a one-purpose practice. That is, in tropical Africa, this method is also used for hunting, fishing, etc. When such is the goal, then the burning takes place on non-cultivated areas. It can be verified that not all of the burned plots will be cultivated.

Fourthly, one must challenge the conclusion that "after a few years the soil is exhausted and new sites are sought". Perhaps DeGregori should have given some quantitative measure to his "few years"! Practically, I

have not seen a farmer who would practice the slash-and-burn method for two or three consecutive years until the soil is exhausted. It seems that what DeGregori calls "new sites" is simply the method of "soil alternation" which is as strong a characteristic of African farming as is the "crop alternation method" or what Robert Colwell calls "crop rotation".

Finally, it should be pointed out that there is a great deal of arrogance in the assessment of the quality of African soils and African practices on them. As DeGregori himself admits:

> "One of the causes of the myths about the tropics is our method of studying this region. Our way of thinking unconsciously reflects the conditions of the temperate zone (as an absolute frame of reference in which our ideas were developed)".[27]

Following are two examples in which the application of this arrogance was disastrous to the African ecological system.

In a Zairean village called Mwene-Ditu, farmers have developed a method of cultivation in the forest. In a deep forest, the sunlight does not reach the ground with enough frequency and in enough quantity to plant those crops that necessitate a considerable amount of sunlight. At the same time this ground is quite fertile.

The practice was to clean the bottom and half-bottom of the forest, creating some spots for the

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[27] Ibid., p. 42.

penetration of the sunlight, and then plant those crops that only take moderate sunlight. (E.g., African rafia trees, African beans, etc.) The crops were of good quality and results were impressive.

The colonial administration, impressed by the results, decided that forests should be cleaned and cotton planted there instead of those African crops. The cleaning of the forest affected the temperature which rose approximately twenty degrees. This abrupt temperature rise destroyed the fungi and humus formations. Next, the falling rain stroked the soil directly and washed away the trace elements. A year later, the tropical forest, with its several varieties of flora and fauna was reduced to a savanna with poor grasses and brushwood. As a result, the cotton plantation turned out very poorly, and a year later was completely abandoned.

The second case relates to the incompatible plants or crops. It is known (at least by African farmers) that certain crops cannot coexist. On the other hand, some others can be combined on one lot. For those who are familiar with the African agricultural systems, it is almost impossible to find a specialized lot. Crops are, in most cases, combined together according to the conditions of the ecosystem. But this does not mean that any combination can be performed.

Again in Mwene-Ditu, farmers combined "African peas" with peanuts on one field. The results were good.

However, since the Europeans did not have knowledge of this type of "peas" it was declared a non-cash crop and, it was ordered that peanuts be combined with rampant-beans. Resistence to the order was punishable by jail.

As it turned out, rampant-beans and peanuts were incompatible crops. The result on the next year records was that neither "african peas" nor peanuts were available. The quality of rampant-beans was very poor and the quantity insufficient. The conclusion was that "African soil" was poor. But the consequences were that African farmers were deprived of peas and peanuts. No study was made to find to what extent this error affected people's diet in addition to the total ecosystem!

Thus far, the reader may be given the impression that Africa is a one-climate, one-soil quality, etc. Nothing can be more misleading! Also, it should not be thought that farmers specialize in the production of one or two crops.

An oversimplified division distinguishes five major physical and vegetational zones: Mediterranean type climates, plains and desert climates, savanna climates, equatorial climate and a variety of other climates which are scattered throughout the continent and cannot be classified in the above categories. The stereo-type conception of African climate and physical conditions is erroneous.

Climatic diversities are paralleled by agricultural

product diversities and practices. Nobody knows (because nobody is interested) exactly how many agricultural, fishing, and hunting products the continent offers. More importantly, those products that are predominantly consumed by African populations are not even mentioned in the research literature.

The following crops and other products illustrate the varieties:

- Root Crops: Yams, taro, cassava, sweet potatoes, African peas, African peanuts, tubers, vines, gourds, vegetables.
- Non-Root Crops: Maize, wet rice, dry rice, bananas, okra, peas, gourds, fluted pumpkins, beans.
- Trees: Kola tree, okee, tamarind, pepper, red sorrel, oil and raffia palms, sheabutter, locust bean, etc.
- Cereals: Pearl millet, sorghum, funio.
- Domestic Animals: Cattle, goats, sheep, chickens, ducks, bees, fowl, pigs, horses, donkeys.
- Hunting: Elephants, antelope, buffalo, porcupine, swine, and various other animals and flies.

This list is given as illustrative rather than limitative. It is simply useful as a means of understanding the fact that in such an ecosystem, various behavioral patterns, products and practices can be derived and that requiring that these behaviors and practices be identical

to those of the European population is pure nonsense, albeit seemingly "scientific".

However, the existence of diversities does not imply that one cannot construct some cultural model which captures some basic characteristics of the man-ecosystem setting as the one described above. Evidently, such a construction is simplistic in nature.[28] But, is it not the property of scientific constructions to be simplistic!

In the next section an attempt is made at constructing some economic principles from the cultural model of the African type. It will be simplistic but close to reality.

THE CULTURAL UNIVERSE

Social Values and Economic Theory: The American Example

Both social science theories and theorists are a product of their social systems which they attempt to explain or rationalize. Economists and economic analysis are capable of yielding laws, not in the sense of demonstrable recurrences and regularities as in physics, biology, etc. but in the sense of norms. The use of

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[28] Many references are available, the collection by [E. Skinner, op. cit.] contains interesting information although, as may works of its kind, our concept of "freeze-in-effect" is more than apparent. The reader is advised to exercise a great deal of personal reasoning to identify it.

mathematical methods makes the formulation more logical and precise, but a methodological procedure is not a substitute for the subject matter itself.

It follows then that at the heart of any serious theoretical problem is a conflict of deep-rooted social value systems and their perception as forms of social organizations. Also value judgments concerning the people using this type of social organization symptomize a great deal of theoretically conflicting formulations.[29]

Furthermore, an attempt to rationalize or perpetuate a social system by conferring on it some kind of universality gives rise to "vulgar economic theorizing". By taking one particular system as a universal datum, the theory deals with appearances only. It ruminates without ceasing on the materials long since provided by the scientist conception, and seeks plausible explanations of the most obtrusive phenomena. It proclaims for everlasting truths, the trite ideas held by self-complacent theorists with regard to their own world which, mistakably,

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[29] When scientists belong to the same social system, then the conflict may be limited to value judgments alone; R. C. Fuller and R. R. Meyers suggest that "It is exactly this disagreement in value judgments that is the root cause of all social problems, both in the original definition of the condition as a problem and in subsequent efforts to solve it." But, when scientists belong to different social systems, the disagreement goes beyond simple value judgments, the difference in systems themselves becomes the most important source of conflicting theorization. R. C. Fuller and R. R. Meyers, "Some Aspects of a Theory of Social Problems", American Sociology Review, No. 3 (June, 1941), pp. 27-42.

is taken as the best of possible worlds.

To this extent, economic theory becomes a political desideratum providing the social system with the needed ideological foundation for its perpetuation and universalization:

> " ... no system can maintain itself by force exclusively; some sort of ideology is needed to show how things fit into place, to reproduce within each new generation a particular conception of the world, a framework of values within which individuals can define their goals."[30]

Table 1 is a simplified version of the relationship among social values, social organization principles and the economic principles derived from them, It is constructed with a partial aid from concepts developed by Brewster.[31] Despite its simplicity, it nevertheless points out the fact that economic theory is inspired by and derived from the social organization. In this sense, economic laws are nothing but norms.

A distinction exists between the so-called "normative" and "positive" economics in the literature. The

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[30]E. K. Hunt and J. G. Schwartz (eds.), A Critique of Economic Theory (Bungay: Penguin Books, The Chausser Press, 1972), p. 8.

[31]John M. Brewster, Society Values and Goals in Respect to Agriculture, (Iowa: Iowa State University Press, 1961), p. 117. The reader will also find the discussion on the contradictions between these values most interesting.

difference between the two seems to be that the former takes "things as they ought to be" while the latter "takes them as they are".

In this writer's opinion, the distinction does not violate the relationship depicted in Table 1. Normative economics attempts to formulate propositions based on some "desirable" social organization while positive economics takes the existing social organization as a datum. However, both theories derive their propositions from social organization, actual or desired.

Let us then assume that we can abandon the American social system as depicted in Figure 1, and enter another system with different values. To what extent can economic theory derived from Table 1 apply to this new system?

One way of approaching this issue is simply to assume that the theory will apply. This implies that the two social systems and their underlying values are identical at least in their general characteristics. This approach has the advantage of being simple. If the theory has reached a stage of mathematical formulation, this is even simpler because pure mathematical logic ignores all the underlying values. Many economists, political scientists, anthropologists, etc. have adopted this approach with respect to the african economic systems.

The imposition of a social system upon another and different social system may have two possible consequences: one is that the system upon which new values are imposed

Table 1

Values and their Economic Theorization
in the American Society

The Value	Social Organization Principles	Economic Theory
1. Status	- hierarchic social structure - design and implementation of instruments and institutions of status differentiation - maximum or higher status as moving engine - social conflicts based on status striving as normal	- every economic action intends to maximize some result: Maximization Principle - demand is a maximum quantity - supply is a maximum quantity - Pareto optimality
2. Work Ethic	- work imperative - self-made-man ideal - environment constitutes means to meet aspirations (maximum) - one gets the product of his own work	- marginal productivity theory of distribution - labor market theory
3. Democratic Value	- all men are equal - none, however wise or good, is good enough to have power over the others - one man one vote and the government is some sort of social contract by individuals - men are created equal, but accept leadership from elite	- money income is a vote by the consumer and this vote dictates what to produce - set of inputs by the firm is a vote to produce - markets insure neutrality or solution on which both agree
4. Self Integrity	- modes exist to resolve all conflicting views between individuals, individuals & group - society is an organization of different and independent	--theory of markets as giving solutions to various wants, aspirations, rights, etc. - depending on participants, one can have from perfect

Table 1 (continued)

The Value	Social Organization Principles	Economic Theory
	individuals having rights, wants, aspirations, etc. of their own - the conflict of wants, rights, etc. are resolvable such that the individuality remains protected as an integrity	to imperfect competition
5. <u>The Enterprise Value</u>	- individual is and ought to be responsible for his own economic security - government prevents people from sharing their burden with others - property rights protected - follows from 4 above - to insure one's integrity people are given rights on resources they combine to produce economic goods for now and the future - each individual has control over his actions	- laisser-faire in economic organization - renumeration of rights such as shares, stock, etc. - limited role to government and public finance

adapts itself completely. In this case, the theory can be used in either of the two cases indiscriminately. The second consequence may be that the "occupied" system simply closes itself and refuses to function. In this case, the new system will attempt to function alongside with the old system, but no dynamic communication will exist between them. The new system will not be capable of modifying the old while the old system will be prevented from moving on its own path by its protective reaction.

The second consequence described above is exactly the freeze-in effect we have defined above. It describes the actual state of affairs in Africa. It is the realization of this state that motivated this dissertation. In order to activate the system again a comprehensive understanding of its values is necessary. From these values a theory can be developed.

The African Framework

Every culture has an order or structure which embodies its values and ideas. The mode of expression of this structure is a set of symbols to be divided into three categories:

(1) The master symbol: it "identifies the central ideas by which a society characterizes and justifies its order, action, and major

values."[32]

(2) Referential symbol: "refers to objective events and behavior and is essentially a perceptual response unaccompanied by important emotional reactions."[33]

(3) Condensation symbol: "evoke psychological behavior which is substitutive behavior for direct expression and enables the release of emotional tension in conscious or unconscious forms."[34]

As is evident from these definitions, the fundamental difference between cultures lies in their master symbol. The remaining differences can all be derived from it.

The difference between African culture and the one depicted in Table 1 lies in their "Framework of Living", i.e., their grand design of man's relationship to his society as embodied in concrete patterns of action. In African culture, as Carlston has shown:

> "The framework for living made man a part of a constricted whole. Tribal man had meaning as self in a perspective in which he was a part of his kinship group. He attained his goals and realized his values simply as a consequence of the central fact that he was a part of his kinship groups."[35]

This communal culture is to be thoroughly

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[32] J. W. Carlston, Social Theory and African Tribal Organization (Urbana: Un. of Illinois Press, 1968), p. 9.

[33] Loc. cit. [34] Loc. cit. [35] Loc. cit.

differentiated from the one found in America. In the later:

> "[man] is separate from these groups, even as he participates in them. As he participates in their action, he has his own space of free movement. In that participation, he never perceives himself as indissolubly a part of a group which is central to his life in the same manner as tribal man perceived his membership in his kinship groups".[36]

From his investigation, Carlston concludes that:

> "Thus, the tribal society and modern societies are at polar extremes as framework for living."[37]

The four values which we have chosen to characterize the American culture reflect this preoccupation with individuals as isolated islands. The concept of "status" has meaning only if individuals can be isolated and then ranked. This, in turn manifests itself in the form of social organization based on classes.

The concept of "work ethic" has full meaning only when man has to rely on his work as an expression of his isolation. His work is himself. Hence the admiration of a self-made-man acquires social dimension. Also, isolated man has to ensure his own security. This can be done, for instance, by selling his labor for security-creating means (wages). So, the existence of a labor market is related to the conception of man as an isolated island.

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[36] Ibid.

[37] Ibid., p. 12. The reader should realize that the use of the term "modern" to designate a particular framework of living is not free of emotional content. The term "modern" is therefore a condensation symbol.

Democratic values relate also the conception that man can be isolated and given a vote to represent him when it comes to social organization. Every individual brings his vote to participate in groups from which he remains isolated in the sense given above. In this case, only those conflicts and problems which arise in his capacity as a member of a group can be dealt with by the Government. Others are his own responsibility. This gives rise to an economic organization based on market principle. Each unit is isolated and possesses control over some resources, he comes in contact with others in relation of exchange such that no one can control anybody. Individualities are protected. In this sense, "free markets", "law of demand and supply", etc. are condensation symbols as well as referential symbols.

The values of "self-integrity" and "enterprise" can also be seen to relate to the basic framework of living. They have both referential and condensational characteristics.

Since the African "framework for living" is communal both her social and economic organizations are fundamentally communal. In the first place, the smallest economic unit is not an individual but a group called extended family:

> "The basic unit of agricultural production was the extended family. True, in most societies individuals were allowed, even encouraged, to produce commodities for their own use, but usually only after they have

fulfilled their obligations to their kinsman".[38]

The extension and size of this unit varies from community to community. But in general, it comprises the elder of the group, his descendents, his younger brothers, sisters and their descendents. Sometimes it includes also the descendents of uncles as well as:

" ... such individuals as were attached to them by bonds of kinship, adoption or friendship."[39]

Extended families are grouped into clans, lineages, tribes, etc. in order of importance, The distinction between these organizations does not reflect such criteria as territoriality, possessions, etc. These groups are purely social organizations all of which function as communal institutions. A man will use such or such other institution depending on the circumstances and the subject matter.

As we have done for the American example, it may be worthwhile to close this section with some implications of the Communal Framework for economic theory.[40]

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[38] E. Skinner, op. cit., p. 209.

[39] Georges Balandier, The Sociology of Black Africa (New York: Praeger Publ. Co., 1970), p. 104. It should be realized that the extended family has no boundary, and can be small or large depending on the community.

[40] We do not intend to go into all theoretical implications of the Communal Culture. This would require a lifetime of research work. Here, our intention is simply to show that because of the Communality of this culture, some economic concepts may not make sense there.

The first of these implications is the labor concept. In a communal culture, labor is not an individual resource in the sense that it can be sold and its proceeds used for individual security. Rather, we do find labor terms which are the economic counterpart of the concept of communal institutions such as extended family, clans, etc. Therefore, there is no labor market because:

> "People at work create not merely products; they also create a web of social relationship."[41]

The second implication deals with land. In communal culture the concept of land and its geography is essentially a social concept. Africans do not split land up into pieces of private properties. Neither do they divide it in natural boundaries such as rivers and hills. Rather, the division of land is made in terms of social relationships and the juxtaposition of social groups or what anthropologists call "geneological maps". Bohannan has described this concept in the context of farming in the following terms:

> "This 'geneological map' of Tivland moves about the surface of the earth in sensitive response to the demand of individual farmers as those demands change from year to year. The 'map' in terms of which Tiv sees their land is a geneological map, and its association with specific pieces of ground is of only very brief duration--a man or woman has precise rights to a farm during the time it is in cultivation, but once the farm returns to fallow, the rights lapse."[42]

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[41] Bohannan, op. cit., p. 182.

[42] Ibid., p. 177.

This explains at least partially, the absence of private ownership of land in a communal culture. The dynamics of communal proprietorship is reflected by the crop and land rotation techniques as found all over Africa.

The third implication which relates to the second is a total absence of land markets. Land cannot be alienated because noone has the right to do so. It is a social property.

The fourth implication of the communal culture relates to those economic institutions which govern group relationships such as exchanges, consumption, etc. When the economic units are individuals with private rights over productive resources, the institution of market becomes essential in all exchange relationships.

But in the communal culture, various institutions of exchange are created to facilitate the movement of goods and resources within and between communities. Rituals, communal dances, etc., are familiar institutions of exchange. Goods change hands but there is no price tag on them.

