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ABSTRACT

A direct broadcasting satellite for sub-Sahara Africa has been proposed. This report was prepared as a briefing document for a UNESCO field team who will visit and consult African countries and advise them about such a system. Extensive surveys of the people and languages of Africa and its political, economical, and educational systems provide a background for considerations of the uses of new instructional media and the engineering considerations involved in a satellite system for Africa. The report emphasizes the necessity for cooperation among the countries of Africa, for a consideration of the place of instructional technology in the "Africanization" of the presently European style educational system, and, above all, for the decisions to be made by Africans based on their perception of the educational needs of their countries. The long preparation period necessary for such a vast undertaking, in the view of the report authors, necessitates an immediate start on the planning and development stage of the project in order that the satellite will be ready to meet the needs of the countries as they arise. (JY)

A DIRECT BROADCAST SATELLITE FOR EDUCATION AND DEVELOPMENT IN AFRICA?

A briefing document for UNESCO, by a group of students and professors in the Institute for Communication Research, Stanford University

"While others try to reach the moon,
we are trying to reach the villages."

Julius K. Nyerere, President of Tanzania

Stanford, California
February, 1972

This document was prepared at the request of UNESCO, Paris, for the guidance of a field team which will study the feasibility of a possible direct broadcasting satellite for sub-Sahara Africa. The document is by

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CONTENTS

Implications of this Report

At the request of UNESCO, we have considered the possible use of a direct broadcasting satellite in sub-Sahara Africa. The following pages contain a partial summary, and a review of some of the implications, of our report.

1. The obstacles to introducing sophisticated electronic technology such as a direct broadcasting satellite into sub-Sahara Africa are not basically technological. The technology is available or can be made available by the time Africa is ready to use it. The problems lie in the areas of policy, economics, and human resources.

2. Consequently, whether sub-Sahara Africa should make use of a direct broadcasting satellite is not a question that can be decided 10,000 miles away. Nor can it be decided by consultants and foreign "experts", because it requires decisions on education and development plans, decisions on international cooperation, decisions on investment of human and economic resources, which can only be made by the countries involved.

3. For this reason, we have addressed this report mainly to the field team which will visit and consult with the African governments, and presumably advise them and UNESCO. For them, we have tried to provide background

information and suggest some of the questions that should be asked.

4. Whereas our exercise has had to be based mostly on secondary data, and without the benefit of field surveys or consultations with policy-makers, the field team would be well-advised to concentrate on visiting as many as possible of the African countries, including those most likely to participate in such a project at an early stage, discussing with them the problems and potentialities of an advanced electronic system for education and development, and starting the process of international discussion and policy-making which is a necessary first step in any such project. The team should also check our basic figures on population, language, economics, and education; data in print on Africa are not wholly satisfactory.

5. At the conclusion of this visit, we can see the advantage (and our African advisers are even more convinced than we of the utility) of a meeting or several meetings, bringing together the countries that have expressed a serious interest in such a project, or possibly a group of English-language and French-language countries separately, to discuss the practicalities of cooperation, planning, and financing.

6. Although it will be essential to have at least one broadcasting engineer on the visiting team, to present

the technical capabilities and limitations, to check our estimates and alternatives against the actual situation, to point out where alternative decisions might make the planned system less costly, and in particular to investigate existing telecommunication plans and facilities, we want to point out that some very important decisions of a non-telecommunication nature must be taken before any realistic technical system design can be made. When the time comes, detailed engineering studies will be required. Meanwhile, the information in this report will make it possible to consider alternative systems and calculate approximate parameters of cost and service.

7. We should suggest, for these reasons, that the visiting team should strongly represent competence in educational and development planning, and instructional technology, inasmuch as these are the areas where the primary decisions must be made.

8. We do not envisage the use of a direct broadcasting satellite or any other spectacular expansion of sophisticated technology as something that will occur immediately in Africa. The economic and human resource requirements are too great, too many questions remain to be answered about how these countries want to develop their educational systems, too much software would have to be created, and too many sensitive

questions of international cooperation would have to be resolved. The situation points to a development of this kind not sooner than five to 10 years from now (although small pilot tests might be made in advance of the major development). But the necessary planning and start-up time is so long that the first steps should be taken at the earliest possible moment.

9. No country in Africa is large or presently rich enough to make really efficient use of a direct broadcasting satellite by itself. Consequently, there will have to be cooperation among a number of countries. Channels, time, perhaps ground-to-satellite facilities, if possible programs, will have to be shared. Countries will have to plan together. The realities of cooperation must be carefully assessed by the visiting team and by the countries themselves.

10. Furthermore, a satellite broadcast intended for any country in Africa will be receivable in some other countries as well. This points to the need to consider political sensitivities, and adapting the technology so as to avoid exacerbating them.

11. Nevertheless, we do not consider these difficulties insoluble. As we point out in Chapter II of the following report, cooperation (although not federation) has proved feasible up to a point. The situation, however, does suggest the

advantage of a slow start, with careful preparation and much discussion back and forth; and possibly a beginning by a few countries with the opportunity for others to join later.

12. Africa is not homogeneous, either culturally, linguistically, or politically. The idea of a single series of programs serving all of sub-Sahara Africa is unrealistic. There are, nevertheless, some regional relationships (noted in Chapter II) where cooperation might come easier.

13. The linguistic diversity is particularly troublesome. As we indicate in Chapter I, most of the 35 countries could be served, so far as official language is concerned, by French and English channels alone. But this would deliver the broadcasts where they are least needed -- to the political and business leaders, the civil service, and in general the most highly educated classes in the cities. There is virtually no reliable information as to how many people outside these few speak French or English, but the implication is that the number is not large.

14. One possibility to be checked out carefully by the visiting team is the number of students, at what level in the school system, who could benefit from French or English broadcasts, and to what extent these might be

shared across national boundaries. For example, if the Niger or the Ivory Coast primary school broadcasts would be usable in other Francophone countries, that would be an attractive possibility.

15. However, as the focus of the education and development effort turns outside the cities, the need of broadcasting -- if at all -- in native languages becomes more imperative. The census of African languages and their speakers is far from complete. As indicated in Chapter I, 42 to 56 per cent of the people of sub-Sahara Africa could probably be reached by the 10 most common indigenous languages; the lower figure seems more likely to approximate the actual situation. This is due rather to their use in populous countries than their use in many countries. Using 50 indigenous languages might cover another 20 per cent or a little more of the population. If one were to try to cover all the area, he would require many hundreds of languages.