To be sure, markets did exist in communal culture, but they were not conceived as they are in Western culture. Their meaning relates to the fundamental principles of the communal culture. Very few necessities of life pass through the markets and, if they do, they are not subject to the so-called "market price". The market is a place of

communal life expression: there are courts in the markets, there are government decisions being made in the markets, there are social consumptions taking place in the markets, there are marriage ceremonies, etc. Hence, this institution is extremely at the heart of the communal framework of life and cannot be used as an example to show that the law of supply and demand is working:

> "It was only rarely in indigenous Africa that labor, land, brains, or ability, and that strange thing called capital (difficult to define significantly for economies that are non-industrial), all go into the same market as do the products of their utilization and manipulation. Therefore, production did not reallocate factors to any appreciable degree".[43]

Since this institution was so central to the working of the system of social interconnectedness, it was under tight communal control. In effect, product quality and quantity entering the "market" were minutely controlled. When it was necessary to exchange at a price, such price was determined authoritatively by a control body:

> "the market authorities enforce quality control. They disallow sale of rotten meat or other unsatisfactory goods.... Chiefs retained direct control over the markets and either themselves or through special deputies maintained the market place and kept peace within it."[44]

Another organizational aspect of the institution of the market in communal culture is that it constitutes some kind of spacial link between isolated geneological institutions. Every community is made the center of a

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[43]Ibid., p. 209. [44]Ibid., p. 213.

group of markets which meets every fourth, fifth, or seventh day, depending on the size of the area.

In a neighborhood with markets that meet every five days, each community is likely to be either at or near the center of a cycle or a ring of five markets, each of which meets one day of the five-day "market week" that results. These patterns are found all over Africa from Dakar to the Nile, and south well into Rhodesia.

The importance of this aspect of the institution of the markets is that they:

> " ... provide another map, based on a different institution, by means of which space, time, and social structure are coordinated. This trade map or market map permeates different tribes, different cultures, and across national and language barriers."[45]

It appears then that this institution was not only a center for communal functioning but also a basis for some sort of panafrican relationships and culture.

The last implication to which we shall turn concerns the nature of the decision making process in the communal culture as we have described it above. It is theoretically incorrect to apply the marginal utility theory to this situation. By its very nature, the social preference must be the starting point from which extended

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[45]Ibid., p. 217.

family preferences are derived.[46]

In this system, farmers make decisions which are both complex and systematic. The principles or criteria to be used in the determination of rationality become also complicated, mostly when it comes to the quantitative expression of these criteria. At the outset, the principle of maximization has very little significance in a society where status is not the first concern.

Also, it seems more plausible to approach a farmer's decision in the framework of a "communal system" in which various objectives can be obtained with one decision and vice-versa. To take into account the "communal authority", it would seem reasonable to conceive farmers decisions as "allocated decisions", i.e., the farmer decides over the matter allocated to him by the communal authority. In this case, some decisions are made in common, some in particular, some are made for communal objectives, others for particular objectives. It can be shown that such a system arrives at a Pareto optimal decision from a totally different angle.[47]

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[46]This is the assumption that will be made in the construction of the decision model in this study. It will be shown that this assumption makes it easy to avoid the Arrow paradox. Kenneth J. Arrow, Social Choice and Individual Values, Cowles Foundation Monograph 12 (2d ed; New Haven: Yale University Press, 1972).

[47]This will be proven in subsequent chapters.

SUMMARY

In this chapter, the African Universe, both physical and cultural, has been presented. The main point made here is that existing terminologies and approaches to this universe are characterized by a great deal of preconceptions, albeit their claims to some kind of universality.

The consequence of these preconceptions is to freeze to a very great extent, any attempt to construct original approaches which may be capable of understanding the reality and eventually modifying it.

As an example, the relationship between cultural value and economic theory in the United States was derived. It was shown that when this cultural model is not universal, a need for a thorough understanding of how theories can be constructed from other cultural models arises. The basic framework of living of the African world was also presented. From it, some economic realities were derived as they actually operate in Africa. These were mentioned as passing points because we have intended to analyze them all in this dissertation.

The remaining chapters which follow will concentrate on how farmers living in that culture make their decisions. It will be shown that the Pareto criteria is operative for this system. Finally, we shall speculate on some necessary policy implications of the model.

Chapter 4

OBJECTS, ATTRIBUTES AND THE CHOICE

In this chapter an attempt is made to develop the thesis that choice is based not on goods per se, but on their characteristics. If the characteristic set possesses desirable properties, they can be recognized and classified. A decision can be made strictly on the basis of this classification.

The argument is constructed on a mathematical logic. However, thorough discussion before and after each argument permits the construction to be followed by both the non-quantitatively oriented economist as well as those who are quantitatively oriented.

QUALITATIVE, COMPARATIVE, AND QUANTITATIVE PREDICATES OF OBJECTS

Farm management involves a decision making process. At an initial stage, this decision is qualitative in the sense that it is based upon the properties of the objects upon which the action is taken. In this case, different objects can be partitioned or divided into classes each of which possesses the property in question.

Those properties which the decision-maker uses to classify objects are called "qualitative predicates".

They constitute, at least from the intentional point of view, the starting point for the portion of the universe on which the decision-maker will operate.

The second type of predicates is call "comparative predicates". They simply order the various objects of the given universe of discourse, i.e., they express relations, but only relations as can ensure an ordering. As an ordering, comparative predicates have, as a minimum,[1] the form of predicates with two arguments.

There is a relationship between qualitative predicates and comparative predicates in the following sense: two or more objects may be classified as elements of the same class by property (i.e., class of flexible), but these objects may differ in the degree in which this property pertains to them (i.e., object A is more flexible than object B). Therefore, the introduction of comparative concepts is intended to order objects according to the degree in which a classifying property pertains to them. The necessity of this relationship in decision-making will become clearer as the work proceeds.

Finally, with quantitative predicates, a quantitative determination is required of both qualitative and

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[1] We are insisting on the word minimum to avoid any restriction of the choice to a binary choice as was done by Arrow. Schwarts has shown that such limitation and the optimization rule hence derived have little empirical content. Thomas Schwartz, "On the Possibility of Rational Policy Evaluation", Theory and Decision, No. 1 (1970), pp. 89-106.

comparative predicates, i.e., numerical characteristics of properties of objects expressed by one number, a pair of numbers, a triad of numbers, and so forth. When it is stated that a given object "has the degree of hardness 5", that "it weighs 5 g", "has a length of 5 cm", "a speed of 5 m/h", or that "the consumption of gas in 100 miles amounts to 7 gallons", etc., this establishes a representation of qualitative predicates in one or more sets of numbers.

With respect to comparative predicates, if we say that "X is twice as large as Y" it is possible to construct a quantitative concept to reflect this fact. For instance, one can say that a V. W. sedan travel "twice as cheap as a Ford LTD" or convert this statement to the number of gallons of gas consumed by the two cars in normal higher traveling conditions.

The logical flexibility with which one can move from qualitative to comparative, to quantitative, and back has convinced many scientists to regard quantitative predicates as explication of the qualitative and comparative predicates. This view is further strengthened by the fact that in the language of both exact and social sciences, most of the quantitative concepts can be defined more accurately and unambiguously than is the case with qualitative concepts. Also, quantitative concepts remove the difficulties accompanying a number of qualitative concepts, especially the difficulties related to the

possibilities of subjective interpretation, vagueness, multiplicity of meaning or the like.

It should be emphasized that quantitative concepts represent more suitably qualitative and comparative concepts in the case of standardized measurements. For example, the logical and semantical structure of oldest measurements (foot, inch, step, etc.) is essentially anthropocentric in character. Efforts are being made to make these and other quantities more accurate by fixing standardized convention concerning the properties of these quantities. Here the attempt is not only to desubjectivize these units, but also to attain mutual comparability and convertibility, as well as secure the properties (objective) that are expected of the measurement: especially metrisation of quasi-series, and additivity.[2]

However, with respect to social sciences, there is ground for reservation. In some instances, many qualitative properties cannot be differentiated according to degree, i.e., they cannot be ordered on the basis of "more" or "less". For instance, two goods may not be comparable ("orderable"); a red car cannot be compared to a heavy book because "redness" is not comparable with

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[2]This aspect of measurement in the African case will be dealt with later. For a good discussion of some of these properties see Ladislav Tondl, "Prerequisites for Quantification in the Empirical Sciences", Theory and Decision, No. 2 (1972), pp. 238-61.

"heaviness".[3] This becomes more important in a study of different social systems and/or the underlying economic systems. Where economic systems attach non-comparable qualities to objects upon which decisions are made, there may not be a set of standardized properties useful in understanding various systems. It seems that in this case economic systems and their measurements are also anthropocentric.[4] If standardization is a wish, it is not realistic to make use of such a wish in theoretical construction of actual social systems.

To sum it up, this study is methodologically axiomatic. These axioms are constructed on the basis of a logical consistency from qualitative predicates to comparative and quantitative predicates. It is important that the relationship between these three predicates in the African case be absolutely specified.

The set of axioms and relationships hence derived can be rejected either on a logical ground or on an empirical one. It is the property of all scientific predicates to be rejectable.

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[3]Elementary economic theory limits its field of analysis to those objects capable of comparison to construct indifference curves. Also, in most cases, binary relation is the most stressed, hence eliminating the possibility of multi-dimensional relations.

[4]In this respect, anthropologists are more advanced than economists. This applies also to Africa.

RECOGNITION AND CLASSIFICATION OF OBJECTS

Modern market researchers, psychologists, and even some economists have come to recognize (after so many years of deterministic theorizing) the postulate which asserts that individuals discriminate among various objects on the basis of the "properties" or "characteristics" of those objects.[5] Instead of building a theory of the consumer on a simplistic property "goods are goods", an attempt was made to construct theoretical propositions based on "intrinsic properties of particular goods".

Simultaneously, the theory of the firm was undergoing similar revision. The traditional neo-classical theory, as noted above, envisioned an abstract firm. This construct consisted of a single decision criterion and an ability to get information from an "external" world, called the "market". The information received from the market enables the firm to apply its decision criterion, and the competitive system proceeds to allocate resources and produce output. This theory is also deterministic "markets are markets". Cyert and Hendrick have suggested "behavioral" and "managerial" approaches provide the needed

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[5] Kelvin J. Lancaster, "A New Approach to Consumer Theory", Journal of Political Economy, No. 2 (1966), pp. 132-57.

"internal decision making process".[6] This suggests that firms, like consumers, discriminate among actions on the basis of their "intrinsic properties". Markets, as can be seen, are the result of that process of "discriminating decision".

Farm management is a decision-making process. In order to understand the "intrinsic nature" behavior of the farm manager, one is required to specifically state those objects (or actions) as well as the "attributes", "characteristics" which distinguish those objects. Then one is to show how a given managerial decision discriminates (does not discriminate) among these "attributes".[7] The collection of things previously referred to as objects may include not only physical objects, but also institutions (e.g., family), other persons beside the decision-maker (e.g., seller and buyer).

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[6]Richard M. Cyert and Charles Hendrick, "Theory of the Firm: Past, Present, and Future; An Interpretation", Journal of Econ. Literature, No. 2 (1972), pp. 398-412.

[7]The terms "attributes", "predicates", and "characteristics" are used synonymously in this study. These attributes may be "qualitative", "comparative" or "quantitative". As was mentioned in connection with the process of representation, it is not always possible to derive quantitative attributes from "qualitative" ones. This introduces the possibility that "quantitative" attributes alone may be incapable of capturing all aspects of decision-making.

Objects and their "Attributes"

Proposition 1: There exists a finite non-empty set, N, of objects each of which is distinguishable.

Proposition 2: There exists a set, M, of "attributes" which indexes N such that:

$M(x_m)$ is the collection of all sets $\{x_m\}$ indexed by M and having the property that $x_m \in X$.

These propositions establish two important elements on which the farmer's decision will be founded. First, all the objects available to him are given (proposition 1), but since a decision must be based on "attributes" of these objects, proposition 2 allows for the possibility that the farmer is capable of attaching an attribute to each object in order to distinguish it from the others.

Here the set M can be anything imaginable. One can think of it as a set of signs. In this case if x_m has a negative sign it can be thought of as an input in X. In such setting, X is a set of objects called inputs and outputs depending on the sign of its elements.

Also M can be a set of measurements say pounds, kilograms, money, etc. In such a setting the direct product in proposition 2 may give things like the weight of each element $x \in X$, or its money value. Furthermore, M can be a set of qualitative attributes, say moral values. For instance, M may have just two elements $M = \{0, 1\}$ such

that x_0 designates those elements which are morally wrong and x_1 those that are right. Even further, M may be a set of customs establishing social attitudes toward elements $x \in X$. As before, if we assume that $M = \{0, 1\}$, x_0 may designate those elements in X that are not socially accepted, and x_1 those that are.

One particular example may help in illustrating the point made above. In India it was considered religiously improper to consume beef. Beef is in set X of available consumable goods, however its index from the social belief set (M) renders it illegitimate for consumption. This introduces the possibility of ordering elements $x_m \in X$ according to some criteria. We shall come to this later. At this point, we only state that not all "attributes" are quantitative. In societies of the African type most of them are "qualitative".

The discussion above demonstrates that besides the easiest elementary constructs which assign quantitative "attributes" to each element in X, there are more difficult situations in real life. In fact, even when such "quantitative attributes" are possible, difficulties may still arise. The following theorem may help in developing this point.

Theorem 1

Let X be a set and let F be a real valued function mapping X into M. If F is surjective then there exists a function G mapping M into X such that:

$$FOG = I_m$$ [8]

where O is an operator and I_m is the identity matrix.

The proof of this theorem is suggested in Appendix D. A brief comment may help motivate its relevance to the issue of finding "attributes" to differentiate all elements of X from each other. If a farmer's decision is made on the basis of "attributes" of objects, it is necessary that there be as many "attributes" as there are objects. To the extent that this is so, the farmer will be expected to order or classify all objects according to their "attributes" and express his preferences over them. It is only in the conditions of theorem 1 that such ordering and preferences can be expressed without ambiguity. In the two cases discussed below, the situation is more complicated.

Let us assume that the function F is representable by a matrix A describing the coefficients of objects-characteristics. What theorem 1 tells us is that the conditions under which the inverse of A exists is equivalent to the fact that the number of "attributes" is equal to the number of "objects". In this case each object in X is disjoint and distinguishable from all the others. If

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[8] A function f: A $\rightarrow$ B is said to be surjective if $\forall y \in B$, there exists $x \in A$ such that $y = f(x)$. For a comprehensive discussion see Charles C. Pinter, Set Theory (Reading, Mass: Addison-Wesley Publ. Co., 1971), pp. 53-63.

an ordering is constructed on the basis of these "attributes", it is easy to define a choice rule which will be unique.

The first of the two more difficult situations occurs when the matrix A has no inverse due to the fact that the number of columns (attributes) is more than the number of rows (objects). This is very representative of the situation in African small farms under study. The limited number of goods makes it difficult to satisfy all the existing "attributes" both "quantitative" and "qualitative". The result will be that one object will be given more than one "attribute". If one insists that ordering and choices be made according to the rule derived from theorem 1, there will be no such a unique rule.

It is possible to argue that the system can still be solved by means of the generalized inverse and a unique solution found. In practice however, this implies that some "attributes" can be expressed as linear combinations of the others and hence can be dropped. This is possible only if it can be shown that one particular category of "attributes", say "quantitative attributes" are the only ones used. In this case one or more "quantitative attributes" can be used as a linear combination of the others. But if both "quantitative" and "qualitative" are used, there may be some practical difficulties in expressing one or more "qualitative attributes" as a linear combination of the other "quantitative attributes".

What this possibility suggests is that a farmer may very well use a "qualitative attribute" where all the theoretical constructs may indicate the usefulness of a "quantitative attribute". This may be an example of instances where western theorists are incapable of understanding behavior of African farmers.

A second difficult situation occurs when the number of objects is greater than the number of "attributes". This instance is more appropriate for developed economies such as the U. S. economy. But it is also possible in African farm economies when the set of "objects" includes non-quantifiable objects. In fact, if the set of objects is extended to all the religious, political, arts, education, social services, necessary for the functioning of the village, it is conceivable that several objects may be ranked according to or given one "attribute". In this case, as in the first, the process of choosing is more complicated than what theorem 1 implies. Behavioral response of a farmer in a market economy will be substantially different from that of a farmer in an African economy. One example may illustrate this point.

In a market economy, the choice of the object (for consumption and/or production) in the case given in the second situation above is made on the basis of an external "attribute" called "efficiency" or the minimum cost principle. We have called the "attribute" external to emphasize the requirement that prices used in computing

the cost are given (good or factor prices). This is one of the virtues of the competitive assumption.

If we consider an African small village cultivator and assume that he is faced with a situation like the one given above, how does one determine the rule for deciding? It is tempting to assume that he uses "market efficiency" by presenting such quantities as "revenue", "costs" and the like. Beside its simplicity (this rule is the most commonly used and keeps up with good old economic traditions), it is the most formalized to date.

In actuality, African farmers faced with such a situation use rules that are compatible with social traditions rather than economic efficiency as usually defined. This is somewhat similar to a manager who uses past prices as a projection of future prices and bases his decision on them. Even if one assumes an adaptive dynamic behavior, the fact remains that this adaptation is to traditional prices with some allowance for minor changes. What is different from the African farmer point of view is that his traditions and rate of changes are not formulated in quantitative magnitudes. According to the African conception of the universe, "everything is related to everything else". This farmer assumes that "attributes" to which he refers himself can be given from outside his system. In such an interrelated universe, qualitative "attributes" tend to outweigh the quantitative ones. There is no logical reason that a decision based on the former

is better than the one based on the latter.

Classification Principle

In the section above, we have described the universe of decision as composed of objects and their "attributes". We have proposed that decisions are made not on objects per se, but on their "characteristics" or "attributes". This proposition is in no way different from the one made by economists when they assert that decision theory deals with the problem of optimal decision under uncertainty as to the outcomes of different actions (strategies). In terms of our approach, outcomes are attributes and actions are taken because those attributes are attached to them.

In order to elaborate fully on these propositions, a further step is taken in this section to expand the discussion introduced above. For convenience, we may drop altogether the set X of objects and deal directly with the set M of their attributes. This section attempts to logically construct this substitution.

Take a set of "attributes", M = (metalic, non-metalic, hot, warm, cold, solid, melancholic, choleric, sanguine, phlegmatic, red, white, black, translucent, flexible, pleasant, near to, parallet to, friendly, etc.). Assume that these attributes are all different or distinct. In mathematical terms, we say that these "attributes" constitute distinct points in the space M such that the neighborhood of each does not contain that of the other.

Then M is a T_1 - space.

Definition 1

A T_1 - space is a topological space in which, given any pair of distinct points $\{x, y\}$, $x \neq y$, each has a neighborhood which does not contain the other.

We are assuming that if a farmer is presented with various objects from the set X he is capable of classifying them by attributes such that each class contains only those objects possessing a given "attribute". If for instance, a farmer is presented with an object he cannot classify according to "attributes" he knows, he will, either reject the object as irrelevant or will simply put it arbitrarily in any attribute class. Even worse, if a farmer is presented with both the object and its "attribute" he may reject both the object and the "attribute" if there exists no neighborhood which can contain such an "attribute".

Without anticipating on our discussion, it may be instructive to illustrate the point made above by an example. Let an American farmer be presented with the following object (course of action): transfer his property to the state. The attribute of such a decision is also given to him "state can ensure equity". This action and its attribute are presented to him by a Russian farmer. Without further specification, one can propose that the American farmer will reject the "object".

Another example: let an African farmer presented

with the following object "acquire private ownership of land", the attribute of the object "maximum private wealth". Without further specification, one would expect him to reject this "object" as he cannot conceive of "maximum private wealth" outside his community.

What these two examples show is that in some cases "attributes" from an M - T_1 - space may not be accepted or recognized in an N - T_1 - space. This is the result of the following theorem.

Theorem 2

If M and N are compact subspaces of a Hausdorff space, then each of them is closed.[9]

That two sets of attributes from two or more different systems are completely different may be an exaggeration. We have emphasized this possibility in order to warn those economists who use "attributes" from very different systems to derive generalizations about economic vs. non-economic behavior.

Proof of Theorem 2

Let M be a compact subspace of a Hausdorff space

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[9] A Hausdorff space is similar to T_1 - space except that it has a stronger separation property, i.e., each pair of distinct points can be separated by open sets, in the sense that they have disjoint neighborhoods. A compact space is a topological space in which every open cover has a finite subcover. By an open cover of a set E in topological space X, we mean a collection $\{G_i\}$ of open subsets of X such that, $E \subset \cup G_i$. Hence, a subset M of X is said to be compact if every open cover of M contains a finite subcover. That is to say, if $\{G_i\}$ is an open cover of M, then $\exists$ finitely many indices i=1,2,...,n, such that $X \subset G_1, \cup G_2 \cup \ldots \cup G_n$.

H. We want to prove that M is closed by showing that its complement, M' is open.

M is open if it is empty, so let us assume that it is non-empty. $\forall$ y ε M' there exists a neighborhood K such that y ε K ε M'. By the definition of H space M' is a union of open sets and is therefore open itself. The same reasoning applies to N and its complement.

Definition 1 and Theorem 2 tell us that each farmer is able of classifying all objects according to some given "attributes", and it is only on those "attributes" from the set he has used for classification that are essential to him. If an object appears with non-classifiable "attributes" he either rejects it all together or if possible may arbitrarily put it in any class.

Using the theory developed here, many so-called African farmer's resistances to changes can be correctly interpreted. In like manner advertising can be interpreted as an effort, on the part of the seller, to convince the buyer that a given object has "attributes" which he can satisfactorily like. Phrases like "Try it, you will like it" are intended to produce a change in "attribute" assessment by the consumer.

So far, we have only introduced the assumption that a farmer can classify. But we have not rigorously defined what the process of classification is, much less what a

class is. Before we give a formal procedure of classification, Figure 1 is given to motivate what is to come.

a)

16 stable	2 red	11 closed
5 metalic	4 black	10 metalic
1 red	3 white	12 two
6 angry	7 monetary	13 angry
9 equity	15 equity	14 monetary
	17 stable	18 white

b)

stable (16, 17)	red (1, 2)		closed (11)
two (12)	metalic (5, 10)		white (3, 18)
black (4)	angry (6, 13)	equity (9, 15)	monetary (7, 14)

Figure 1. Attributes Classification

Panel a) gives some 18 objects which are designated by the "attributes" (e.g., red, white, etc.). The real number placed in front of each "attribute" simply identifies it and should not be confused with a quantitative measure of that attribute. Panel b) on the other hand, has classified all "attributes" in classes (e.g., class of red, class of white, etc.).

For the time being, we are avoiding the most difficult situation in which a given object may be red and metalic at the same time, stable and monetary, etc.

What we realize here is that panel b) is a smaller image than panel a), in the sense that if each class in b) is taken as a point, b) has fewer points than a). We say that classification has produced a shrinkage.

What we need to show is that despite such a shrinkage, each class (say class of red) is still a point in the subspace of all attributes from a) which were red.[10] The reason this is needed is that if a decision is made on the basis of a class, it should be possible to comprehend it, not as a choice of the class as such, but as a choice of the "attributes" of which the members of this class possess. If, for instance, "attributes" are removed from that class and replaced by others, it is conceivable that the class may no longer be chosen.

For example, economists have attempted to infer that African farmers if faced with two classes, one contains a monetary income derived from sales of labor in the market place (wL=r) and another class containing "tribal customary dance", they will choose the latter and reject the former. It is then infered that such a decision is irrational. In terms of the theory developed here, "money income" is not an "attribute". It is an object, and so is "tribal dance". Let us take a village economy in which objects exchange on a non-price basis, say, during a "tribal dance". Let us call consumption attribute 1 and

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[10] If we assume that panel a) is a H-space defined above, then any subspace of a H-space is also an H-space.

non-consumption attribute 2. Then the two classes have

MI = {0} (Monetary Income)

TD = {1} (Tribal Dance)

In this setting, selecting Monetary Income cannot be termed rational. Let us formalize these proposition.

Definition 2

Let Φ: M $\rightarrow$ R^+ be a lower semicontinuous function on M. We say that:

(i) Φ is invariant under f if $\Phi(m) = 0$ implies $f(m) = m$

(ii) Φ is weakly contractive on f if for each $m \in M$, $\Phi(m) > 0$, there exists a positive integer $n(m) \in I^+$ such that $\Phi(f^n(m)) < \Phi(m)$. (I^+ is the set of positive integers.)

Part (i) tells us that the image of m under f is the same as m itself. On the other hand, part (ii) tells us that even though this image is identical to m, in characteristics, it is smaller in size. We have to prove that this shrinked image (class) is still a point of M. We will use a slightly differnet point-set theorem to prove this proposition.[11]

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[11] This proof follows James.S. W. Wong, "Mappings of Contractive Type on Abstract Spaces", Journal of Mathematical Analysis and Applications, No. 37 (1972), pp. 331-40. It is straight forward and more appropriate to mappings which shrink distances than, say the Kakutani theorem.

Theorem 3

Let M be a compact Hausdorff space and f a continuous mapping from M into itself. Suppose that there exists a non-negative lower semi-continuous function Φ which is invariant under f and weakly contractive on f, then f has a fixed point in M.

Definition 3

A point $\hat{m}$ of M is called a fixed point of a continuous mapping f of M into itself if $f(\hat{m}) = \hat{m}$.

Proof of Theorem 3

Since Φ is lower semi-continuous on the compact space M, it has to attain its minimum at some point $\hat{m} \in M$.

If $\Phi(m) = 0$ (by definitions 2 and 3, then $\hat{m}$ is a fixed point of f, otherwise there exists $(\hat{m}) \in I^+$ so that $\Phi(f^n(m)) < \Phi(\hat{m})$ which contradicts that Φ is minimum at $\hat{m}$.

What is established here is that if M is a space of all "attributes" and if any subset of M (like M itself) is an H-space, then we can obtain a smaller space composed of those minimum "attributes" from each subspace of M. The classification which allows us to obtain such shrinkage is called "shrinkage" mapping.

Definition 4

A mapping F is said to be weakly contractive if for every $m_1, m_2 \in M$, $m_1 \neq m_2$, there is a positive integer $n(m_1, m_2) \in I^+$, such that for $\rho(x, y) < \xi$,

$\rho(f^n(m_1), f^n(m_2)) < \rho(m_1, m_2)$, where ξ is some small neighborhood.

Since every class is a point set, we can legitimately permit our farmer to use "class attributes" as a basis for his decision or choice. In the next chapter we shall see how a choice rule can be constructed on these classes.

Chapter 5

CHOICE AND VALUATION IN A COMMUNAL SYSTEM

In Chapter 4, it was stated that choice can be based on the predicates possessed by objects rather than on objects themselves. Building on this proposition, this chapter develops the nature and structure of that choice.

In the African context (see Chapter 3, Section 3), there is a difference between individual farmer's choice and the communal choice. The former is derived from the later. This correspondence is rigorously constructed.

Next, it is shown that given the structure of the attribute set and the preference relation on that set, a measure structure can be derived. This measure can be termed the value of the attributes. Then choice may be (but does not have to be) based on this value.

Prices, wages, interest rates, and the like, are examples of such measures in a market economy. In Africa, where markets are not relied upon to determine standard values, all possibilities are open. These are briefly discussed.

In Chapter 6 to follow, these possibilities are examined in light of the production decisions of small farmers.

THE CHOICE: INDIVIDUAL VS. COMMUNAL

Our farmer was faced with a set of objects which he has identified by their "properties" or "attributes". In order to understand his decision-making process, one would be required to stipulate what his stand is in relation to these various attributes. A more fundamental issue may even be to know how he arrives at such a stand.

The last issue is more complicated. It involves religion, political behavior, etc. In brief, it is a cultural issue. One may then assume that "attributes" are culturally determined (qualitative), without denying the fact that many has designed some measurement tools which are used to give a quantitative representation of these properties.

To derive the stand and then the valuation of properties, a preference relation will be used.

The farmer is shown (exposed to) various attributes which he can fully identify. The process of identification is centered not upon the values taken by the "attributes" but upon the attributes themselves. We shall introduce values later in section 3 below.

He is then asked to order them in a certain specified fashion. For instance, the farmer may be asked to establish a relationship between elements in each subset of the panel b) in Figure 1, or he may be asked to

establish a relationship between the various subsets thereof. We assume that he will respond and express his stand.

It is essential to understand that at this point we have only required two things:

1. that the farmer perceives these elements as order relationship, and
2. that no outside "standard" be used to establish the relative assessments.

For simplicity we assume such a relation to be binary, that is, $\forall\ m_1, m_2, m_3 \in M$, there exists a relation (R) such that the following properties hold:

(i) $m_1\ R\ m_1$ (reflexivity)

(ii) if $m_1\ R\ m_2$ and $m_2\ R\ m_3 \Rightarrow m_1\ R\ m_3$ (transitivity)

(iii) $m_1\ R\ m_2$ and $m_2\ R\ m_1 \Rightarrow m_1\ I\ m_2$ (antisymmetry)

(iv) either $m_1\ R\ m_2$ or $m_2\ R\ m_1$ (completeness).

The fourth property may be more general and is given to avoid the situations in which no comparison exists between two attributes. This is the case for instance when "red" does not compare with "hard". Also, the use of binary relations is accepted to facilitate the analysis.

In economic theorizing, economists use the above properties and some characteristics of M to derive a

utility function.[1] Then it is shown that this utility has a maximum point or maximal value on the whole range of M. This maximal point is referred to as a "saturation point", and this point is the most efficient.[2]

Arrow's paradox is that properties (i)-(iv) do not lead to a rational evaluation of social preference which is consistent with the maximal principle. Later, Schwartz relaxed some of these assumptions, but arrived at the conclusion that: "I think the trouble is caused by the weakened Collective Rationality Requirement. This captures the minimum kernel of the traditional conception of a rational choice as a maximizing choice".[3]

If one looks at this issue from an African system of logic, there is still another cause of trouble. This lies in the sequence of preference construction. The line taken by Arrow, Schwartz and all the others is that preferences are constructed going from individual to social

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[1]Preferences are assumed continuous and convex. The utility function so derived is assumed monotonically increasing, etc. Hukukane Nikaido, Introduction to Sets and Mappings in Modern Economics, (trans. Kazuo Sato, (New York: American Elsevier Publ. Co. Inc., 1970).

[2]A decision maker must then be a maximizer in order that his decision be optimal. "A representative consumer is usually better off if consumer goods are acquired in greater quantities ....". Ibid., p. 225. With regard to the producer, the condition states that "When there is no $z \in y$ such that $y \leq z$ for a point y in Y, the process y is said to be efficient", ibid., p. 220.

[3]Schwartz, op. cit., p. 90.

preferences. This is in accordance with the "individualistic" philosophy which characterizes Wester thinking. In the analysis of African systems the sequence ought to be reversed. The following proposition is required.

Proposition 1

There exists a communal preference relation $R_s(M)$ which conforms to properties (i)-(iv).

One question which such a proposition may raise is how can one determine R_s. It is true that the Arrow political system assumes one man, one vote. This also is characteristic of Western thinking systems. I submit that proposition 1 can be easily verified. Take a farmer who has expressed his preferences as described above. Then ask him how he arrived at that relation. In the majority of cases he will refer to things such as "this is the only acceptable way we do it" or "our tradition requires us to do so", etc. This can be taken as a revelation of $R_s(M)$. It may give the impression that the decision maker has no power to think and define his own preferences. However, such an impression may, in most cases, be incorrect. The individual thinks and decides not as an isolated, independent animal, but as a socialized entity. He does things for and in the community, and the community does things for him. Then the following proposition is given.

Proposition 2

If $R_i(M)$ is the individual preference over

attributes set M, there is a social $R_s(M)$ such that $R_i(M) \in R_s(M)$.

The implications of propositions 1 and 2 are as follows for any $m_1, m_2, m_3 \in R_s$:

(i') $m_1 R_s m_2 \Rightarrow m_1 R_i m_2$

(ii') $m_1 R_s m_2$ and $m_2 R_s m_1 \Rightarrow m_1 I_s m_2$,
$\Rightarrow m_1 R_i m_2$ and $m_2 R_i m_1 \Rightarrow m_1 I_i m_2$

(iii') $m_1 R_s m_2$ and $m_2 R_s m_3 \Rightarrow m_1 R_s m_3$,
$\Rightarrow m_1 R_i m_2$ and $m_2 R_i m_3 \Rightarrow m_1 R_i m_3$

(iv') either $m_1 R_s m_2$ or $m_2 R_s m_1 \Rightarrow$ either $m_1 R_i m_2$ or $m_2 R_i m_1$

What these implications say is simply that individual preferences are a reflection of communal preferences. Communal preferences are not the same thing as the so-called "Social Preferences". Social Preferences are constructed under the assumptions of an individualistic system, which does not hold in the African case as was mentioned above.

The next characteristic of communal preferences is that they do not require maximization criteria to be the leading consideration. Even more, a maximum solution (assuming it is considered) ought not be a unique point. It might not even exist. For these reasons a simple "satisficing" solution is sufficient.

Definition 1

A solution $S \in R_s(M)$ is said to be communally "satisficing" if it belongs to the communal profile.

Definition 2

A "communal profile" is an ordered n-tuple $(R_{s1}, R_{s2} \ldots R_{sn})$ of orderings of the attribute set M.

Definition 3

An individual i's solution s_i is satisficing if it belongs to the communal satisficing solution, i.e., $s_i \in S$.

Propositions 1 and 2 and definitions (1)-(3) distinguish a "communal preference" relation from a "social preference" relation. The correspondence between "communal preferences" and "individual preferences" implied by them will be established at this point. This argument is rigorous in order to make it clear that African decision-making follows some logical patterns to be recognized and studied.

COMMUNAL PREFERENCE AND INDIVIDUAL PREFERENCES: A CORRESPONDENCE

So far, one has kept in line with Western philosophy by assuming that farmer i's preferences are his own, except for the fact that they are derived from the "communal preferences". At this point, one wants to break away from this assumption by introducing the concept of "extended family".

In the societies under investigation, the farmer derives his preferences from the "communal preference".

He also derives them in such a manner that they are "non-discriminatory" among the members of his extended family. To understand this concept, let us go back to our concept of "attributes". In African societies, not only goods have attributes but people do too.

Assume that farmer K has 20 members in his family (extended). Assume next that he can order them with an "attribute" called "closeness" (A_i). Assume also that such an ordering is binary. Then we propose the following definition:

Definition 4

Let k_i and k_j be any two members of the K family. We say that k_i and k_j are C-connected with respect to the attribute (A_i) if $\forall\, k \in K$:

$$a_i\ k_i\ R\ k_j\ I\ k_j\ R\ k_i\ I\ C\ A_i\ k_i\ R_{ij}$$

Definition 5

An extended family is a family in which the distinction of one member from another in a pair with respect to the attribute of closeness does not exist.

Theorem 1

An extended family is C-connected.

Proof

Use definition (4) and discussion preceding it to establish the result.

The reader should not find it difficult to show that extended family preferences are transitive, symmetric and

reflexive.

At this point it is necessary to establish a correspondence between a set of extended family solutions (Y) and the communal satisficing solution. To do this, the following definitions are given:

Definition 6

A set valued function F of a set $X \subset R^e$ into set $Y \subset R^m$ is called a correspondence if:

(i) it assigns to each $x \in X$ a subset $F(x) \subseteq Y$

(ii) for every $x \in X$, $F(x) \neq \phi$

Definition 7

The correspondence $F:X \to Y$ is upper hemi-continuous (U.H.C.) at $x \in X$ if for every open neighborhood ξ of $F(x)$ there exists an open neighborhood Φ of x such that $\forall z \in \Phi$, $F(z) \in \xi$.

Definition 8

The correspondence $F:X \to Y$ is called lower hemi-continuous (L.H.C.) at $x \in X$ if for every open set $M \in Y$ such that $M \cap F(x) \neq \phi$, there exists an open neighborhood of x such that $z \in \Phi$, $M \cap F(x) \neq \phi$.

Definition 9

The correspondence $F:X \to Y$ is called continuous at x if it is lower and upper hemi-continuous at X.