16. The choice of languages for the satellite is, therefore, of the utmost importance. Not only will it determine how many are in the potential audience, but also whether they are in the cities or the country, at what level of education, in what parts of Africa -- in short, the uses that can be made of the satellite. To provide utmost flexibility in this part of the planning, we have described several possible systems (Chapter VI) that include a large number of satellite radio channels.

17. From the outside, it looks as though rural development may be the principal development business of Africa for the next decade. This is for a number of reasons.

18. For one thing, none of these countries has the industrial potential to add a great amount to GNP in the year immediately ahead (see Chapter III).

19. Although some of the countries are rich in minerals, the development of these tends rather to concentrate than to spread the gain.

20. The essential requirement for a better life for most Africans will therefore be an improvement in the agricultural sector, from which more than 80 per cent of the people now draw their livelihood. An effective communication system, localized in substance, using local languages, and supported by local field services, could contribute to this by diffusing information on production and marketing, health and community development, and by supporting an educational system geared to the needs of rural people.

21. Education in Africa is trembling on the brink of revolutionary changes. The colonial pattern of education, designed on the European model chiefly to produce civil service personnel, has not responded well to attempts to

expand it to serve the masses of rural people. The dropout rate has been very high. The severe selections at the end of primary school, combined with the dropouts, have created a class who are neither educated nor quite at home with the uneducated; and the severe limitations on university entrance, together with the general university preparatory nature of the curriculum, have produced a group who are neither able to go on to the white collar jobs nor to perform the technical and mechanical services so much needed by the emerging economies. The result has been in many cases politically unpalatable and economically wasteful. Almost without exception, we have heard from our African consultants about a paramount need for curricular and system revision, so as to make education relevant to the needs of rural people (see Chapter IV, on education).

22. If many of the sub-Sahara countries are indeed contemplating an Africanization of their European educational systems, with an emphasis on rural development, then it would be a mistake to use sophisticated electronics in support of the old system, rather than the new. However, the educational systems must precede the electronics. Therefore, one of the most important questions to be decided by the countries, and checked into by the visiting team, is the intention with regard to changes in the educational systems and rural development in general. It may well be that the development of African education

must make important use of systems other than formal education for socialization and instruction. If significant changes of this kind are contemplated, then they will require major curricular revision, preparation of materials, and perhaps retraining of teachers. They may require a series of "reforms as experiments", advancing step by step, making use of technology and experience. And in that situation of change, after the necessary educational planning, a new supporting system like a direct broadcast satellite might, as dramatic new technology often does, catalyze and speed the process of change.

23. By the same token, however, such an emphasis on rural education and development would considerably influence the nature of a possible satellite system. It would require greater use of local languages and some hard thinking as to what subject matter can be generalized, what must be localized. And it would make the addition of a number of radio channels to the satellite a more attractive possibility.

24. The field team will be aware, of course, that there are different theories of how new instructional technology can be used to bring about educational change, and different estimates of how much it can accomplish. Most system planners prefer to preplan change carefully, then seek an appropriate technology to fit the planned change.

That is, they look at a carefully planned curriculum as the main source of change, and technology as chiefly a contributor to efficiency rather than an important change agent. This strategy would seem to be appropriate chiefly for countries where considerable planning and research capabilities are available, although the idea of planning goes through all acceptable strategies for educational change. In certain other countries, however, it has been demonstrated that technology itself, under certain conditions, may be a major force in promoting or catalyzing change. This latter strategy does not exclude planning, but emphasizes taking advantage of the dramatic impact that new and potent technology can have on a traditional and entrenched educational system. Different countries are in different situations with regard to change in their educational systems, and a strategy for change in one country will not necessarily be appropriate for other countries.

25. Whether electronic instructional technology <u>can</u> be of help is no longer really at issue. Hundreds of experiments (see Chapter V) show that students learn from <u>any</u> of the media, as well as from face-to-face teaching and direct observation. <u>How much</u> is learned depends more on the content (the software) and on the particular uses to which the instructional media are put (and, of course, on the social, cultural, and political context), than on

the media themselves. Obviously, television and film are advantageous when a process, person, object, or situation needs to be seen; less advantageous when the important things need to be said rather than seen. In the latter case, radio is available, and at one-fifth or less of the cost of television. Film has a certain advantage over television in that it can be repeated or shown when desired by the teacher rather than on a schedule; but it is at an enormous disadvantage in the cost and difficulty of distributing the right film when and where it is needed. The broader the coverage area, therefore, the greater the cost-effectiveness advantage of television. And even relatively inexpensive and unglamorous audiovisual devices like slides and filmstrips have certain obvious teaching advantages, although they lack movement and, like films, have distribution problems. Similarly, tape recorders and disc record players are useful in many learning situations.

26. Thus, the educators and developers of Africa can choose from a broad spectrum of learning aids, and should not be constricted by any preconceived system pattern or any foreign model in making their choice. Rather, they should decide upon priority objectives, and then design an instructional system to achieve them. Within the limits of their resources, they should, of course, give careful attention to the potential of a direct broadcast

satellite, which, for a high total cost but a low unit cost, can deliver instructional television and/or radio, and, incidentally, film, slides, and recordings, more widely than it would likely be possible to deliver them by ground systems in any comparable development time.

27. In planning instructional media, however, it is necessary to remember that they are seldom used alone. Rather, they operate almost invariably as part of a total system of teaching and learning activities. When television is used well in school, the classroom teacher acts as full partner in the process, and the student spends a great deal of his time with workbooks and texts related closely to the television. When radio is used to teach children at home in the remote interior of Australia, the child studies his text, works out his home exercises and his correspondence papers, and whenever possible has a two-way radio conversation with his teacher. The television or radio usually does one particular job -- never the whole job. In the British Open University, for example, broadcasts are designed to fill about 10 per cent of a student's study time. In India, the radio rural forum broadcast was designed only to stimulate the discussion and planning of a carefully organized group of village men.

28. Thus, any plan to make use of a direct broadcasting satellite implies a great deal of necessary and

related activity -- organization and training of a field staff if the main target is to be rural curriculum making and the preparation of printed study materials, preparation of teachers if the broadcasts are to go into schools.