To understand the intuitive meaning of these definitions, it is sufficient to conceive X as the set of "communal solution attributes" and Y as the set of "extended family solution attributes". Definitions (7)-(8)

are needed to arrive at definition (9). The interesting intuitive nicety of definition 9 is that it is formulated in such a manner that a solution attribute in X is a set rather than a point. Hence F(X) does not have to be a point (if it exists).

Now to establish the correspondence principle, first take the following lemma.[4]

Lemma 1

Let $F:X \to Y$ be a correspondence from $X \subset R^l$ into $Y \subset R^m$. If F is compact valued and if F has a closed graph, then F is upper hemi-continuous.

Theorem 2

Let F be a correspondence from $X \subset R^l$ into $Y \subset R^m$. F is lower hemi-continuous if for every sequence $(x^n)_{n=1...l}$ in X converging to $x \in X$ and $y \in F(X)$ there exists a sequence $(y^n)_{n=1...m}$ converging to Y such that $y^n \in F(x^n)$ for all n=1...m.

Proof

Use lemma 1 to establish the existence of a closed graph. Then use this fact and definitions (6)-(7) to establish the result.

Theorem 2 is very important and will be referred to constantly in this study. It is by virtue of this

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[4]This lemma is not proved here. It is easy to show that if there is a sequence converging to a certain solution $x \in X$ and another converging to a certain solution $F(x) \in Y$, we can obtain that a closed graph exists.

theorem that properties (i')-(iv') are consistent with properties (i)-(iv). If x is a "communal satisficing solution" then y is an "extended family satisficing solution". An interesting property of these solutions is that they are defined over a set, so that any point of that set can do the job, i.e., can be satisficing. There is no reason why such points have to be maximal.

The existence of "communal preference" and "extended family preference" is reflected by such things as "communal work", "communal consumption", etc. to which we have referred in section 3 of Chapter 3 above. It will be given extensive attention in the remaining portions of this dissertation.

VALUE OF AN "ATTRIBUTE"

The crucial issue in the study of different economic systems is to understand how people themselves value the kind of actions they take. This analysis in the foundations of valuation has two components: first, one may be interested in deriving the existence and uniqueness of some sort of measurements or valuation to which people refer in their decision making, and, second, one may be interested in studying various procedures whereby such valuation is reached. The last concern is less important once the existence and uniqueness issues have been resolved.

In this section, we want to show that the analysis

conducted in sections (1)-(2) leads to a measurable result which possesses properties (i)-(iv) (for extended family action), and (i')-(iv') (for communal action). It is also demonstrated that the choice of the yardstick or the numerical relational structure is entirely arbitrary. Most importantly, the fact that the "value" of an action (a choice) is relative, i.e., depends on the numerical scales of measurements chosen leads us to state that the use of price in analyzing non-market economies like the one under study is unappropriate. The word "unappropriate" refers to the "usefulness" of the propositions obtained from, as well as to the "interest" of the choice of that set. In other words, the use of price systems to assess economic decisions made by small farmers is a useless exercise. The analysis using such a scheme has no interest on what these farmers are exactly doing.

In order to establish the above propositions we shall refer to the logical structure of preference relation constructed above. It was assumed that a set of "attributes" M existed, and that the farmer was capable of establishing a relationship among any three of the elements of M. Such a relation was reflexive, connected and transitive. It was also assumed that the set M was non-empty and finite. Let us call this structure "Relational Structure" and denote it by:

$[M, R]$ or $[M, \succeq]$

Next, let us assume that there exists a set of

measurement scales S over which a relation ($\geq$) can be defined such that:

$\forall\ v_1, v_2, v_3 \in S$ we have,

(1) $v_2 \geq v_1$

(2) $v_1 \geq v_2$ or $v_2 \geq v_1$

(3) $v_1 \geq v_2$, and $v_2 \geq v_3 \Rightarrow v_1 \geq v_3$

Such a structure is called "value relational structure" and will be denoted by $[S, \geq]$.

The first order of business is to establish that, in fact, the set M of "attributes" has such properties as to be measurable. Once this fact is established, then one can show that the structure $[S, \geq]$ can be used to find such a measure (value). This value relational structure can be chosen arbitrarily, provided that it possesses some specified properties. The construction of such a value is crucial to the understanding of some behavioral patterns of various economic systems. The intent is to make the analysis comprehensive and rigorous.

Definition 10

A set A is called countable if it is the range of some sequence.

The set N of natural numbers is the easiest countable set (although it is infinite or countably infinite). This may explain why economist's reasoning is essentially based on real numbers. The set of all rational

numbers is also countable.[5]

Theorem 3

The set M of "attributes" with the relation R on it is a countable set.

Proof

There is a last element in N, say $y \in N$. The set of y in N for which the set $\{x \in N: x < y\}$ is uncountable, is a non-empty set, since it contains the last element of N. Let x^* be the smallest element in this set, and let $M = \{x \in N: x < x^* \text{ or } x^* = x\}$. Then M is countable.

By assumption, we have held that M was finite and non-empty. Therefore, the set of "attributes" is finitely countable. The next step is to construct some kind of measures which will allow us to count that set.

Definition 11

The length, L(I), of an interval I is defined to be the difference of the endpoints of that interval.

The concept of length can very easily be extended to more complicated sets. For instance, one can define the "length" of an open set to be the sum of the lengths of the open intervals of which it is composed. It is better

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[5]The following propositions follow immediately from set theory and will be assumed:

(i) Every subset of a countable set is countable.

(ii) If A is a countable set, then the set of all finite sequences from A is also countable.

(iii) The union of a countable collection of countable sets is countable.

to keep this analysis simple and to avoid the more complicated cases.

The concept of length is an example of a set function which will be called "measure" in the analysis below. This function will be the measure on the set M of "attributes" and this measure will be interpreted as a value of each attribute.

Definition 12

A measure mE is a set function which assigns a value to each set E in some collection of sets. This measure has the following properties:

(i) mE is defined for each set E of values,[6]

(ii) for an interval I, mI = L(I)

(iii) if $[E_n]$ is a sequence of disjoint sets (for which m is defined), $m(\cup E_n) = \Sigma_m E_n$

(iv) m is translation invariant, that is, if E is a set for which m is defined and if E + y is the set $\{x + y: x \in E\}$ obtained by replacing each point E by the point x + y, then $m(E + y) = mE$.

These properties have the following intuitive

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[6]The set of values is normally called "real number set", i.e., (R). This condition is not specifically stated because the choice of that set is arbitrary. For a comprehensive discussion of these properties, see H. L. Royden, Real Analysis (2d ed.; London: The Macmillan Company, 1968).

meaning: property (i) is a simple requirement that a set of "attributes" in M have a well defined measure. Property (ii) says that the measure of an interval I is simply the length of that interval (length as given in definition 11). Property (iii) establishes the additivity principle when the sequence $[E_n]$ is composed of disjoint sets. Finally, property (iv) accepts the possibility of a transformation such that the measure remains the same, i.e., the measure is not sensitive to this kind of transformation.[7]

It should be emphasized that properties given in definition M are ideal. It is practically impossible to construct a set function having all four of these properties, and in fact "it is not known whether there is a set of functions satisfying the first three properties".[8] For simplicity let us weaken property (i) and retain (ii-iv). This leaves us with the requirement that m be a countably additive measure, i.e., it is a nonnegative function (on the set of real numbers) such that $M(\cup E_n) = \Sigma_m E_n$ for each sequence $[E_n]$ of disjoint sets in M.

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[7] Besides this "interval scale transformation", some other transformations are admissible in the theory of measurement: ratio, log-interval, and ordinal transformations. For an illustration of these cases see Krantz, et. al., op. cit., pp. 10-13.

[8] H. L. Royden, op. cit., p. 53.

Definition 12

A collection, δ of subsets of X is called an algebra of sets if it has the following properties:

(a) $\forall A, B \in X \Rightarrow A \cup B \in X$

(b) $\forall A \in X \Rightarrow \bar{A} \in X$ (where $\bar{A}$ is the complement of A)

(c) $\forall A, B \in X \Rightarrow A \cap B \in X$

Properties (a)-(c) follow simply from set theory and operations on the sets. Their meaning is intuitively clear and needs no interpretation.

Definition 13

An algebra δ of sets is called a σ-algebra, if every union of a countable collection of sets in δ is again in δ.

What definition 13 says is that if $A_i \in \delta$ is a sequence of sets, the $\bigcup_{i=1}^{\infty} A_i$ must again be in δ. From De Morgan's law (property (c) above), it follows that the intersection of a countable collection of sets in δ is again in δ.

Theorem 4

The set M of attributes is a σ-algebra.

Proof

M was said to be a T_1-space (definition 1, section 2). Use any two subsets of M to show that the set M is an algebra. The fact that these subsets are disjoint and that M is countable (Theorem 3, this section) can be used to establish the desired

result.

The next step is then to establish that M is a measurable set.[9] This is not intuitively clear. We may use the definition in footnote 9 to infer that clearly the set of real numbers is measurable. But this does not prove that our set M is measurable in the same way as the real numbers are.

Definition 14

A collection β of Borel sets is the smallest σ-algebra which contains all of the open sets. β is a collection of sets each of which can be obtained by a countable number of operations, starting from open sets. Each operation consists of taking unions, intersections, or complements. As such a collection, β is the smallest σ-ring which contains all open sets.

Theorem 5

Every Borel set is measurable. In particular, each open set and each closed set is measurable.

Proof

Construct an open interval $(a, b) = (-\infty, b)$ (a, ∞), by definition of measure, and the fact that the collection of measurable sets is a σ-algebra, establish that such interval is measurable.

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[9] A set E is said to be measurable if for each set A we have $m^*A = m^*(A \cap E) + m^*(A \cap \bar{E})$. That is, for each A, we have $m^*A \geq m^*(A \cap E) + m^*(A \cap \bar{E})$.

Each open set is the union of a countable number of open intervals and so must be measurable. Thus the collection of measurable sets being a σ-algebra which contains the open sets, it must also contain the family β of Borel sets because β is the smallest σ-algebra containing the open sets.[10]

With this background, one can return to the set of "attributes" M. Definitions (10)-(15), and theorems (3)-(5), as well as the discussions of section 2 permit us to state the following important theorem.

Theorem 6

The set of attributes M is a measurable set.

The proof if this theorem is obvious from the above definitions and theorems. It is not given here.

The crucial result established is that under the given system of reasoning the set M of attributes can be measured. The existence and uniqueness of such measures is the next step. This can be shown using two important theorems: The existence theorem and the uniqueness theorem. The former asserts that if M has the structural properties that have been analyzed and if farmer's preferences are well behaved (communal and/or extended families), then the possibility of attaching a value to

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[10] Another way of proving this theorem was to note the fact that the collection β of measurable sets is a σ-algebra containing each interval of the form (a, ∞), then establish that β is the smallest σ-algebra containing all such intervals.

each of the actions on M is established. On the other hand, the latter asserts that this value is invariant under certain transformations. These theorems will be stated without proof because by virtue of the detailed discussions given above, their proof has become obvious.[11]

Theorem 7

If [M, R] is a relational structure with properties (i)-(iv), and [S, $\geq$] is a "value relational structure" with properties (1)-(3), then there exists a value function, V such that $\forall x_1, x_2 \in M$:

$$x_1 \; R \; x_2 \iff v(x_1) \geq v(x_2)$$

Intuitively, the theorem tells us that since M is measurable there exists a set of measures, called "values" which can be used as a yardstick in the measurement of the elements of M. The structure [S, $\geq$], by its properties, can be accepted as such a set of measures.

Theorem 8

If v is a value-function on M, v' is another value-function on M with the same properties; if there exists a strictly increasing value-function w, with domain and range equal to S, such that

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[11] For those readers interested in the subject, we suggest the work of Krantz, et. al., op. cit., Chapter 1. Especially definitions (1)-(5) and Theorems 1 and 2. The proof of these theorems are very detailed and follow a slightly different method from the one used here. But, intuitively, the implications are the same.

$\forall x_i \in M$:

$$v'(x_i) = w\ (v(x_i))$$

Theorem 8 establishes the invariant property of the value-function. That is, the value of any element $x_i \in M$ is not changed by a transformation if the latter is among the admissible transformations (footnote 7).

The fundamental issue raised by theorems (7)-(8) is that of determining which of the two structures [M, R] or [S, $\succeq$] is essential. As the reader may have realized, structure [M, R] is the fundamental or experimental structure. On the other hand, structure [S, $\succeq$] is absolutely arbitrary, i.e., once the relational structure has been well established, the choice of the value-structure is arbitrary. The following section addresses itself to this issue.

ON THE CHOICE OF THE VALUE_STRUCTURE

In elementary macro theory, the student is often told that "money is a unit of measure" as well as a "store of value". In elementary micro theory, this same student is told that "preferences can be represented by a utility function" which may be measurable. As he advances in his economic reasoning, he will be told that "the logical results and proposition in micro analysis do not depend on the measurability of the utility indicator" and, a little further, that "the results of the demand theory can be derived without assuming any utility function", and proof

will be given to him later to the effect that "preferences are revealed in the marlets". By studying consumer's behavior at successively higher prices, he can derive consumer preferences. In other words, "prices" and "quantity demanded" have become units of measure for "consumer preferences".

From the producer's viewpoint, "prices" (input as well as output prices) and "quantity sold" are sufficient to measure the value of his actions. Profit, which is essentially a price-quantity relationship, is the indicator or the yardstick for the evaluation of the business worthiness.

The theory of "revealed preference" combined with that of profit maximization establishes what is here called "Market Fundamentalism". Both consumer and producer use the same yardstick to measure their action: <u>the market value relational structure</u>. This is, according to this theory, the acceptable [S, $\succeq$] structure. What is proposed here is as follows: given a relational structure [X, R] for both the consumer and the producer, there exists a market relationship structure [P, $\succeq$] such that $\forall\ x_i, x_j \in X$:

(1) $v(x_i) = p_i x_i$ is the value of x_i

(2) $v(x_i) \succeq v(x_j) \iff p_i x_i \succeq p_j x_j$

One can construct, by means of V, the same conditions as (i-iv) and hence derive preferences from market behavior.

It is interesting to note that [P, $\succeq$] is assumed to be a perfect competitive structure with the implication

that P is given as any real number set is given. Therefore, the market structure as valuation structure is very similar to a "real number structure". This is why, among other reasons, economists have so much love for perfect competition in proving more advanced theorems in micro-economics.

However, there is still a question to be answered. What happens to money as a "unit of measure" if the market structure [P, $\geq$] solves all the valuation issues? Economists have struggled with the issue for a long time. Keynes has proposed that "money is a store" of value so that for a consumer who does not use market value-relation structure, he can use money as a measure of his "wealth", then the structure looks like [M, $\geq$] so that for two periods of time t_1 and t_2:

$$v(w_t) = M_t$$

$$v(w_1) \geq v(w_2) \iff M_1 \geq M_2$$

There is a logical relationship between this formulation of the valuation structure and Keynes' propositions on the macro economic structure and policies. The consumption function does not use market relation and hence, policies to affect it can be formulated outside the market system.[12]

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[12]This point is never mentioned in the literature. It is introduced here to show how the value-relational structure adopted affects the kind of theoretical conclusions one can reach.

Later, Patinkin attempted to reconcile Keynes and the price economists. He called this "real balance or wealth effect" which, in terms of our theory here, says simply that both market price (including interest rate) and non-price valuation systems are used. But, the main conclusion was simply that non-market value can be transformed and translated in market value (price). That is, Theorem 8 can be applied to non-market value, and the ratio transformation is an admissible transformation. Hence, the Patinkin value relational structure is $[\frac{M}{P}, \geq]$ or else $[\frac{W}{P}, \geq]$ where M stands for money assets, and W stands for wealth in general. This scheme introduces then a "financial market" very identical to the "commodity" and "labor" markets.

The decision valuation becomes then a valuation relative to a price system. "The value of an action relative to the price system p is the inner product $p \cdot a$."[13] (Underlined by us.) In this context, the price p_i of the i^{th} commodity is "a real number interpreted as the amount paid (in the sense of 2:1) initially by (resp. to) the agent who commits himself to accept (resp. to make)

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[13] See Debreu, op. cit., p. 100. On the next page, Debreu says that, "An action x_i of the i^{th} consumer is called a consumption (inputs are positive and outputs negative)". Ibid., p. 101. Using the definition in the text, we get the value of a consumption to be $p \cdot x_i$ which is "relative to the price system."

delivery of one unit of that commodity."[14]

Since African village economies are not market economies, the value-relational structure is not $[P, \geq]$ or $[\frac{M}{P}, \geq]$ or $[\frac{W}{P}, \geq]$. It is even more appropriate to generalize that there is no such a system which exclusively uses these three structures. But since our concern is not with these general cases, we shall explore the African case.

VALUATION IN AFRICAN MANAGEMENT SYSTEMS

The most difficult problem in African management systems stems from the fact that no one measurement exists as a common denominator for all attributes, and actions based on them. Rather, there is a system of measurements from which selection is made depending on the type of attribute (or object) at hand.

For simplicity, one can divide actions of African farmers into two categories: Those actions which concern the primary drives versus those concerning secondary drives. A primary drive refers to the motivation for survival, while the secondary drive refers to achievement motivations.

Survival and security are examples of the primary drive. Profit maximization is an example of the secondary or motivational drive. In a market system, profit maximization is assumed to satisfy both primary and secondary

[14] Ibid., p. 100.

drives. Hence the measurement structure makes use of price as a common denominator in evaluating all actions.[15]

In Africa, survival and security drives are assessed by means of communal measures. For instance, two actions A and B can be compared on the basis of the number of peoples to benefit from them. In this case, we can say that:

$$v(A) \geq v(B) \iff k_i A \geq k_j B$$

where $k_i > k_j$ and k indicates the number of peoples who would benefit from a given action.

The same thing holds true for both survival and security drives provided that the framework is communal. In this case, one can encounter cases where the market rule would be incompatible with the communal rule in the sense that a communal rule may give rise to a choice which is irrational from the market point of view. Before one makes any statement on such a choice the knowledge of the rule issued is necessary.

Motivational or secondary drives are based on a social system's values as was shown in Chapter 3. In Africa, many motivational drives exist which are compatible with the communal system. For instance, one can be

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[15]The term price refers to commodity price, interest rate, rent, wage, etc. As was pointed out above, economic analysis has always attempted to construct a price for every good and service in order to have a standardized measure.

motivated to conceive one's achievement in terms of the ability to practice communal values. In this case, ability to practice communal values. In this case, ability to analyze and teach ancestor's values can be used as a measure of achievement.

In some cases, for consistency, prices were used as measurement devices. But such prices were integrated into the communal framework by making them determined by either the chief or his delegates.[16] In this sense, price is a social phenomenon rather than a given and impersonal datum. Even in this case, if there is a conflict between the price rule and the communal rule, most farmers will choose the communal rule. As in the case of primary drives, before any statement can be made about these rules, one must know them. Neither of them can be claimed to be more rational than the other in the absolute sense.

Some other measures are found in the farmer's decision making such as:

- historical data
- background data
- etc.

Also, when survival drive is associated with the

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[16]Price negotiations are very intense in the African context. This makes prices very unpredictable for decision making purposes. Sometimes, even when the price is fixed by a chief's rule, this rule is very flexible and can change at any time of the market day.

availability of food or any other commodities, decisions are made in quantitative terms such as the number of baskets of maize, the weight of a cassava flower basket, etc. In this case, real numbers can be attached to these quantities and a choice made on them. But, a rationality statement based on quantitative measurement may prove incompatible with the communal rationality rule. In this case, the concept of rationality becomes relative.

SUMMARY

In this chapter, individual and communal preferences and choice were established. It was shown that, in a communal framework extended family preferences and choice are derived from communal preferences and choice by means of the correspondence principle.

Given the specifications of the attribute set M, it was shown that preferences and choices based on these preferences were measurable. African farmers therefore possess a certain value-structure from which measurements are selected to assess various actions and to choose among them.

The most frustrating analytical problem of these African systems stems from the fact that there exists no unique standard of measures. Each decision is assessed with different measures. Probably because of this complicated system of measurements, economists have the tendency to use price as the measurement standard. The weakness of

this lies in the fact that the communal rule is completely ignored. Also, the system is not a market system.

For future analysis, this problem of measurement is crucial and deserves a substantial amount of research work. What we have accomplished here was to recognize that such a measurement system exists and that farmers refer to it in their decision making.

In the next chapter, it is shown that production activities are derived from the basic attributes as analyzed in this chapter. Also, it will be proven that the communal framework leads to a Pareto optimal solution in the village system.

Chapter 6

THE PROCESS OF ATTRIBUTE PRODUCTION AND FARM MANAGEMENT SYSTEMS

THE CONCEPT OF PRODUCTION

Here, an attempt is made to conceptualize the process of production in terms of objects and their characteristics as developed in Chapter 4. It is hoped that such an approach will be helpful in understanding both the nature of the production activity and the attendant problems encountered.

Following the argument developed in Chapter 4, it is postulated that objects can be created according to a set of specified properties and their values (measurements). Hence, by explicitly defining some characteristics and their values, it becomes possible to understand the reference to which every society turns in making its production decisions. The following axiom is proposed:

Axiom 1: An object $x_i \in X$ is said to be desirable if the following holds:

$\forall\, v \in \prod_{i=1}^{V} M$ there exists an object $x_i \in X$ such that:

$$x = \{x \mid v(x) = v(m)\}$$

where V is the vector of values and M is the set of attributes, and $m \in M$. The Cartesian product

$V \times M$ defines the attribute-value set.[1]

What Axiom 1 establishes is simply that to be desired an object x has to belong to the community reference system. The latter is composed of an attribute set M and a measurement structure V.

Once an object is desirable, the community will attempt to create or produce it, i.e., produce the characteristics that are found acceptable. In order to do this, this community has to consume some existing characteristics in such combination that the creation of $x_i \in X$ results from these characteristics. When the community possesses sufficient characteristics to create a desirable object x_i then x_i is producible. The following axiom is proposed:

Axiom 2: An object $x_i \in X$ is producible if it is desirable, and there exists a set of objects Y having properties M' and values V such that:[2]

(i) $v(y) = v(m)$

(ii) $x_i = T(y)$

Axiom 2 establishes the existence of those objects generally referred to as inputs. But it is obvious from

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[1] See proposition 2, section 2 in Chapter 4.

[2] In linear production systems, T is equivalent to the matrix A in the Leontief types of models. In these models, A is the matrix of input/output coefficients all of which are expressed in quantitative magnitudes. This leaves the question of how these quantities were decided upon unanswered.

it that what is important is not so much the quantity of those inputs, but their characteristics (or quality), and the ability of the system to recognize and rationalize these attributes. To do so, the community makes use of its reference system.

Also Axiom 2 gives the transformation process which consumes attributes from y to create attributes in x.

One central problem in the theory of production is to determine the rule by which the quantities of x and y are determined. Also, if T is a matrix of some coefficients, the magnitude of these coefficients have to be explained.

If one assumes that attributes are given so that a measurement yardstick can be utilized to represent them, a rule can be found in quantitative terms. For instance, one may say that for a given set Y of inputs and the transformation T, object $x_i \in X$ is determined such that it is the maximum obtainable. This quantity can be called "efficient":

> "Speaking still in terms of one product of given quality, an efficient manager chooses that combination of productive activities which maximizes the amount produced for given available quantities of factors which have given qualitative characteristics."[3]

This rule has two essentail characteristics: first

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[3]Tjalling C. Koopmans, "Analysis of Production as an Efficient Combination of Activity", Activity Analysis of Production and Allocation, ed. T. C. Koopmans (New Haven and London: Yale University Press, 1971), p. 34.

it is made in terms of quantities of x's by holding y's, T and their predicates constant. Second, it is normative in nature:

> "Since it defines the value of the function as the result of a maximizing or (more generally) an economizing choice, this concept is in the first place normative."[4]

By restricting itself to quantitative magnitudes and a maximization principle, the decision rule makes it difficult to analyze decisions based on non-quantitative attributes as well as those which are not based on maximization. For instance, a farmer may decide on the production of corn adapting himself to weather variations, in this case weather attributes as seen by the farmer may not be quantitatively measured. Also an attribute called maximum adaptation may not be relevant to this decision.

Farmers' decisions, in this study, are based upon attributes of both outputs and inputs. These attributes are seen in relation to some wants which may or may not be quantifiable. In this context, rationality of a decision has to be related to the particular attribute which the manager refers to in his day-to-day decisions.

Also, with respect to T, it is only when all predicates are quantifiable that it will take quantitative dimensions. Otherwise, T can be a simple sequence of tasks, the combination of which yields a particular result.

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[4] Ibid.

It also takes various forms depending upon its stage in the sequence. The following example illustrates the point.

A farmer decides to cultivate rice because of an attribute called "crude protein" possessed by the crop. His labor possesses an attribute called "energy". The weather gives him an attribute called "wetness". On the basis of Axioms 1 and 2, attribute "crude protein" makes rice a desirable object, attributes "energy" and "wetness" make labor and weather desirable objects for consumption in the creation of the object, rice. Assume now that this process of creation is a sequence including cultivation, planting, weeding and harvesting. Table 1 illustrates the variation in T attributable to the stages in the sequence.[5] Here, E is the amount of energy consumed in each activity in terms of calories per kilogram of body weight per hour.

In table 2, not only is T sensitive to the sequence, but also to the system of farming: shifting versus semi-permanent. In the shifting cultivation method, the ratio of energy consumption over wetness (E/10) varies from 1.9 to 3.1 while in the semi-permanent cultivation method it goes from 1.6 to 3.7.

The decision to produce "crude protein" henceforth

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[5] We have assumed that the rate of wetness was constant at 10.0 points. The table is computed using some information from Table 29 of M. P. Collison, Farm Management in Peasant Agriculture: A Handbook for Rural Development Planning in Africa (New York: Praeger Publ. Co., 1972), p. 144.

involves not only the labor allocation decision, but also the choice of T. Various criteria can be used to decide on its efficiency.

Table 2

Energy Allocation in a Production Sequence for Rice (Toro Village-Uganda)

	Shifting Cultivation		Semi-Permanent Cultivation	
Farming Sequence	E	T=E/10	E	T=E/10
Cultivation	31	3.1	19	1.9
Planting	19	1.9	16	1.6
Weeding	20	2.0	32	3.2
Harvesting	30	3.0	37	3.7

For instance, the difference between T in cultivation and harvesting can be used as criterion for choosing between producing rice in a shifting or semi-permanent system. But a decision made on this basis does not imply that the desired predicates, "crude protein" will be maximum in the chosen system.

In summary, production is a process by which attributes are consumed in the creation of other attributes. As such, a decision rule ought to specify the attribute set to which it applies. Allocation of objects to the production of desired attributes can be understood only if a system approach is taken. The next section takes up this approach.

THE CONCEPT OF A SYSTEM

The concept of a system can be approached from the engineering viewpoint or from the business viewpoint.[6] To make the analysis simple, we will proceed from a combination of both viewpoints.

Definition

A comprehensive definition of a system must take into consideration six elements:

- the state of the system (S)
- the set of inputs of the system (P)
- the set of functions defined over inputs (F)
- the set of values defined in the state (M)
- the time set ($\bar{T}$) ($\bar{T}$ is not to be confused with the transformation referred to above)
- the dynamic mapping which values the behavior of (M) through time (δ).

Rather than use this approach, one can make the matter easier if only three of these factors are considered: input terminals, output terminals and the state or internal

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[6] As an illustration of these two views see A. Wayne Wymore and Stanford L. Optiner respectively. A. W. Wymore, A Mathematical Theory of Systems Engineering: the Elements (New York: John Wiley, 1967). Stanford Optiner, Systems Analysis for Business and Industrial Problem Solving (New York: Prentice Hall, 1965).

operation of the system.[7] Symbolically, a system can be represented by the following:

(1) $P(t) = (f_1(t), f_2(t), \ldots, f_n(t))$ the set of input functions at time t.

(2) $Q(t) = (q_1(t), q_2(t), \ldots, q_m(t))$ the set of output states at time t.

(3) $Y(t) = (x_1(t), x_2(t), \ldots, x_n(t), q_1(t), q_2(t), \ldots, q_m(t))$ as the state of the system without operation. Where $x_i(t) \in P$, and $q_i(t) \in Q$.

(4) $\delta(f, t)\ (y(o)) = y(t)$ is the state of the system in operation.

This idea is illustrated in Figure 2 (page 132).

As can be seen, not only does the system behavior depend on input and output functions, it also depends on the operations (the center box of Figure 2). Hence, a more applied concept of a system conveys the idea of a set of elements (inputs, outputs) plus an operation on these elements. These sets can be represented either by some quantities or simply, they may be non-quantitative attributes.

To get from the above notion to the subject matter of the study, we introduce the concept of subsystem and subsystem coupling as well as that of control.

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[7] This internal operation is equivalent to what was designated as T in the first section of this chapter. Input and output terminals can be thought of as attributes or quantities representing these attributes.

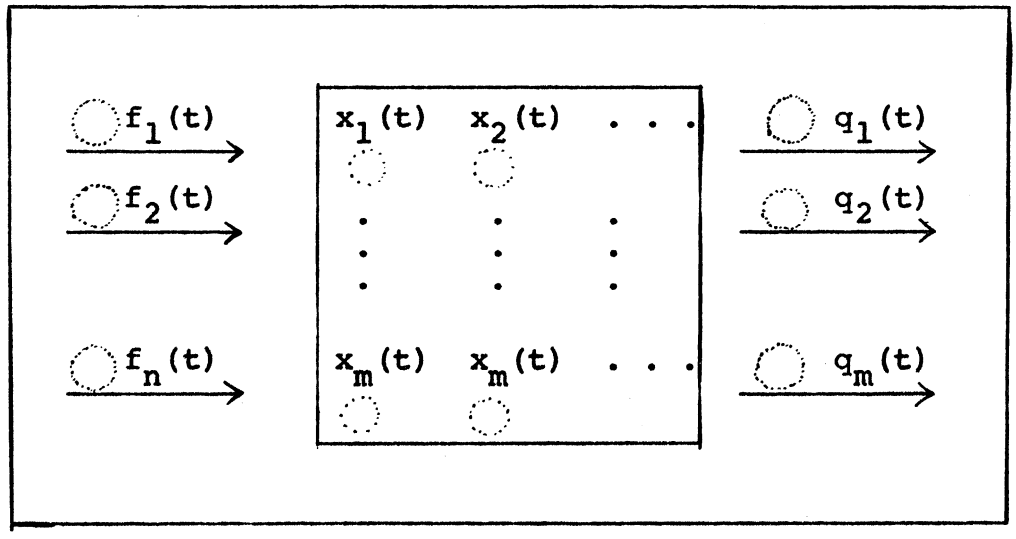

Figure 2

System Representation

Subsystem and Subsystem Coupling

Using either the symbolic definition of the system or its representation, the idea of a subsystem is readily understood. It simply refers to the fact that a system can be divided into two or more small systems such that:

if $z_1, z_2, \ldots \varepsilon Z$

then $z_1 \cup z_2 \ldots \cup z_n = Z$

where z_i's are subsets of the system Z.

Next, let us imagine that, after a system has been divided into its subsystems, one is interested in defining some kind of mapping (function) between these subsystems. This is the question of deciding upon what types of existing subsystems can be coupled and how they shall be coupled. This concept of system design and system coupling is well known in engineering design, but social scientists

have only begun to explore its implication for social systems design.[8]

The determination of a system couple within itself requires four steps:

- specification of the original system Z
- specification of a set P of input "terminals"
- specification of the subset $P_i \in P$ to be tied up by the couple
- specification of the output function $q_i \in Q$ which will provide the input values to the coupled terminals.[9]

The idea of subsystem and coupling is very intuitive, and is illustrated in Figure 3 for a system Z which is divided into z_1 and z_2 according to the definition in the above paragraph.

As can easily be seen ξ_{11} ties the outputs of the subsystem z_1 as inputs in that system. On the other hand, function ξ_{12} ties outputs from subsystem z_1 as inputs in subsystem z_2. Similarly, function ξ_{21} ties up outputs of subsystem z_2 to be used as inputs in subsystem z_1.

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[8]See Optiner, op. cit.

[9]Here we have limited ourselves to a case of 1-system couple which is accomplished within the system itself in such a manner that only the values of inputs at time $\bar{T}$ determine the behavior of the system. This idea is different from two other related ideas: "n-couple system" which concerns the coupling systems and the "cascade couple" which conveys the connotation of a coupling recipe for a system outside itself.

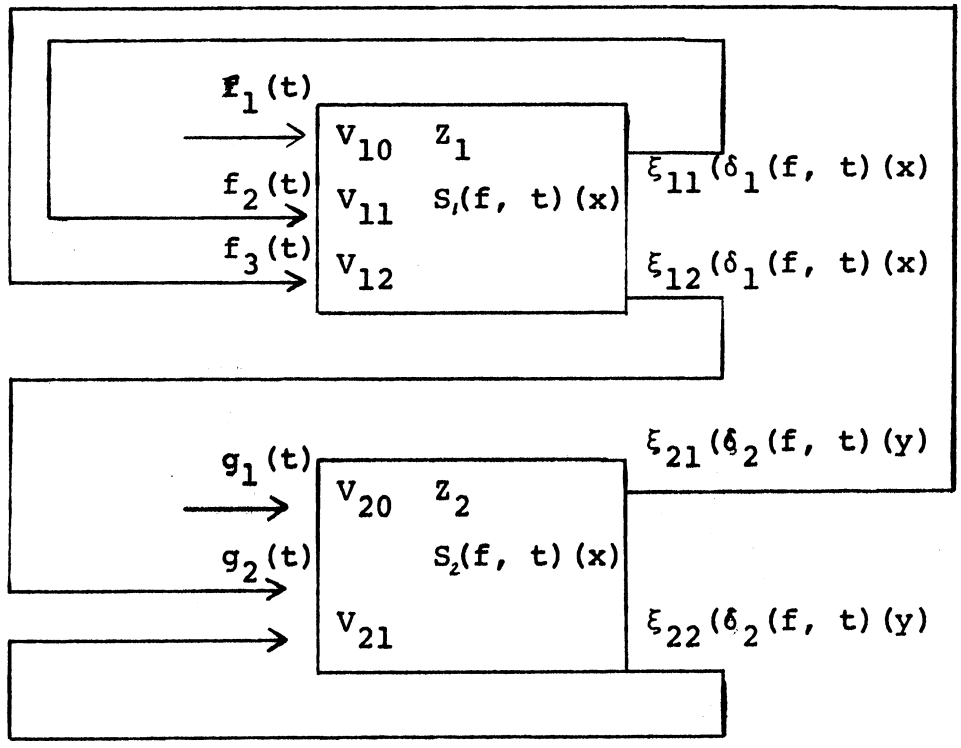

Figure 3

Subsystems and System Coupling

For convenience these functions will be called "feedback functions". When the feedback is a function illustrated by ξ_{11} or ξ_{22} it will be called a "feedback loop" while a case such as ξ_{12} or ξ_{21} will be called an "intersystem feedback".

Control Function

To complete the construction, the concept of "control function" must be introduced. A control is a subsystem function which compares output with a criteria, i.e., a function which maps the actual state into the

monitored or designed state. When feasible, the control function corrects the discrepancy between the desired state and the actual state.

For instance, assume that the desired state can be summed up and simply represented by the total output of the system. A system designer (say an economic planner) will specify not only the state of the system, but also its feedback and control functions. That this is the procedure followed in linear programming techniques can be made clear simply by specifying the conditions under which a system is controllable.