29. Any such plan also requires the training of technical personnel to work in studios and ground stations, and to install and maintain reception facilities.

30. It requires also a major effort at programming the satellite itself. The programs for any such a spectacular and public system must be made with great care, and many of them should be tested and perhaps remade in order to avoid an expensive failure. We have estimated the cost of such programming under African conditions at $5,000 an hour for television, $1,000 an hour for radio. Unquestionably, it could be done for less, but Africa deserves better than cheap programming.

31. For all these reasons, even after the basic decisions on priority uses, cooperation, and system have been made, the "start-up" time will still be long if the project is to start well.

32. In Chapter VI we have described and roughly costed a number of different types of satellite systems. It would not be useful to elaborate and recommend any of these until prior decisions have been taken. Neverthe-

less, our examples indicate the variety and nature of representative equipment and combinations available (see Chapter VI, Table 19) -- from a satellite furnishing 400 radio channels to approximately one-third of the sub-Sahara area (at a capital cost of about $42 million), to one providing four television channels to about one-third of the area plus 200 radio channels to the entire area ($80 million), to one offering two television channels to each of four separate subdivisions of the area plus 100 radio channels to the entire area ($225 million).

33. We have also specified, without making new detailed engineering studies, the power and launch requirements for each of these satellites, frequencies available, requirements for ground stations, return audio links, direct reception for television and radio signals from the satellite, and power sources where power lines do not exist. This will be no news to an engineering member of the team, but it may help to summarize. For other members of the team, we have provided cost estimates as they would seem likely to be if an order were to be placed today. For example, we have estimated a receiving terminal for one TV channel (or 100 radio channels) at 2.6 GHz, in quantities of 100,000, at $200 each. This cost would go up if the unit has to receive more than one TV channel, and if quantities are lower. Counting the cost of a receiving set as $100,

this would make the total capital cost of one direct reception unit as low as $300. This sum means, however, that few home terminals would exist, most terminals would be in schools, and the cost of a large ground reception system usually would be more than that of the space link itself.

34. We have estimated the cost of a ground station (to transmit to the satellite) with studios, at $2 million. Thus, the more countries that required their own ground stations, the more the system cost would rise. We have estimated the cost of power sources (where mains do not exist) at from $60 (for animal power) to perhaps $200 (for generator power) for the first year.

35. So far as the space link itself is concerned, these costs are likely to come down somewhat over the next five to 10 years because much of the development engineering will be done for other projects.

36. The more nearly a space system is used to cover the entire area of sub-Sahara Africa, or to give 100 per cent coverage to a group of countries, with television, the greater the unit cost advantage for the space system over ground television. There would be no such advantage, of course, if the coverage were to be localized in a few geographically small countries or in urban areas; and in

this case ground television would have the additional advantage of being able to localize programs.

37. There is no such apparent cost advantage in covering all of sub-Sahara Africa with radio from a satellite. Although space in the radio spectrum is at a premium, it would still be possible to find places for the 85 or so high-powered radio stations necessary to provide at least one channel for educational and development purposes receivable everywhere in the area. In this case, as in that of ground-based television, these ground stations could have the advantage of localized programming. However, one station per area would not provide much school broadcasting. The advantage of the space system would become apparent if it were desired substantially to increase the number of radio channels available.

38. The decision on a space vs. ground-based development of instructional radio and television must take into account:

Time - a satellite could probably make radio and television available to many rural areas long before terrestrial stations would do it.

The need for local programming - the less that programs can be shared between countries,

the more that local culture must be reflected and local language must be used, the less advantageous a space system appears. This depends, of course, on the number of languages broadcast simultaneously and the geographical distribution of the linguistic groups.

Coverage - the wider the desired coverage of sub-Sahara Africa, the more attractive a space system appears.

39. The countries of sub-Sahara Africa are not wealthy. GNP is typically between $50 and $100 per capita, and the rate of annual growth has only recently climbed to four per cent in real gross domestic product. Therefore, undertaking a development like this, which would not only require a large initial capital outlay, but also a large annual cost of operation, is a matter for serious consideration.

40. From the outside, it would seem that a possible result of the visit of the field team and of UNESCO's counsel might be to interest a group of the more affluent countries and perhaps to have them decide to begin the project in a smaller way under a regional organization while the other countries wait and see. This would have certain advantages -- fewer problems of sharing and cooperation, ability to choose a less expensive satellite design that would concentrate

television and radio on a limited area rather than the whole subcontinent, opportunity to learn how to program into the rural areas, make the necessary educational changes, and experiment with the necessary infrastructure, before expanding the project. If the system could be proved effective on a limited basis, then other countries could join when able, and a larger space system could be substituted when necessary.

41. But we want to reiterate our feeling that educational and developmental needs, as perceived by these countries, must give rise to any such project as this. Just as there can be non-Western patterns of development, we feel most strongly that the educational changes now about to take place in Africa, and the instructional technology used to implement them, should take an African form, rather than a European or an American or any other form. Consequently, we hope that the next step will be to stimulate a period of planning and consideration of alternatives, on the part of interested sub-Saharan countries, out of which will grow an African decision and an African system, whether or not it includes satellites or television or any other "new" tools of learning and teaching. We have never seen a completely successful outcome when a plan from outside was set down in a developing country. We have never seen the necessary involvement take place unless the plan developed mostly from within.

INTRODUCTION

This report

The nature of this memo is exploratory, suggestive, groping at times in the absence of information, but always, we hope, respectful of the complexities of the human situation. UNESCO has asked us to consider the possibility of a continent-spanning communication system for sub-Sahara Africa --a system that may employ direct broadcast satellites. Our discussions at Stanford have not been intended for the formulation of a master plan for African communications. They can be at most a first step in a long process, a process that leads--where? We are far from certain.

We address this memo to a very small audience. The next level of this exploratory process must occur in Africa itself, where a field team can study the African situation close-up. Our audience is the field team. In the actual situation, they can assess the social needs of the sub-continent and study the possible contribution that some form of communication system can make to those needs. If there has been one realization we have had throughout our discussions here in California, it has been that we are 10,000 miles from Africa.