Theorem 1

Let Z be a system as defined above and let $Z^* = \text{Dual}\ (Z, Q, \xi)$ where ξ is a set of output functions for Z, with values in Q. Assume Q is non-empty and closed in (Z). Then for each pair y_i, $\xi_i \in \xi$, y_i is determined by ξ_i if every state in Z^* is reachable from every other state in Z^*.[10]

Theorem 1 establishes that if the system Z has a dual and if this dual fulfills certain conditions, the dual can be used as a control device between the actual state and the criterion for the desired or "monitored"

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[10] To prove this theorem, it is sufficient to show that for some output state $\xi^* = G$, we can define a $f \in F^*$ and $t \in T^*$ such that $y_i = \xi^* (f, t) (\xi)$. This is so if $y(x) = (\delta^* (f, t) (\xi) (x) \rightarrow y_i$ is determined by ξ.

state.[11]

Additivity Principle for Optimization

Let us assume that the monitored desired state is some optimum. Then the system designer or the economic planner, or simply the farm manager will specify his system, its feedback loops and intersystem feedback in such a way that it is controllable in the sense given above.

Assume next that the system is subdivided into two subsystems each of which produces a given output by means of given inputs and some operations. Next, assume also that the control function can be subdivided into two subfunctions. If the two subsystems are additive and independent, the following can be postulated.

Theorem 2

If Z_1, Z_2 ϵ Z and F_1, F_2 ϵ F, a point y ϵ Z is a satisficing point if a point y_i is a "satisficing" point in Z_1, and a point y_2 is satisficing in Z_2 such that:

$$y = y_1 + y_2.$$

The proof of this theorem is straight-forward, and

[11]This es exactly what was attempted in section 1 of this chapter by establishing some correspondence between input characteristics and output characteristics then a rule for choosing among various correspondences.

is illustrated in Figure 4 for the case of two subsystems.[12]

This theorem is used by Wymore, in the above mentioned work, in the context of the activity analysis with a price system. Our analysis runs in terms of physical magnitudes or characteristics and does not depend on prices. Prices can be introduced as a measurement device. However, in a non-price system such as the one under consideration, price has limited significance even as a measurement device, and much less as a decision making variable.

The following example illustrates the importance of Theorems 1 and 2, in the African system. Suppose that an African farmer specifies his system in two subsystems: an agricultural subsystem and a non-agricultural subsystem.

Next, he defines his control or monitored function as a satisficing rather than maximum output. Theorem 1 tells us that both agricultural and non-agricultural "satisficing" points depend unequally upon the state of his inputs. If the only limiting input is his effort (labor), both physical and mental, it follows that agricultural and non-agricultural satisficing points are uniquely determined by the state of labor.

Finally, Theorem 2 tells us that total output

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[12] We are using the term "satisficing" rather than maximum to avoid a decision rule whose rationality is limited to a maximization principle.

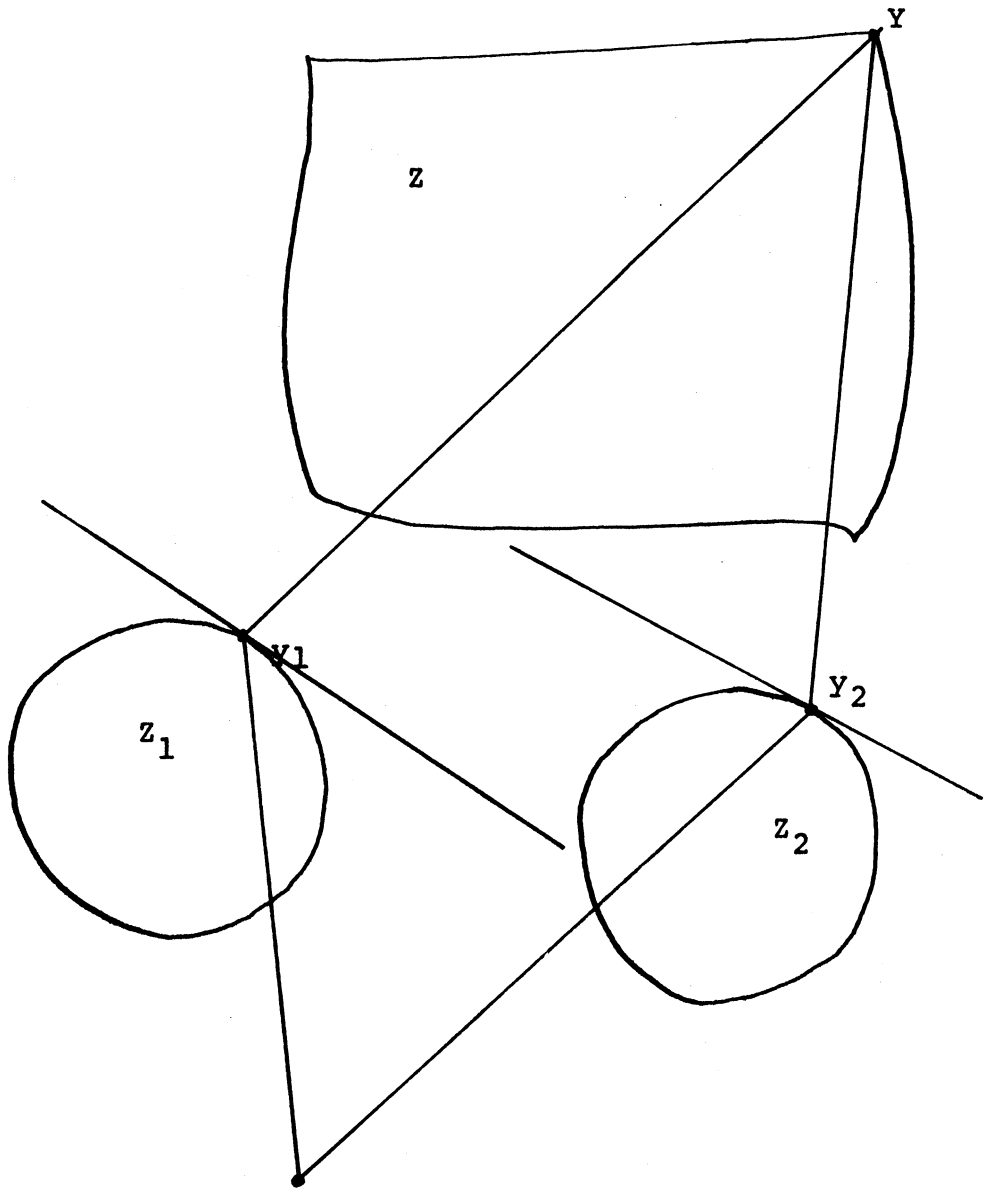

Figure 4

Subsystem and System Optimal Points

(agricultural and non-agricultural) is satisficing if its components are satisficing. If this criteria can be used to make a judgment about rationality, part-time farming is rational. Using only agricultural or cash-crop output to derive statements about rationality, as is done in various studies analyzed in the first part of this dissertation, is inadequate. To paraphrase Galbraith, "the boundaries of a subject matter are conventional and artificial; none should use them as an excuse for exclusing the important."[13]

MAIN CHARACTERISTICS OF THE AFRICAN FARMING SYSTEM

Many writers have elegantly shown that the African farming system is characterized by the small size of the holding. Others have emphasized isolation, lack of exchange, non-specialization, little deliberate production, etc.

For our purposes, the most operational characteristics of this farming system are:

1. It is part-time farming.
2. It is multiproduct and multiactivity farming.
3. Exchange takes place without markets in the Western sense.

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[13]John Kenneth Galbraith, The New Industrial State (2d ed.; New York: New American Library, 1971), p. 138.

4. Market prices are not considered to be good signals of the state of the society (and its economy).
5. There is "social control" of an individual manager's decisions. This control determines the signals of the state of the society.
6. The existence of both "personal" use and "social" use of inputs; "personal" and "social" production; and "personal" and "social" consumption.

The above characteristics convey the idea similar to that conveyed by the multiplant multiproducts firms of the modern American industrial system. There is a "social direction" (characteristic 5), and each manager is simply a "decentralized direction". Characteristic 4 is similar to the fact that prices are not imposed upon the big firms by the markets. Also, it is similar to the new awareness by the big firms that prices are not the most important decision variable of the manager. Promotion, reputation, product and brand name development, etc. are much more important attributes. More importantly, from the African farm point of view, the price may simply not exist.

Characteristic 6 points also to a similar fact that in big firms there exists a continuous inter-firm exchange of goods, factors and services in order to maintain the balance of the whole system. Except for transportation cost this exchange is free.

Characteristics 1 and 2 are more obvious than any other. The most distinguishing is 3 where exchange takes place without markets and prices. What this characteristic means is that there is a physical exchange of goods and services among peoples. However, this exchange is not concluded on a price basis.

The above differance in exchange mechanisms stems from the fact that variables in the African system are not readily quantifiable. Exchange takes place according to the needs, but, the African economic system does not operate under the assumption that the satisfaction of a need must be paid for, at least not in a quantifiable magnitude.

The basic assumption in the African system appears to be that everything is a free "gift" of nature and hence must not have a price. Land is a gift of nature. Labor or man's energy is a gift of nature. Time is a gift of nature, Any combination of these inputs to produce a commodity is a "social act". Consumption is hence a consumption of "gifts": natural gift and "social act" gift.

An African expresses a very deep satisfaction at seeing his fellow consume a commodity he has given to him. It is an act of acceptance, recognition of his power to create a "gift". There is a feeling of greatness: he is a creator as the "Creator". Society owes its existence to the "Creator". A contribution of the act of creation is

of great significance, i.e., production, in the African sense, creates life and, since life has no price (quantifiable), production does not have to have a quantifiable price. It seems that this system is essentially founded upon the consumption and creation of these qualitative satisfactions.

What the above analysis shows is that the manager of a small farm does not conceive or attach a quantifiable cost to his activities because most of it is believed to be a gift. Next, he does not only manage the farm, but by the nature of his activities he also manages all the other activities which contribute to the process of "life creation" and "life management". The central direction which dictates the nature of these various activities is given by the so-called "tribe". Some authors have identified the farm unit with the tribe.[14] This is the same thing as identifying Ford Motor Company with the United States, and has very little analytical content.

As was noted above, the basic difficulty in analyzing such a system lies in the impossibility of finding a common measurement for all these various

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[14] See for example, T. J. Kennedy, op. cit. and E. K. Fisk, "Planning in a Primitive Economy: Special Problems of Popu-New Guinea", Economic Records, 38 (December, 1962). Also E. K. Fisk, "Planning in a Primitive Economy: From Pure Subsistence to the Production of a Market Surplus", Am. Econ. Rev., 40 (June, 1964).

activities so as to make some efficiency statements about the system possible.

In order to understand the working of these farming methods, one has to approach the system as a whole. Production of crops is only a small part of the "life creating" activities of the farmer. In fact, cultivation is simply a part-time occupation and the time given to it is proportional to the social need for it.

Here, one has a system of labor allocation among various (but not necessarily alternative) activities. The objective of this allocation is life creation and life management. Labor can be measured but life creation cannot (by assumption). If, however, life becomes an input in labor creation, it is therefore very difficult to measure the labor force.

To make this basic difference in systems motivation, one can broadly state that the African system has the last two motivations of the Galbraithian system: identification first and then adaptation.[15]

SELECTED EVIDENCE OF BEHAVIORAL PATTERNS OF AFRICAN FARMERS

This section sets out to apply the concepts developed in Chapters 4 and 5 to some selected cases. In

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[15]John K. Galbraith, op. cit., cited by Charles L. Hessian, John Kenneth Galbraith and His Critics (New York: New American Library, 1972), p. 144.

the absence of a market system, it is still possible to research the motivational attributes which dictate the kind of decisions these farmers make. It is emphasized that in such a non-market system, the process of activity evaluation is extremely complicated by the diversity of motivations to be satisfied. However, once a set of motivations is selected, it can be shown that a given decision is rational relative to the given motivation set. In fact, the rationality of any decision ought to be relative to the criteria chosen.

Labor Allocation in a Multi-Activity Farming System

It was stated in previous chapters that the limiting factor in the African farming system is labor. The farmer must allocate this limiting factor such as to produce all the desired attributes. On-farm activity is simply part of this process of attribute production. The coupling of on-farm and off-farm activities is important if the farming profession is to be an integral part of the system.[16]

Table 3 illustrates this coupling by means of labor allocation on off-farm activities for 12 farms in Toro

[16] As was shown in Section 2 of this chapter, it is essential that the coupling of subsystems be such that the total system remains integrated and dynamic. In section 3 of this chapter, it was emphasized that farming is a part-time activity to be understood only in the context of the other activities such as village administration, construction work, etc. Table 3 gives some evidence of the proposition.

Time Allocation in African Farming System: Off-Farm Attributes
(Hours per Week)

Types of Activities	Farmer Male Householder	Off-Farm Male Householder	Female Householder	Wife	Other Men	Other Women	Boys (10-15)	Girls (10-15)	Types of Attributes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Neighbors, Visitors	10.9	2.8	5.1	5.2	5.7	19.6	2.9	1.7	--strength of framework of living
Off-Farm Work	1.8	63.0	--	2.0	32.0	3.4	--	--	--any social or economic attribute e.g. village administration
Trade	5.0	2.1	1.9	.7	11.0	.3	.2	.2	--exchangeability of goods and services
At Dispensary	4.6	1.7	3.1	2.9	1.1	1.6	1.5	.5	--health
Building Work	2.3	1.2	.1	--	2.8	.1	.2	--	--physical protection, health,etc.
Household Work	1.9	1.2	18.4	20.4	2.7	12.1	2.3	9.5	--consumption of nutrients, processing
School	--	--	--	--	8.2	2.3	23.0	24.4	--Education

Table 3 (continued)

Types of Activities	Farmer Male Householder	Off-Farm Male Householder	Female Householder	Wife	Other Men	Other Women	Boys (10-15)	Girls (10-15)	Types of Attributes
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Other Non-Farm	3.3	.4	3.9	.8	2.8	1.1	3.3	1.7	--any other village administration, education,etc.
Total Work	29.8	72.4	32.5	32.0	66.3	40.3	33.8	38.7	

Source: M. P. Collinson (1972). Attributes added by this author. The data refer to Toro farmers of Uganda. The sample included 15 farmer males, 9 non-farmer males, 6 female householders, 22 wives, 10 other men, 20 other women, 11 boys and 11 girls.

(Uganda). Also, that table illustrates the work team patterns and the framework of living by means of row 2. In column 10, the kind of attribute each activity allocation is supposed to produce is added for illustration.

Also the table shows a certain consistency between the kind of attributes the system wants to produce, and its allocation of labor-time to produce them. Age and sex divisions are also part of the system organization.

When economists concentrate on on-farm activities alone, there follows a considerable amount of loss in system analysis by suppressing these necessary aspects of behavior. Public programs elaborated essentially on the basis of on-farm activities have given rise to failures and frustrations. These, in turn, have generated views of peasant irrationality and have brought disillusion with small improvements as an instrument for development.

As can be read from row 10, one cannot ignore these tangible and non-tangible wants that off-farm activities are supposed to satisfy. Unfortunately, this is exactly what is done by theories that dump all the off-farm activities into a leisure category and their underlying policy recommendations. As Goodfellow pointed out:

> "If we were to recommend to a Bantu people to abandon some of their organized activities ... and devote the time saved to increased agricultural production, we might find ourselves in the absurd position of advising them to reduce their wants and increase their production ... this is absurd because the values that control production rest in the

expressed wants."[17]

It is essential to understand that actual modern farms built in Africa are based on this absurd separation of production and wants. Cash crop farming is not geared toward satisfying an African farmer's wants. This is so because in most instances these cash crops are export-oriented and the proceeds do not flow back to the village communities.

Energy Absorption Patterns in African Farm Systems

Table 3 was more general and intended simply to show how the system allocates its labor time among various activities so as to produce desired attributes. Next, one wants to be more specific by showing how the African farming system allocates its energy through the whole year.

Energy is defined as the amount of calories per kilogram of body weight per hour. A cycle is defined by the kind of activities which the system concentrates upon during a given period of time. The African year is hence divided into cycles depending on the crop at hand. Taking for instance, the ground nut, the year can be divided into five periods: Cultivation Period (June, July and August), Planting and Care-Taking Period (September, October, November, December), Harvesting and Processing (January), Preparation and Consumption (February), Slack Period

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[17] Collisson, op. cit., p. 150.

(March, April and May).[18]

As can be seen, each period corresponds to a particular activity of attribute production or consumption. Assume that there is only one attribute called energy. The farmer consumes energy to produce ground nuts which are characterized by their energy content.

The farmer has to balance the consumption and production of energy in his labor allocation decision. One assumes that if the farmer has a surplus of energy intake over his energy expansion, he is rational in the sense that he economizes energy by using less energy in production than what he actually possesses.

Table 4 gives the energy intake, the energy use, the man-hour used and the year surplus (deficit). These quantities are given on the basis of the five periods described above.

The decision to cultivate ground nuts is therefore presented in terms of system approach presented in section 2 of this chapter. The farmer has to decide on the sequence of activities for the whole year. He also must have an idea of the amount of energy the total activity requires and the surplus energy to be derived from it. Then his man/hour work per day is decided upon as well as the off-farm activities of the kind presented in Table 3

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[18] Some activities may be extended over two or more periods. Here interest is given to the predominant activity.

Patterns of Energy Intake and Consumption in African Farming Systems (Energy is defined as the amount of calories per kilo of body weight per hour)

Period (1)	Months (2)	Man/Hour Day of Work (3)	Energy Intake (4)	Energy Use (5)	Deficit/Surplus (6) = (4)-(5)
I	January (Harvesting)	41	1,960	1,750	210
II	February (preparation, consumption)	24	2,149	1,601	548
III	March April May (slack)	21	1,575	1,543	32
IV	June July August (cultivation)	45	1,740	1,892	-152
V	September October November December (planting care)	33	1,623	1,672	-42
				Total Year	+196

Source: R. H. Fox (1953), Collison (1972) and this author's computations. The data refer to Gambia's farmers who cultivate ground nuts.

above.

According to the decision rule set forth here, the system allocation presented in Table 4 is rational. One does not need markets or market prices to arrive at such rational behavior.