We have had the gadfly role, to poke around a bit at the problem, to define some approximate parameters, to pro-

wide cautions, and yet to give free rein to the great possibilities of technology for social service. It is the field team that will have to deal with the realities of the concrete African situation. Certainly, the team must travel throughout the continent and include in its discussions African leaders and scholars. It must deal with the quilt of languages and people that is Africa. It must examine concretely the priorities of African nations and the contribution that communication can make to those priorities. It must understand the role of communications within the total African system. It must be aware of the colonial legacies, the independence struggles, the neo-colonial possibilities.

So we are speaking to that field team. Others who may read this do so, as it were, over the shoulder of the field team. If other readers find useful material here, our work will have had an unforeseen dividend.

We are hopeful that we can assist the team in their definition of the questions involved. The angle set at the earliest part of the journey determines how efficiently one proceeds toward his goal.

The ease with which a satellite can be set in place above the African continent belies the complexity of the continent in its shadow. If we are optimistic that the technology that has reached the moon can reach into African villages as well, we must also be aware that the total job of earth-man in Africa is much more elaborate. A moon landing

involved mainly the technological know-how, the skills that have in fact been advancing so rapidly. A village landing involves much more. It involves not only the technological skill of our time, but also the complexity of rapidly changing social situations and rapidly expanding social needs. How, and if, these two major elements--technology and social needs--can be made to complement each other on the African continent: this indeed is a question largely unexplored.

What we did

By direction, we limited our examination to the independent countries of Africa, south of the Sahara. The northern tier of countries of predominantly Arab background was not included--Spanish Sahara, Morocco, Algeria, Tunisia, Libya, Egypt, and the Sudan. These nations are distinct in cultural heritage from the black African areas, though certainly Islam has a long history in West Africa. The medieval kingdoms of Ghana, Mali, and Songhai all had Muslim rulers and benefited from educated Muslim bureaucracies. Indeed, fabled Timbuktu in Mali had a Muslim university in the thirteenth century.

We are also aware of Pan-Africanists' dream of African unity, and do not eliminate the Arab states from those hopes. The definition of sub-Sahara Africa is not entirely arbitrary, however, as we see from the civil war in the Sudan. But like all divisions, it can be challenged. In any case, we follow this line of division.

Another division line is in southern Africa, approximately along the Zambezi River. We did not consider the white controlled countries of South Africa or Rhodesia, or the Portuguese areas of Guinea Bissau, Angola, and Mozambique. Obvious political reasons preclude hope for cooperation between this area and black Africa in the near future. Included in our study, however, were the former High Commission territories, Botswana, Lesotho, and Swaziland.

Table 1 lists the countries that fall under our consideration, and Figure 1 shows the area of Africa that is included.

The discussions at Stanford were conducted by two professors of communication and involved eight graduate students and research assistants. Professors of linguistics and electronic engineering contributed as well. Some of the African students at Stanford shared their ideas with us freely and informally. Finally, UNESCO sent two African scholars to contribute to our discussions. This was an input that was extremely valuable, and served to underline further the clear necessity of involving Africans in all future discussions and field operations. Such involvement is not an optional luxury.

For this reason, we are posing our questions and stating our material to the field team. Needless to say, the brief question "What about a system of satellite communication for Africa?" implicitly contains some of the most complex and

TABLE 1

COUNTRIES OF SUB-SAHARA AFRICA

CONSIDERED IN THIS MEMO

Botswana	Malawi
Burundi	Mali
Cameroon	Mauretania
Chad	Mauritius
Central African Republic	Niger
Congo	Nigeria
Dahomey	Rwanda
Equatorial Guinea	Senegal
Ethiopia	Sierra Leone
Gabon	Somalia
Gambia	Swaziland
Ghana	Tanzania
Guinea	Togo
Ivory Coast	Uganda
Kenya	Upper Volta
Lesotho	Zaire
Liberia	Zambia
Malagasy Republic	

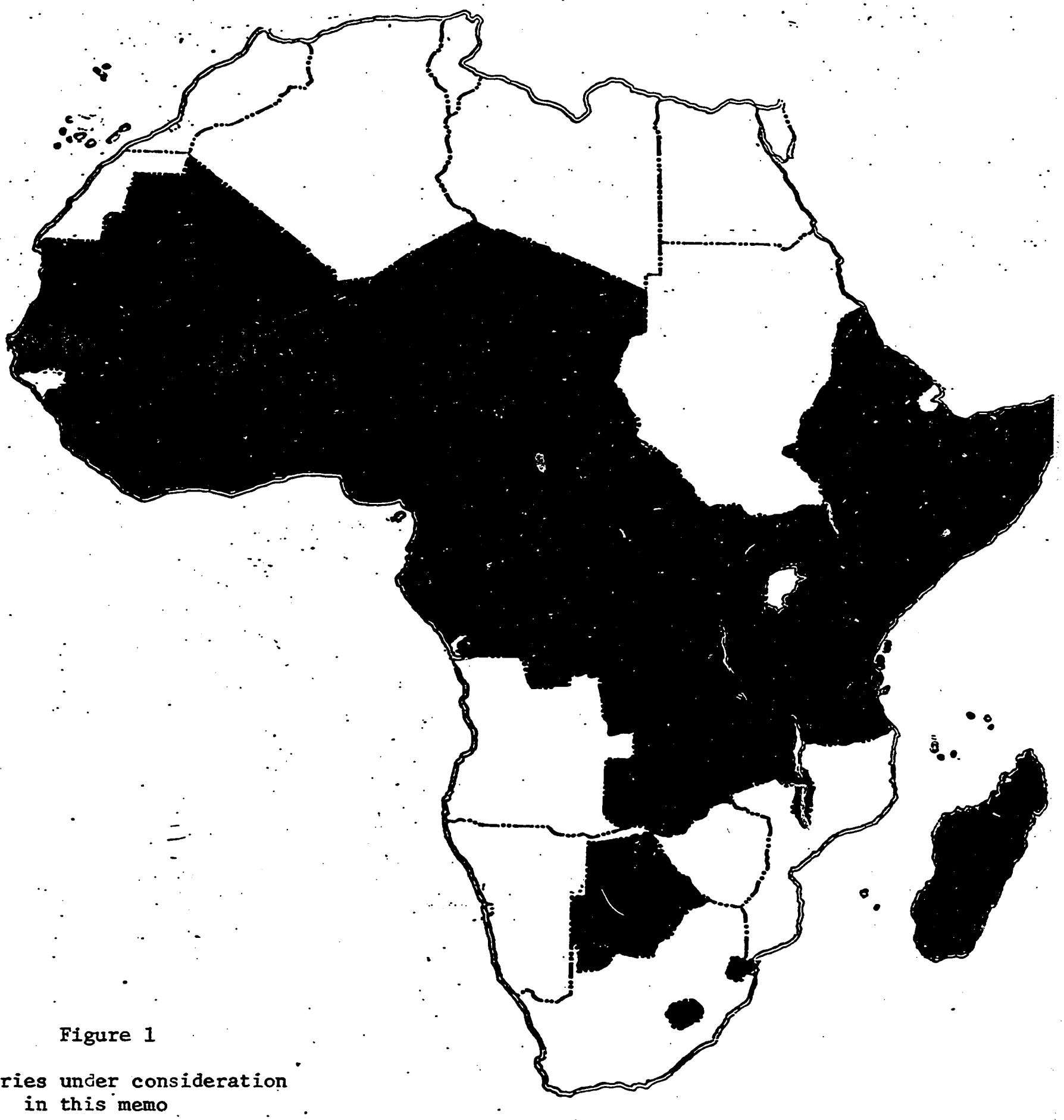

Figure 1

Countries under consideration
in this memo

challenging questions facing anyone trying to draw up concrete plans for a real situation. Please forgive us, therefore, for including elementary data even though it may be seen by sophisticated and experienced persons who will serve on the field team.

The basic questions

To a person thinking about an African communication system, prior questions suggest themselves. Apart from any considerations of communication systems, what are Africa's needs? If communication is proposed as some kind of a solution, what problems does it solve? What needs does it serve? What problems does it raise?

Africa is the newest area of the world to emerge from colonial status. The Scramble for Africa occurred during the 1880's. Before that, Africa was seen mostly as a barrier to Asia, the area which Europeans had sought as a main source of foreign wealth even before the opening up of the Americas. To add to this long lack of interest in Africa as a commercial area, there were the physical barriers to the continent. The Sahara blocked travel to the black areas to the south (though we know Arab traders did indeed cross the desert). The West Coast lacked natural harbors to allow European ships to linger. Because of the altitude of much of the African continent--tablelands that drop off near the sea--African rivers have many waterfalls that effectively limit penetration

by boat. Even the Nile has a swampy sudd at its southern reaches, hindering or preventing navigation.

While Africans did trade with Europeans before the 1880's (indeed, the first Africans who were brought as slaves to Portugal in 1441 were the first of perhaps fifty million slaves), the Europeans were not allowed to venture inland to find the sources of slaves, gold, and ivory. The same was true on the East Coast where Arab traders were restricted to the coast. Trade was conducted through African middlemen.

Another barrier to European entry was disease. Particularly in West Africa, mortality rates among Europeans were very high. The anopheles mosquito is credited by West Africans with keeping out white settlers for a long time! East Africa and southern Africa could support settlers because of the more favorable health conditions there.

African society was organized along family lines. It extended outward from the nuclear family, to the extended family, the lineage, the clan, the tribe, and the nation. The lineage unit could look back to common ancestors, and was the main building block of the African societies. The clan took in several lineage groups, but with looser links. A tribe was several clans united linguistically and culturally.

Most Africans have traditionally been herders and subsistence farmers. A few were hunters.

When the colonial administrations came in, they set

boundaries, the boundaries that still remain. They also instituted some schools. Through these schools, Africans received a knowledge of one of the European languages, usually French or English, since the colonial languages were the languages of the schools. The education that did occur was a process in which Africans learned about European matters. The Europeans who came to Africa were there to trade and to teach religion; they did not come as students of Africa.

Neither did the Europeans come as settlers--except in a few places. The main European interest was in the extraction of minerals and agricultural products. African agriculture had been a slash-and-burn, subsistence type, but now produced cash crops to some extent for export to Europe. Agricultural exports became the main contribution of Africa to world trade; the colonial powers did not set up industries in Africa.

The two World Wars exposed African men to wider worlds, and helped them see the limitations of the white man's power. A small number of Africans began to attain European or American degrees in the years after the Second World War. Under prodding from the United Nations, the European colonial powers started to grant independence to their African colonies. Britain did so gradually, from the Sudan in 1956 to Swaziland in 1968. France, whose colonial administration had always been more centralized, gave independence to its African colonies in 1960. Belgium left the Congo that same year.

Portugal has maintained control over Guinea Bissau, Angola, and Mozambique by declaring that they were not colonies at all, but provinces of the homeland. Portugal, as we know, now faces guerrilla resistance in three of these provinces.

The newly independent nations maintained, for the most part, the borders set up by the European nations at the Berlin Conference where the partition of Africa had occurred in 1884. The tasks facing the African nations at independence involved three main areas.

First, they had to build their separate nations. To do so meant primarily to inject into the consciousness of the people a national identity, a feeling for being Ghanaian or Sengalese or whatever. The great danger has been that regional groups or ethnic groups may not want to be a part of the nation as defined by the colonial borders. They may seek to secede and become nations themselves. This is what we saw in Katanga, Biafra, and Eritrea.

Second, the new nations were faced with building the administrative apparatus of a nation. They had to provide services for their people and collect taxes, to provide for peace throughout the country. Part of the process of opposing colonial regimes involved making promises of a better life after independence. The African population had seen how the colonial administrators lived. African expectations went very far beyond what the new governments, with their inexperienced

bureaucracies, could deliver. Some leaders, like Tanzania's Nyerere, have been able to unify the country around more realistic goals. In other nations the stresses of administering a new state have caused leaders to fall from power. New states need trained leaders at every level of the administration if the government is to provide services to the population.

Third, there is economic development. Once political independence has been attained, the new African nations have found their economic legs wobbly. Dependence on one or two crops, lack of industrialization, foreign ownership of local assets--these are the common problems of African economies. The Ivory Coast has attained a healthy growth rate by continuing a close relationship with France. Kenya has been developing its tourism, so that tourists are now its main source of foreign exchange; Kenya is less dependent on coffee than it had been. Tanzania has chosen to take a socialist tack, avoiding entangling aid agreements. Overall, African countries remain the world's lowest in gross national product.