Time Allocation and Protein Production in African Farm Systems

That production is a consumption of attributes in the production of other attributes was the main statement made in section 1 of this chapter. Assume that the objective of the farmer is to combine his labor time and energy in the production of two crops, ground nuts and rice. This production requires a set of operations which depends upon the type of crops. The rule is to spend energy and time between the crops in proportion to their protein content. It is postulated that farmer X is rational if this proportionality principle applies.

Table 5 (page 152) gives empirical evidence of rationality in the sense just given in African farming.

Total time and energy use (attribute consumption) is proportional to the protein content and total amino acid content. On the basis of these attributes and these attributes only, the decision to spend less time in rice

Table 5

Time and Energy Consumption in Ground Nuts and Rice in Proportion to their Protein and Total Amino Acid Content (Time is measured in number of hours per season)

Crop	Type of Operation	Total Time in Fields (hours)	Percent Time in Work	Energy Use (calories/ kilo of body weight/hour)	Protein Content (grams)	Total Amino Acids (mg)
Ground Nuts	Ridging	318	29	8.0	25.6	27.610
	Lifting	410	57	5.0		
	Windrowing	365	34	3.2		
		Total 1093		Total 16.2		
Rice	Weeding	341	34	3.0	7.5	7.973
	Pulling	297	30	3.4		
	Transplanting	358	36	3.8		
		Total 996		Total 10.2		

Source: Fox (1953). Collinson (1972), AID No. CSD/2497 (1972) and computations by this author.

than in ground nut production activities is rational.[19]

Land Allocation by Crop and Weather

So far, efforts were concentrated upon evidence showing labor allocation and nutrient content of the crops. Next, land use is related to the weather patterns and crop type. African farmers are acquainted with these conditions and consistently attempt to allocate land accordingly. For simplicity, the year is divided into three seasons: First Rains; Slack; and Second Rains. As was shown in Table 4 (page 150), the slack period is characterized by both low calorie intake and time consumed in the fields. Here attention is given to the Rains seasons.

In Table 6 (page 154), both the patterns of land-crop allocation and land resting are presented. Also, data are consistent with our theory that the system simultaneously allocates land among various activities in a systems like manner (as opposed to specialization). If the rule is to set the rate of change in land utilization at not more than 25 percent, the allocation process depicted here is rational.

Turning to Table 7 (page 155), it is seen that

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[19]The elements which constitute the total amino acids are: moisture, nitrogen, conversion factor, lysine, methionine, threonine, and tryptophan. For a detailed description of the amino acids content of other crops see Agency for International Development: A Literature Review and Research Recommendations on Cassava, Doc. No. CSD/2497 (Georgia: Un. of Georgia, 1972), pp. 112-13.

Table 6

Evidence of Land Allocation by Weather and Crop Type:
Rotation with Fallow/Arable (Acres)

	Banana (acres)	Coffee (acres)	Food Crops (acres)	Total Area (acres)	Area Rested (acres)	Area Cleared (acres)
First Rains (1964)	2.28	.33	.91	3.52	-.07	.36
Second Rains (1964)	2.25	.33	1.24	3.81	.15	.08
First Rains (1965)	2.28	.34	1.16	3.78	N.A.*	N.A.*

Source: D. Pudsey (1966).

*N.A. - Not Avaliable

Table 7

Crops and Crop Mixture in Relation to Nutrients Content: 12 Farms in Toro

Crop or Mixture	Second Rains 1964		First Rains 1965		Protein (grams)	Total Amino Acids (mg)
	Acres/Farm	% Cultivated Area	Acres/Farm	% Cultivated Area		
Mature Bananas	2.24	58.8	2.25	60	NA	NA
Coffee (some inter-cropped)	.47	12.3	.51	13.6	NA	NA
Sweet Potatoes	.14	3.7	.17	4.5	1.3	994
Cassava	.09			1.3	1.6	1.184
Beans	.10	2.6	.26	6.9	22.1	20.043
Grains: Maize Millet Rice Sorghum Wheat	.58	15.1	.29	7.7	39.0	49.103
Roots: Potatoes Yams	.15	3.9	.19	5.1	4.4	3.581
Total	3.77	96.4	3.67	99.1	--	--

Source: Collinson, op. cit., p. 177.; A.I.D., op. cit., p. 113.; and this author's computations.

besides insuring interseasonal land use stability, the farmers are geared at obtaining some relationship between land used and protein production. Except for coffee and mature bananas (cash crops) a point can be made that such decision is rational on the basis of both rules: inter-seasonal stability of land use and crop mixture to insure adequate production of amino acids. In both cases, the theory that farmers use attributes to produce other attributes is verifiable.

The bulk of this section was to give some selected evidence pointing to the way our theory can be applied. It was strictly illustrative rather than exhaustive in nature. It is felt that those interested in this theory will find it relatively easy to fit it to more elaborate data. It is also felt that this theory opens the way to a fresh approach to development policies as will be seen in the next chapter.

One aspect of the theory which has not been empirically verified relates to the communal control of production and management decisions. To the best of our efforts, it was not possible to find empirical evidence on this subject. Two options were then open: the first was to construct a questionnaire and conduct an investi-gation among African farmers randomly chosen; the second was to attempt to construct a theoretical proof of the consistency (under well stated assumptions) of the communal system with the Pareto optimality criterion.

Given obvious constraints, the second option was chosen.[20] In the next section, attention is given to this endeavor.

COMMUNAL RULE AND PARETO CRITERION

In this section, the aim is to construct a general model based upon the assumptions of a communal economic system. It is shown that with proper adaptations, such a system meets the Pareto optimality criterion. This optimality is called "communal optimality". The ordinary optimality is shown to be inefficient in the sense that it is possible to add more output and satisfaction by moving to a communal point.

Definitions

Define four sets J, Z, M and N as follows: J is a set of family or ordinary commodities, Z is a set of communal commodities, M is a set of all the family production units, N is a set of all the consumers.

Define Q(Z) to be an input correspondence from E_Z^+ to E_J^+ for the communal production unit. Then for any point $z \in E_Z$ the correspondence Q(Z) stands for a set of all input vectors of family commodities which the communal authority uses to produce a vector of communal goods. It

[20] Among other constraints, note the time constraint, the distance constraint, material and financial resource constraint.

is assumed that such a set is nonempty.

Define $H(J)$ as a correspondence from the set of communal commodities which the family unit uses to produce ordinary or family goods. Hence, $\forall\ z \in E^+_Z$, $H_m(J)$ is the production set of the family m, when the vector of the communal goods is z.

As in Chapter 4, define R_s to be the communal preference function over the relevant commodity space. For example, $R_s \in E^+_j \times E^+_j$ will be the communal function over the set of ordinary commodities.

Define $X_s \in E^+_j$ to be the consumption of ordinary commodities by the community, and $X_s \in E^+_Z$ its consumption of communal goods.

The family production is designated by $y \in E^+_j$ where $y = (y^1 \ldots y^m)$.

Define $\theta(Z)$ to be the feasible allocation of resources which is consistent and compatible with the point $z \in Z$. Therefore, $\theta(Z) = \{(x, y, z) \mid z \in \theta(Z), y \in H_m(J), x \in E^+_j$ and $\sum_N x^n = \sum_m y^m - Z\}$. This definition is very important as it recognizes the existence of an allocation which satisfies the family production, the

communal production, and the consumption sets.[21] For the whole community we take $\theta = \bigcup_{z \in Z} \theta(Z)$.

Also, define $X(Z)$ to be the consumption set compatible with the allocation $\theta(Z)$, i.e., $X(Z) = \{x \mid$ for some (y, z), $(x, y, z) \in \theta(Z)\}$.

Define $K(Z)$ to be the set of feasible aggregate outputs of ordinary or family commodities consistent with the point Z of communal commodities such that $T(Z) = \{\sum_m Y_m(Z)\} - \theta(Z) \cap E_j^+$. For the whole community we take $K = \bigcup_{z \in Z} K(Z)$.

Assumptions

We make the familiar assumptions on all the relevant sets defined above. Both $Y_m(Z)$ and $\theta(Z)$ are convex. This implies that $K(Z)$ is also convex. However, one should exercise some caution about the convexity of K.[22]

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[21] In the current analysis, the point $z \in Z$ does not explicitly enter the analytical system.. This is more appropriate to private market systems without a public sector. However, some economists, such as Hotelling and Bergstrom, have recognized the necessity of constructing the so-called partially decentralized system which explicitly includes the public sector. This area is very promising and needs more research efforts. H. Hotelling, "The General Welfare in Relation to Problems of Taxation, and Railway and Utility Rates", Econometrica, 6 (1938). Theodore Bergstrom, "On Efficiency Provision of Social Overhead Goods", Department of Econ., Washington Un. (St. Louis, Mo: 1971), mimeo.

[22] See Bergstrom, op. cit., for a comprehensive discussion of this caution.

From the compactness of Q, follows the compactedness of X(Z). Of course, the compactedness of Q is insured because it was said that there is a limiting factor (labor) in the communal system. This combined with the fact that only a certain quantity (limited) of output is producible in both Z and J makes compactedness of Q possible.

Correspondences $Y_m(Z)$ and $Q(Z)$ are assumed upper semi-continuous as defined in Chapter 4.

The social preference function R_s is assumed transitive, reflexive and $R_s(X^n) = \{x \mid x^i \; R_s \; X^j\}$ is closed. Also R_s is complete on E_j or E_z. It is continuous, weakly convex and locally nonsatiated as well as monotonic.

Also, we assume that the set $\{\sum_m Y_m - \theta(Z)\}$ is non-empty, closed, output convex, and bounded for any communal point $z \in \theta(Z)$.

Finally, we assume that for any allocation in the communal sector, there exists a supporting function $\vartheta = \inf\{\lambda: \lambda^{-1} z \in Z, \lambda>0\}$ for any point θ_i internal to the allocation set.[23] This supporting function is equivalent to what was called a measurement function. That is, for any point in the allocation set we can find a measurement

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[23] By definition, a point x_o is said to be an internal point of a set K if the intersection with K of each line through x_o contains an open interval about x_o, i.e., x_o is internal to K if, given $x \in X$ there exists an $\xi > 0$ such that: $x_o + \lambda^n \in K$ for all λ with $(\lambda) < \xi$.

function giving a value to that point. Once such a value is found, everybody in the community agrees with it.

Needless to repeat our concern that in African systems, it is extremely difficult to find this communal measure. However, this is also true when one is interested in finding a unique level of equilibrium prices. But for theoretical purposes, one can, without loss of generality, assume that it exists.

A Model of Communal Equilibrium

There are two communal goods; one factor of production, say labor; a single communal unit, say a work team producing each good, using labor as the only input; and there are two family goods, y_1 = manioc, and y_2 = maize. The transformation, T, of section 1 of this chapter is a fixed coefficient technology of the Leontief type.

Assume, for the parameters $a_1, a_2, \alpha_1, \alpha_2 \geq 0$, that the production looks like:

(1) $y_1(z_1, z_2) = \{(y_1, 0), -y_3 \mid y_1 \leq a_1 e^{\alpha_1 z_1} y_3\}$

(2) $y_2(z_1, z_2) = \{(0, y_2), -y_3 \mid y_2 \leq a_2 e^{\alpha_2 z_2} y_3\}$ for the maize

(3) $Q(z_1, z_2) = \{(0, 0, z_1 + z_2)$ if $(z_1, z_2) \in E_2$ $(z_1, z_2) = Q$ if $(z_1, z_2) \notin E_2^+\}$ for the communal goods z_1 and z_2.

Assuming that labor is useful only as input and that all of it is used, one can confine the analysis only to the

production of y_1 and y_2.[24] In this case, the analysis is reduced to a two-dimensional space, which, for analytical purposes, is easily tractable.

The set of family commodities comprises only manioc and maize, i.e., $T(Z) = \{(y_1, y_2) \mid y_1 \geq 0, y_2 \geq 0, \text{ and } T(Y, Z) \leq L\}$ where $T(Y, Z)$ is now the input-output function. As can be seen, the set $T(Z)$ becomes the intersection of the non-negative orthant with a half space. And the aggregate communal production $T = \{(y_1, y_2) \mid y_1 \geq 0, y_2 \geq 0, \text{ and for some } (z_1, z_2) \in E_2^+, T(y, a) \leq L\}$. This is illustrated in Figure 5 (page 163).

In figure 5, AB is a fixed coefficient production relationship for manioc and CD for maize. To find the aggregate production T, take, as was defined above, the union of the two sets, i.e., $T^* \equiv \bigcup_{Z \in E_2^+} T(Z) = \{(y_1, y_2) \mid y_1 \geq 0, y_2 \geq 0, \text{ and for some communal products } (z_1, z_2) \in E_2^+, T(Y, Z) \leq L.\}$

By assumption T^* is bounded so that the northeast boundary of the set T^* is the envelope curve of the bounding byperplanes of the sets $T(Z)$. This set of points

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[24] Here the analysis is restricted to the context of the closed model by assuming that labor is not produced within the system. However, if the possibility that labor energy is dependent on the calorie intake is introduced, one can get an open model. This possibility is not investigated here. For a good discussion of this, see Kelvin Lancaster, Mathematical Economics (New York: MacMillan, 1969), pp. 79-98.

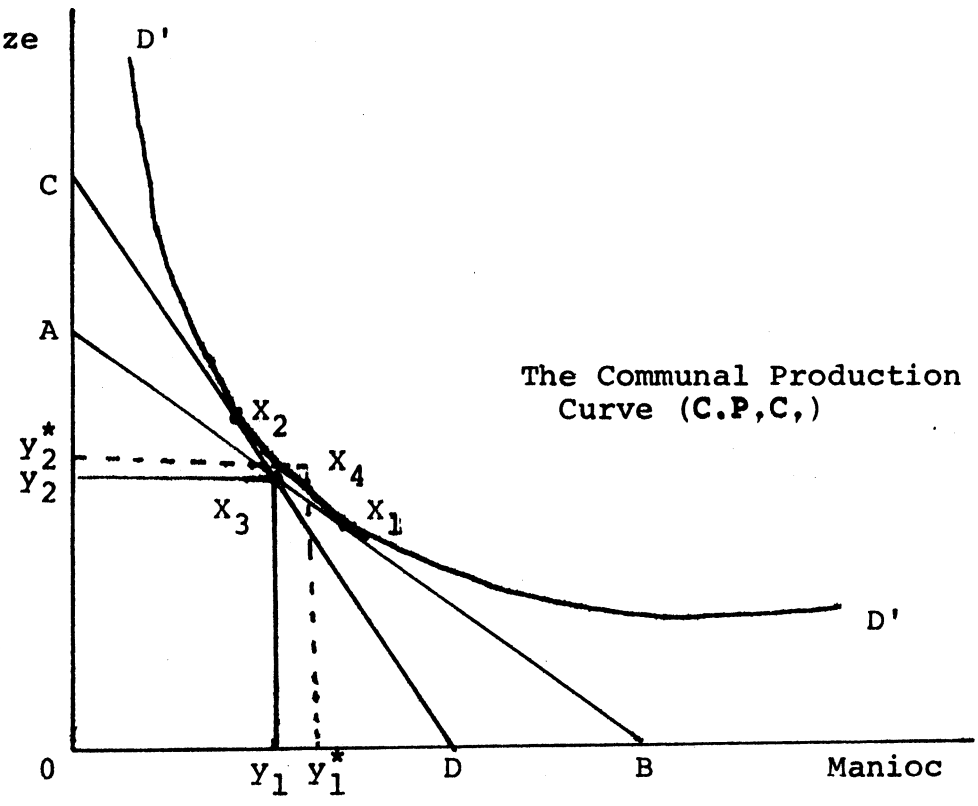

Figure 5

Communal Production Curve

on the northeast boundary we call it the "Communal Production Curve". It gives the maximum of family production for a given set of communal products (z_1, z_2). It is insisted that all points on the Communal Production Curve are those allocation points which establishes a compatability between what the families produce and what the commune produces.

Any point outside that line is not communally acceptable because it is incompatible with the communal allocation.

In terms of Figure 5, if production took place only

with family commodities and no communal commodities existed, the relevant and maximum point would be X_3 with the vector of out (y_1, y_2) being produced. Point X_3 is accepted in the literature as the most efficient where the curve AX_3D is the relevant transformation. This is also the most efficient point accepted in Linear Programming literature.[25]

As can be seen, the application of the theory to the communal production introduces many possibilities some of which are superior to the private efficiency point X_3. Take for instance point X_4, it is compatible with the communal production principle as it lies on the C.P.C. curve. Also, it is superior to the point X_3 in the sense that, by moving from X_3 to X_4, one has increased both y_1 and y_2.

Consider also points X_1 and X_2 which lie on the C.P.C. curve. If each of them can be shown to be superior to X_3 by other criteria, they too, are preferable to X_3.[26]

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[25]See for example, G. Hadley, Linear Programming (Reading, Mass: Addison Wesley Publ. Co., 1962), especially chapters 1-3.

[26]Such criteria could be that the communal preference function is tangent to the C.P.C. at either of these points, or that the supporting function does not legitimize X_3 in relation to X_1 or X_2. This latter case can hold for instance if the equilibrium price is a function of taxation or communal expenditures. Point X_4 can be conceived of as a point of equilibrium with public education (z_i), while point X_3 is private equilibrium without public education. In this case, public education is an input which allows the system to move to a higher level of production.

It can be conjectured that, the freeze-in-effect of Chapter 3, by ignoring and/or suppressing communal production patterns, has forced the system to a point such as X_3. This inefficient point can be avoided only if some public policies, which take the place of communal patterns, enhance the system to reach a point such as X_4. This point will be touched upon later in policy implications.

Communal Equilibrium and Pareto Criterion

An allocation X is said to be communally optimal if for each $z_i \in Z$ and $R_s(X)$ one has:

for $x \in X(Z)$ and $\forall \hat{x} \in X(Z)$ not $\hat{x} P_s x$

This allocation X is Pareto optimal if $x \in X \equiv \cup X_i(\acute{a})$ and for every $\hat{x} \in X$ not $\hat{x} P X$.