With this sketchy background, we can ask: What are Africa's priority needs? Is formal education the key growth factor? Or is literacy most important? Would some type of informal education take priority? Is more training needed for rural development? Are better agricultural methods the key to development? Disease has often weakened African manpower; would preventive medicine result in greater resources of

labor in these nations where capital is so scarce? Should greater communication be first provided for the government infrastructure so that government services may be more available and efficient?

Of course, African priorities should be determined by Africans. As we discuss the African situation, we will examine it for the feasibility of various types of communication systems that will extend development in directions that Africans desire.

We will now touch briefly on several aspects of the African situation--the people, the languages, the political realities, economics, the education situation, the available communications media. Finally we will discuss alternative communication systems.

CHAPTER I

PEOPLE AND LANGUAGES

by

Peter Spain

The populations of black Africa today can be divided into three main ethnic groups: Pygmies, Bushmen, and Negroes. The Pygmies number only around 200,000. They have been pushed back from the lakes region by various invasions, and now live in the forests of Botswana and South West Africa. The Bushmen are even less numerous, 50,000 at the most, including the Hottentots. They live now quite scattered through South and South West Africa, northern Angola, Zaire, and Gabon.

The Negroes form the main base of the African population and the vast majority of the population of black Africa. They include the groups usually called the Negroes, who occupy present-day West Africa, sharing the northern part of it with the Hamites from North Africa; and the Bantus who live throughout eastern and southern Africa. The equator roughly divides the two groups.

Africa, as a whole, is not a densely populated area. Table 2 lists all 35 countries with their populations and

TABLE 2

POPULATIONS AND POPULATION DENSITY BY COUNTRY

Country	Population (thousands)	Population/km^2
Botswana	623	1.1
Burundi	3,600	134
Cameroon	5,786	12.5
Central African Republic	1,522	3.6
Chad	3,706	2.7
Congo	936	3.1
Dahomey	2,686	25
Equatorial Guinea	285	10
Ethiopia	25,046	20
Gabon	510	1.9
Gambia	364	33
Ghana	9,024	36
Guinea	3,921	16
Ivory Coast	5,115	16.3
Kenya	10,944	19
Lesotho	1,043	31
Liberia	1,171	14
Madagascar	6,932	11.6
Malawi	4,609	34
Mali	5,088	4
Mauretania	1,171	1.1
Mauritius	861	396
Niger	3,848	3.3
Nigeria	66,174	70
Rwanda	3,587	136
Senegal	3,925	19
Sierra Leone	2,644	34
Somalia	2,789	4
Swaziland	421	22
Togo	1,861	36
Uganda	8,584	48
Tanzania	13,236	13
Upper Volta	5,376	20
Zaire	21,638	9
Zambia	4,295	5

Source: BREDA, Dakar

population densities. The total population of these countries comes to 235,975,000, about 14 persons for every square kilometer. Nigeria is far and away the most populous nation, with 66 million people, or 28% of all Africans in these 35 countries. The five most populous countries--Ethiopia, Zaire, Tanzania, Kenya, and Nigeria--account for over 58% of all sub-Sahara Africans. Of the thirty other countries, none has more than 10 million people.

The density of population varies widely. Mauretania and Nigeria have about the same land area, but while Nigeria's population is near 66 million, Mauretania's is closer to 1 million. In terms of land area, the only countries that have population pressures are Rwanda, Burundi, Nigeria, and the island nation of Mauritius. Most of the sub-continent has population density of less than 10 persons per square kilometer. Substantial portions of northern Mauretania, Mali, Niger, Chad, and Kenya, and almost all of Botswana have less than one person per square kilometer.

The UNESCO Regional Office for Education in Africa estimates the population growth rate of these countries is 2.5% as of 1970. This means that the 235 million people there will increase to 494 million by 2000.

Considering Africa as a whole, the growth rate is only 2.3%. While there are higher growth rates in Asia (2.7%) and in Latin America (2.8%), the fertility rate in Africa is

higher than in other regions of the world. Between 1960 and 1966, the gross birth rate of Africans was 46 per thousand while the average around the world is about 34 per thousand. But the death rate in Africa is also higher than elsewhere in the world, with an average of 23 per thousand compared with 16 for the rest of the world.

The result is that a large proportion of the population, about 43%, is less than fifteen years old. In 1967, there was not a single African country where the adults over 60 made up more than 10% of the population. On the average, they were only 5%. This means that there is a very high percentage of dependents, mostly children, as compared with the working population.

No country has a metropolitan area with over a million persons. Only Dakar, Accra, Lagos, Ibadan, Kinshasa, Nairobi, and Addis Ababa have over 350,000 inhabitants. Africa remains predominantly a rural continent. Only 12% of the people live in towns of more than 20,000 inhabitants.

However, the concentration of the population in towns of this size and above is growing at 5.4% per year, a rate higher than any other part of the world. This high rate, of course, reflects the low level of urbanization to start with. In aggregate terms, about 30 million Africans live in towns of more than 100,000 now. The natural rate of growth of that population is about 750,000 to 1 million per year, but, if the drift from the countryside is added to this, the rate of

population growth is over two million per year.

According to the Food and Agricultural Organization's estimates, the African agricultural population should grow at a rate of 1.8% per year up till 1985, while the non-agricultural population should grow at 4.8% over the same period.

The drift from the countryside causes serious problems because the towns which are insufficiently industrialized are unable to absorb this ever-growing labor force. It is a story repeated around the world. Africa, at the present time, has a large number of workers who are continually moving from country to town and back again looking for satisfactory employment. In scuthern Africa, the presence of industry in South Africa attracts hundreds of thousands of workers from Botswana, Lesotho, Swaziland, and Malawi, and serves to illustrate the employment problems throughout independent Africa. It also illustrates a dependence of these southern nations on South Africa.

Languages

"That the linguistic situation of Negro Africa is very complicated is a well-known fact. How complicated, nobody can tell for sure, because nobody, not even the professional linguists, knows exactly how many languages are spoken in Africa, and not even, in most cases, how many languages are spoken by how many people in any given country." (P. Alexandre,

"Some Linguistic Problems of Nation-building in Negro Africa," in Fishman, Ferguson, and Das Gupta, Language Problems of Developing Nations, 1968, p. 119).

This linguistic situation must be considered against the fact that broadcasting systems have a limited number of channels. Limitations are even more serious when a satellite is used as the transmission link of a communications system. Yet linguists estimate that there are 800-1000 languages in black Africa, over 240 in Nigeria alone. So far the study of African languages has concentrated on the description of language structure, rather than on the size of language groups. Information about how many people speak a certain language is very difficult to acquire, and the available data are sketchy. Table 3 shows that data within countries are, in many cases, simply not available--few totals in the table come to 100%. What is particularly striking from this table is the lack of information about European languages, particularly the extent of English and French. "...According to the most reliable estimates, probably less than 10 percent of the population of Africa south of the Sahara is possessed of any degree of proficiency in either French or English. The French phrase 'Afrique d'expression anglaise/francaise' is less of a misnomer provided it be remembered at all times that it is only a very small portion of this more or less vague entity, Africa, which expresses itself at all in the languages of the former colonial powers." (Alexandre, op. cit., p. 120). This is simply

TABLE 3

PRIMARY AND INTERMEDIATE LANGUAGES

Nation	Languages (primary and intermediate)
Botswana	Setswana: 69%; Shona: 9%
Burundi	Kirundi: 28%; Swahili: 17% French: 7%*
Cameroon	Ewondo-Fang: 19%; Bamileke: 18%
Central African Republic	Banda: 47%; Gbeya: 27%
Chad	--
Congo	Kikongo: 50%; Teke: 25%
Dahomey	Fon: 60%
Equatorial Guinea	Fang: 80-90%
Ethiopia	Galla: 44%; Amharic: 32%; Tigrinya: 7%
Gabon	Fang: 30%; Kele: 31%; Njabi: 31%
Gambia	Mandingo: 46%; Pulaar: 19%
Ghana	Twi: 44%; Nzema: 44%
Guinea	Pulaar: 39%; Malinke: 26%
Ivory Coast	Anyi-Baule: 24%; Bete: 18%
Kenya	Kikuyu: 29%; Luluyia: 19%; Swahili: 40%
Lesotho	Sesotho: 99%
Liberia	Kru-Bassa: 30%; Kpelle: 25%; English: 5%
Madagascar	Malagasy: 97%; French: 2%
Malawi	Nyanja: 36%
Mali	Bambara: 40%; Pulaar: 14%; Senufo: 14%
Mauretania	Arabic: 82%; Pulaar: 12%
Mauritius	French: 50%
Niger	Hausa: 43%; Songhai: 18%
Nigeria	Hausa: 21%; Yoruba: 20%; Igbo: 17%
Rwanda	Kinyarwanda: 90%
Senegal	Wolof: 38%, 75-80%; Pulaar: 21%; Serer: 20%; Diola: 10%; Malinke: 6%; Soninke: 2%; Arabic: 2%; French: 1%, 15%
Sierra Leone	Temne and Limba: 52%; Mende: 34%
Somalia	Somali: 90%
Swaziland	Siswati: 99%
Togo	Ewe: 40%, 60%; Kabre-Taru: 35%
Uganda	Luganda: 38%; Lunyoro: 11%; Ateso: 9%; Swahili: 15-20%
Tanzania	Sukuma: 13%; Swahili: 7%, 70-80%
Upper Volta	More: 54%; Bobo: 13%; Lobi: 13%
Zaire	Lingala: 40-50%; Kikongo: 20-25%; Swahili: 15-20%
Zambia	Bemba: 33%; Tonga: 15%; Swahili: 10%

*Underscored languages are intermediate languages. Source: BREDA, Dakar

a gap in the work of linguistic mapping. The precise information does not yet exist. A field team will need to uncover these linguistic data or at least form a clear estimate of the true situation, in order to be able to consider the potential of mass communication systems on any broad scale.

Figure 2 maps the official languages of these 35 countries. Just what "official" means when used here varies from country to country. Each country has different attitudes toward its official language. One index of these attitudes is the language used for primary education. Table 4 contains data on the country-by-country policies for primary school languages. Both Figure 2 and Table 4 are dominated by colonial languages, except in Guinea, Nigeria, and Senegal.

Taken together, Figure 2 and Table 4 tell us that most Africans do not use their maternal language in their schoolwork or in their central governmental business. This impression comes through. But in the area of language, we cannot generalize on the basis of impressions. While there may be official languages and school languages, different countries may in fact use indigenous languages in varying degrees. Policies are differentially enforced. The only way to explore this situation is by an exhaustive country by country examination.