Theorem 1

If is compact and bounded, also if the set Z is bounded and compact, and R_s is transitive, reflexive and closed then there exists a point x which is Pareto optimal.

Proof

θ and Z were assumed compact. R_s was shown in Chapter 5 to be reflexive, transitive and closed. Since X is also compact, it follows that there is at least one maximal (optimizing) element.

Theorem 2

If R_s is complete, continuous, weakly convex, locally non-satiated and monotonic then for any $z_i \in Z$

such that $\{\sum_m Y_m(Z) - Q(Z)\} \cap E_j^+ \neq 0$, there exists a communal equilibrium X^* given the income distribution.

Proof

The proof is equivalent to one given in Debreu on the existence of competitive equilibrium except that here, the concept of communal production is used.[27]

The uniqueness and stability of this equilibrium point can be established using the usual procedures of the advanced economic textbooks. We need not go into this here. It is necessary only that one has established the existence and optimality of such a point in a communal system. The remaining task is pure exercise in mathematical economics. It has little importance to this subject matter. Notice that one has given the supporting function g above so as to facilitate the possibility of establishing that such an equilibrium is relative to a particular measurement system.[28]

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[27] See Debreu, op. cit.

[28] In the current analysis g is replaced by a price function to establish competitive equilibrium. This choice was shown in Chapter 5 and is essentially arbitrary. Any supporting function, other than the competitive price system can very well do the job as long as the relevant assumptions are made.

SUMMARY

In this chapter some evidence was provided on the decision making process of the communal system. Various factors which influence these decisions were illustrated after a proper concept of production has been given.

Then, it was shown that this communal system possesses some of the well-established properties of efficiency or optimality. Such efficiency points were proven to be Pareto optimal relative to the communal production system of production preference, consumption and allocation. In some well defined instances, such points are superior to private optimal points as in Figure 5 (page 163).

In the next chapter, this framework is used to speculate on some policy implications of the communal model as constructed throughout this research. These are only speculations and their claim is only that they are consistent with the system that has been developed.

Chapter 7

CONCLUSIONS AND SOME POLICY RECOMMENDATIONS

In this concluding chapter, the intention is to summarize the main concepts developed in the course of the work and the kind of implications these concepts have for policy action.

One of the most difficult tasks in agricultural economics lies in the design of policy instruments. Very rarely do economists agree on what the best policies are. Hence, there is always very deep-rooted subjective considerations to be reckoned with in the suggestions made here. However, to avoid the general tendency of making general policy statements, effort is made to restrict the recommendations to the scheme developed in the work. Consistency between the concepts and mechanisms established in the dissertation and the policy recommendations is the main concern.

MAIN CONCLUSIONS

It was established that farm management, in the African context, is an integral part of a life management system. In this system, cultivation and its related activities are simply a portion of a set of various system's activities. Others include such activities as

the administration of the village, the education of the youngsters, the keeping of law and order, etc. Every farmer performs all of these activities simultaneously.

It was established that, in the course of his actions, the farmer draws his norms for action from a framework of living called the Communal Framework. The validity and efficiency of a particular decision is considered in terms of its effects not on an individual unit but on the family unit and the community at large. A given decision may be efficient on the basis of an atomistic unit, but if it conflicts with the communal norm of efficiency, that decision is invalid and/or inefficient.

The communal norms are established on the basis of "attributes" goods or actions possess. If the "attribute" set possesses some well established properties, it is possible to give them a quantitative magnitude. However, this is only an arbitrary choice in the sense that the yardstick used in the measurement of attributes can be chosen at the discretion of the community.

Concepts such as family consumption, communal consumption, family production and communal production were derived from the underlying framework of living.

In economic literature dealing with Africa, economists and other scientists claim that African cultivators do not act rationally. It was established that rationality is relative to the "attributes" used and the

yardstick utilized to measure them. If rationality is defined with respect to the market variables it has no meaning in non-market economies. Moreover, even in market economies, it is relatively difficult to reconcile micro-decisions and macro-decisions as the so-called Arrow Paradox has shown. Therefore, if the system is communal, it does not take the market as a dictator of behavior and hence this system's rationality cannot be searched for in market reactions.

If the system is communal and possesses the desired properties, it was shown that a communal output is superior to a family output for the system as a whole. This communal output is Pareto optimal. Hence, it cannot be reached unless family actions are coupled with communal actions. This is also one instance of what was called "system coupling".

The mechanism of coupling was shown to occur in various areas of production such as crop mixture, which in essence follows the same principle as that of the mixture of cultivation, administration, art, etc.

It is implied that both the social system and the economic system henceforth derived are essentially different from, say the western system from which the existing economic theory is derived. Instead of microeconomics we have a "Family Economics" and instead of macroeconomics we have "Communal Economics". The African economic system excludes private ownership of the means of production:

land and labor.[1]

On the basis of what is shown here, two ranges of economic policies follow. The first deals with the fundamental issues of building economic institutions which reflect the underlying system of beliefs and social values. The second is a piece-meal type of approach which accepts the existing confusion about what the main issues really are and attempts to design policies such as: price policies, marketing policies, monetary and fiscal policies, etc. In the context of this dissertation, the interest is not so much on these minor issues, rather, it is on the problem of designing a viable economic system which corresponds to the concepts developed here.

As can be realized, the problem of a system design is extremely difficult and cannot be comprehensively tackled by a single researcher. It cannot be dealt with thoroughly in a concluding chapter. It requires another research project toward which this writer is working. It is therefore, suggested that the following recommendations be taken as indicative of the direction to be followed rather than the final results at the end of the road to African system building.

Piece-meal type of policies are considered only

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[1]These statements are general enough to include all of Africa. However, general principles do not necessarily deny the existence of some minor differences in the degree of applicability of the proposition. In Africa, these differences do exist and should be noted.

briefly. It is our experience that almost all of them have been tried and have failed throughout most of the African continent. Among all of them, the choice will be made from those that are consistent with the model developed here. It must be emphasized that their success depends upon the success of the system design.

SOME POLICY RECOMMENDATIONS

It is a common knowledge that the African system as described in the course of this work has been subjected to three outside attacks: slave trade, colonization, and neo-colonization. In terms of system analysis and system sensitivity, these three attacks can be called new "parameters".

None of these parameters were designed to create a self-propelled system. Rather these were "destructive parameters" in the sense that the African system was to provide labor for the construction of a new system in the so-called new world (slavery), or its resources had to be made available for the design of the European system either in Europe or in Africa (colonization and neo-colonization).

The concept of system design as understood here consists of introducing new parameters in the system which will accomplish two things:

1. Eliminate the destructive parameters
2. Reconstruct a self-contained and logical system of social and economic relationships.

As such, the task goes beyond simple economic considerations and comprises politics, anthropology, sociology, etc. The economic side of it as given below is simply a partial answer.

Economic System Design

It is to be understood that the objective of the design is to permit the system to reach the communal equilibrium point which, under the existing relations of production, is superior. The action of the government in the process of system design is interpreted as the creation of a set of inputs which can be used to increase production to the point of communal equilibrium, this input being organizational.

The first action proposed is to transform the so-called villages into "Communal Productive Units" (C.P.U). This unit will commonly produce, manage and sell agricultural products in coupling system patterns. The land and other inputs will be owned communally under specific legal arrangements to be determined both by village authorities and the government.[2]

Each country is to be divided into regions which

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[2]During some of my discussion with Dr. Albert Hagen of the Department of Agriculture at the University of Missouri (Columbia) it was brought to my attention that the scheme designed here resembles what is being tried in Tanzania. It was good news.

regroup a certain number of Communal Productive Units. Geographical and physical characteristics are to be used in determining the regroupment.

In the central government, the Minister of Agriculture will possess a section corresponding to each region. Here, research and policy analysis will be conducted and disseminated.

The selection and growing of crops is to be made mainly on the basis of their importance in the diet of the African people. It is unfair that so much effort is made in the production of crops which do not enter African consumption.[3]

Economies of scale, as well as a strong relationship between production and consumption are the main benefits from this scheme. Small productive units are not capable of adopting expansive cultivation methods and inputs which are necessary in advanced agriculture. Finally, it is easier to distribute and manage the limited credit funds at the disposal of the African governments.

The most important benefit is also psychological. African people and their institutions have undergone a destructive process which has had a traumatic effect to the

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[3]For instance, cassava and manioc which constitute the main staple crops in Africa have not been given sufficient research and production effort. This is even more noticeable in the case of African vegetables which are entirely unknown to non-Africans.

extent of freezing their dynamism. It is expected that by revitalizing these institutions and values in a contemporary setting, people will regain more confidence in themselves. This confidence will be a strong asset in stimulating desired changes if these changes are derived in a visivle fashion from their own systems. This will be a strong incentive.

Hence, the main issue is not the creation of such institutions as have been created in the western hemisphere for the sake of creation. The issue is to recreate African economic institutions based on African economic principles of communality, as described in this research. Hence, we disagree with Kuznets when he states that the process of modern growth is hard to introduce in other countries because:

> "It involves elements peculiar to European civilization for which substitutes are not easily found and that this process is not compatible with the rural mode of life, the large and extended family pattern, and veneration of undisturbed nature."[4]

Piece-Meal Policies

Experts have proposed a wide spectrum of development policies to the African governments. Most of them are perfect carbon-copies of those policies adopted in the so-called developed nations. In the spirit of this dissertation and from our own experience, there is very

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[4]Kuznets, op. cit., p. 254.

little ground for giving too much importance to these policies.

Assuming that the fundamental question of reconstruction is resolved, a set of measures ranging from domestic to international trade policies are conceivable -- which can enhance agricultural development.

The first policy will be a technological policy. This policy refers to a set of practical actions designed to create or improve the state of knowledge about the physical, human and social condition of the African continent. It also includes the introduction of new skills and methods of both cultivation and management, or the improvement of the existing ones. New crop varieties may be considered. However, our experience shows that the continent possesses a great deal of crops, vegetables and cereals, which have not received sufficient research attention because they are arbitrarily classified as non-cash crops. They must be given top priority.

The technological policy package ought to first produce an inventory of African agricultural products regardless of whether they are cash or non-cash products. Then a program of research and experimentation ought to be designed in order to test means and ways of developing these crops under various physical conditions.

This package must include a training scheme for African youngsters on their continent and its potentials. Rural schools must give priority to the training of these

crops under various physical conditions.

This package must include a training scheme for African youngsters on their continent and its potentials. Rural schools must give priority to the training of these youngsters for the farming profession. Cultivation methods, farm records, tropical plant pathology, etc. are subjects that can be dispensed to the elementary school attendants on a regular basis. This program will not only increase their skills, but also will alleviate the rural exodus which is hitting many African countries.

Moreover, the technological policy ought to develop a training program for those cultivators who are already in farming. It is essential that they be given a scientific exposition ofthe kind of things they are doing, and how to improve them. This is relatively easy in the working institution of the Communal Production Unit where everyone is given the opportunity to share his experience with the other members of the community.

At the university level, the technological policy package militates in favor of creating research and extension services which are geared toward understanding the African metaphor both physical and social. Different scientific experiments with tropical crops and tropical farm management procedures are to be conducted, and the findings propogated to the farmers and the rural primary and secondary schools.

At last, it is worthwhile considering the feasibili-

ty of experimenting research on non-African crops and analyze their adaptability to the tropical conditions. However, this has to be done on a very limited basis. It is not rational to spend too much time on these more difficult undertakings.

Besides the technological policy, another range of policies can be considered. First is the communication policy. This covers a set of measures which facilitates the movement of goods and services among regions. It is not recommended that highways be built. Rather, modest but efficient communication and transportation means can be developed which are consistent with the financial and geographical conditions of many of the African countries: roads, railroads, etc.[5]

Next, there is the marketing policy. It includes the development of rational techniques for marketing the products both within a given country, within the continent and in relation to the outside world. Research on consumption and preference patterns of both Africans and non-Africans is needed for this purpose. Up to this point, it is established that African crops receive insufficient attention simply because inssufficient effort is being

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[5]Existing communication schemes are essentially export-oriented. Rather than facilitate intercountry or intercontinental communication, they simply tie some selected sectors and regions to the world market.

made to introduce them to the consumer.[6]

There are many other policies one can imagine.[7] But imagination is not fruitful when the basic foundations of the system are not spelled out clearly. When the foundations are in crisis, it is not so much a matter of imagining policies, but a matter of reconstructing the foundations upon which policies rest. The African continent has had its foundations shaken on the three occasions cited above. The task is essentially and for the most part to reconstruct them. This research was an attempt at that task from one man's point of view and from the agricultural economic viewpoint.

It is hoped that points raised here will generate discussions by Africans and non-Africans who are concerned with the future of that continent. This continent has functioned and is functioning under extremely different economic behavior, and efforts to negate these behavioral laws and replace them with some external ones have been unsuccessful. It is time that researchers look at this continent and its peoples as Africans, which they really

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[6]For instance, a survey conducted by a local newspaper from the Republic of Zaire reports that almost all the restaurants located in downtown Kinshasa (the capital) do not list any African foods on their menus.

[7]Price policies, income policies, monetary policies, fiscal policies, etc. are not interesting in the context of this research and thus did not deserve this author's attention.

are, rather than as carbon-copies of Europeans which they probably never will be.

APPENDIXES

APPENDIX A

Table 8

Land Occupation: Africans vs. Europeans

A. European Land and European Population in Southern, Central and East Africa

Country	Percentage of Land alienated or reserved for Europeans	European Percentage of total population
Rep. of South Africa	89.0	19.4
Basutoland	10.0	0.3
Bechuanaland	6.0	1.0
Swaziland	49.0	2.8
Southern Rhodesia	49.0	7.1
Northern Rhodesia	3.0	3.0
Nyasaland	5.0	0.3
Kenya	7.0	1.0
Uganda	6.0	0.2
Tanyanyika	0.9	0.2

Source: Montague Yudelman, "Africans on the Land", p. 19.

Table 8 (continued)

B. Land Cultivation in Tunisia: Cereals

	Traditional less than 22 acres	Modern 22-110 acres	Modern 110-250 acres	Modern 250-300 acres	Modern 300+ acres
1. Souk el Khemis					
Number of farms	8,300	11	70	32	33
Area by group	63,000	750	11,250	10,000	39,000
Percentage of the total area	25%	0.3%	2.7%	4.8%	20%
2. Beja					
Number of farms	13,100	5	68	51	9
Area by group	76,000	300	4,500	7,800	6,800
Percentage of the total area	37%	0.1%	2.1%	3.1%	10.5%

Source: Pierre Kalala, "L'Agriculture Tunisienne", Ministere de l'Economie, Tunisie, 1970, p. 52; and author's computations.

APPENDIX B

Table 9

Education, Profit and Disposable Income per Removed Farmer at Mubuku (Uganda) (in shs)

Level of Education of the farmer Before Removal in 1964 (Years of Primary School)	Disposable Income 1967	Profit in 1967	Returns to Family labor
2	1,770	557	1,211
3	3,856	3,298	558
3	2,255	1,306	940
5	5,132	4,057	1,075
6	10,541	9,808	733
6	3,867	2,481	1,386

Sources: Constructed from Agrawal and Raja, op. cit., Tables 1 and 8.

APPENDIX C

Table 10

African Farmer's Reaction to Market
Corn and Groundnuts

	CORN			GROUNDNUTS		
Year	Production 1000 Bags	Sales 1000 Bags	Price Pence	Production 1000 Bags	Sales 1000 Bags	Price Pence
1948	1,671	82	252	378	112	N.A.
1949	1,487	121	264	170	47	N.A.
1950	1,835	124	333	163	57	774
1951	1,278	203	357	217	40	792
1952	1,973	688	408	307	79	759
1953	2,787	898	363	375	143	633
1954	3,129	875	339	511	139	629
1955	2,797	706	335	621	178	660
1956	3,926	1,385	342	925	256	660
1957	3,363	933	324	941	194	665
1958	2,847	533	306	682	69	714

Estimating models:

(1) Sales = $\alpha + \beta_0$ production + $\delta_0 + \beta_1$ Price

(2) Production = $\delta_0 + \delta_1$ Price in period t -1

Findings

a - Corn : Sales = -927 + 4.6 Price R = 0.23
Production = 398 + 8.86 P_{t-1} R = 0.12

b - Groundnuts : Sales = -1428 + 2.98 Production + 1423 Price
Production = 268 + 0.17 P_{t-1}
R = 0.33

Source: Yudelman, op. cit., Table 20, p. 248.

APPENDIX D

SUGGESTED PROOF OF THEOREM 1 IN CHAPTER 4

Given the importance of theorem 1 of Chapter 4, a procedure is provided here on the steps to be followed in its proof.[a]

The proof of the proposition in this theorem is equivalent to proving the following:

if F: X → M, there exists a function G: M → X such that $G = F^{-1}$ and F O G = I.

First define the image under F of X to be the set of elements in M such that $x_m = F(x)$ for some $x \in X$ and $x_m \in M$ or:

(1) $F(X) = \{x_m \in M$ there exists a $x \in X$ and $x_m = F(x)\}$.

Next, define the inverse image $G(x_m)$ as the set:

(2) $\{x \in X: F(x) \in M\}$.

By the surjectivity of F, $M \leq$ ran F,[b] and F has a right inverse such that:

(3) $x_m = F(x) \Rightarrow x = F^{-1}(x_m)$

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[a]This procedure appears here rather than in the main text by virtue of the advice from Drs. Robert Finley and McCamley. It is intended to make the text less cumbersome and thus more easily read.

[b]Remember that F surjective is equivalent to F onto. Ran F stands for range of F.

There exists a function G: M → X such that:

(4) $x = g(x_m)$

Using (3) and (4) one gets:

(5) $f^{-1}(x_m) = g(x_m) \Rightarrow f^{-1} = g$

Then the result of the theorem follows immediately.

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