Alexandre's low estimate of the use of French and

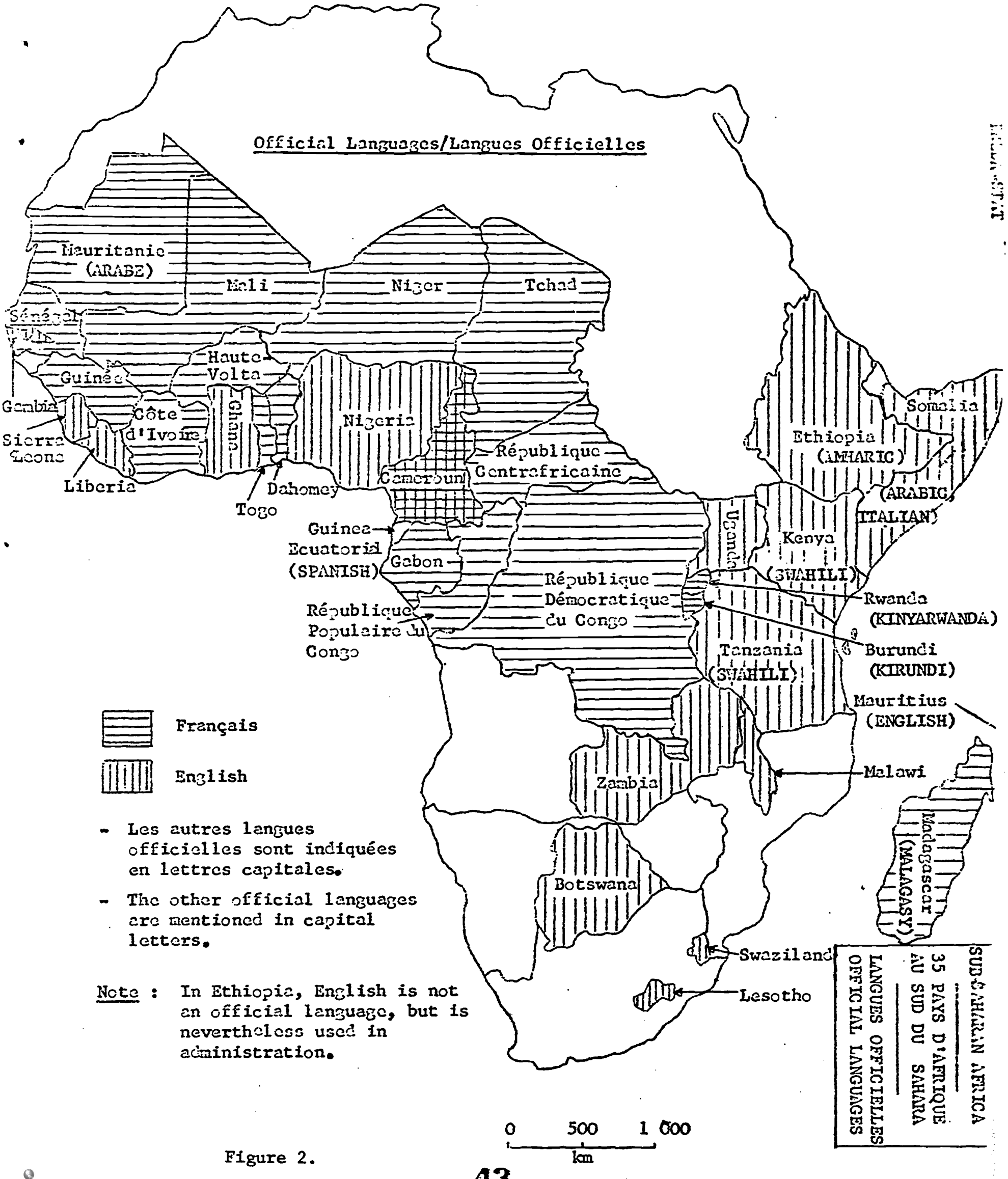
Official Languages/Langues Officielles
Mauritanie (ARABE)
Mali
Niger
Tchad
Sénégal
Haute Volta
Guinée
Gambia
Côte d'Ivoire
Ghana
Sierra Leone
Liberia
Togo
Dahomey
Nigeria
Cameroun
République Centrafricaine
Guinea Ecuatorial (SPANISH)
Gabon
République Populaire du Congo
République Démocratique du Congo
Uganda
Kenya (SWAHILI)
Rwanda (KINYARWANDA)
Burundi (KIRUNDI)
Tanzania (SWAHILI)
Ethiopia (AMHARIC)
Somalia (ARABIC, ITALIAN)
Mauritius (ENGLISH)
Malawi
Zambia
Botswana
Madagascar (MALAGASY)
Swaziland
Lesotho
Français
English
- Les autres langues officielles sont indiquées en lettres capitales.
- The other official languages are mentioned in capital letters.
Note : In Ethiopia, English is not an official language, but is nevertheless used in administration.
0 500 1 000
km
SUB-SAHARAN AFRICA
35 PAYS D'AFRIQUE AU SUD DU SAHARA
LANGUES OFFICIELLES
OFFICIAL LANGUAGES

Figure 2.

TABLE 4

SCHOOL LANGUAGES

Nation	Language
Botswana	English
Burundi	French
Cameroon	French/English
Central African Republic	French
Chad	French/Arabic
Congo	French
Dahomey	French
Equatorial Guinea	Spanish
Ethiopia	English
Gabon	French
Gambia	English
Ghana	English
Guinea	Pulaar, Malinke, Sousson, Kissi, Guerze, Toma Bamare, Koniagui, French
Ivory Coast	French
Kenya	English
Lesotho	English
Liberia	English
Madagascar	Malagasy, French
Malawi	English
Mali	French, Arabic
Mauretania	French, Arabic
Mauritius	English, French
Niger	French
Nigeria	Hausa, Yoruba, Igbo, Edo (Bini), Efik, Kanuri, Nupe, Tiv, Arabic, English
Rwanda	French
Senegal	French; projected: Wolof, Pulaar, Serer, Diola, Malinke, Soninke
Sierra Leona	English
Somolia	Arabic, English, Italian
Swaziland	English
Togo	French, Ewe (in mission schools)
Uganda	English
Tanzania	Swahili, English
Upper Volta	French
Zaire	French
Zambia	English

English would seem to reflect the limited number of persons who have been in school and the much smaller number involved in government.

We can take the ten largest indigenous language groups as estimated by UNESCO. Table 5 lists these, and gives too the range of accuracy for the estimates. They include between

TABLE 5

BREDA ESTIMATE OF NUMBER OF PERSONS IN 35 SUB-SAHARA AFRICAN COUNTRIES WHO BELONG TO THE TEN LARGEST INDIGENOUS LANGUAGE GROUPS

Language Group	Low Estimate	High Estimate
Swahili	20 millions	25 millions
Hausa	15	20
Yoruba	10	15
Amharic	10	15
Igbo	9	12
Pulaar	9	12
Lingala	8	11
Mande group	6	9
Malagasy	7	7
Kikongo	5	7
TOTAL	99	133

This is 42 to 56 per cent of the 236 million people in these countries.

42 and 56 percent of the population. When the 50 most-used indigenous languages are considered, the total number of persons covered is only 63 per cent. The marginal cost of increasing languages after the first ten is very high. The cost of 100% coverage of the African continent from a control point would obviously be staggering.

The data on language coverage are hard to come by. Bernd Heine provides one of the few maps of trade languages for Africa. It is reproduced as Figure 3. The map takes in 30 languages, and covers most of the 35 countries. However, all of Gabon and most of Liberia are not accounted for. These languages are the languages of trade, limited to a specific function and vocabulary. While Swahili developed into a maternal tongue from its evolution as a trade language, we need more information on these languages to know just how useful they are in the areas of our map.

Part of the reason for the multiplication of languages in Africa has been the distances among the scattered population. Trade has been the first contact point, and has been a force for language-sharing. The use of communications technology in whatever form can be a homogenizing force. A nation or a group of nations may consciously promote a national language. If so, communications technology can contribute to that effort.

This language question is a problem that members of a field team must consider carefully. On the one hand, they

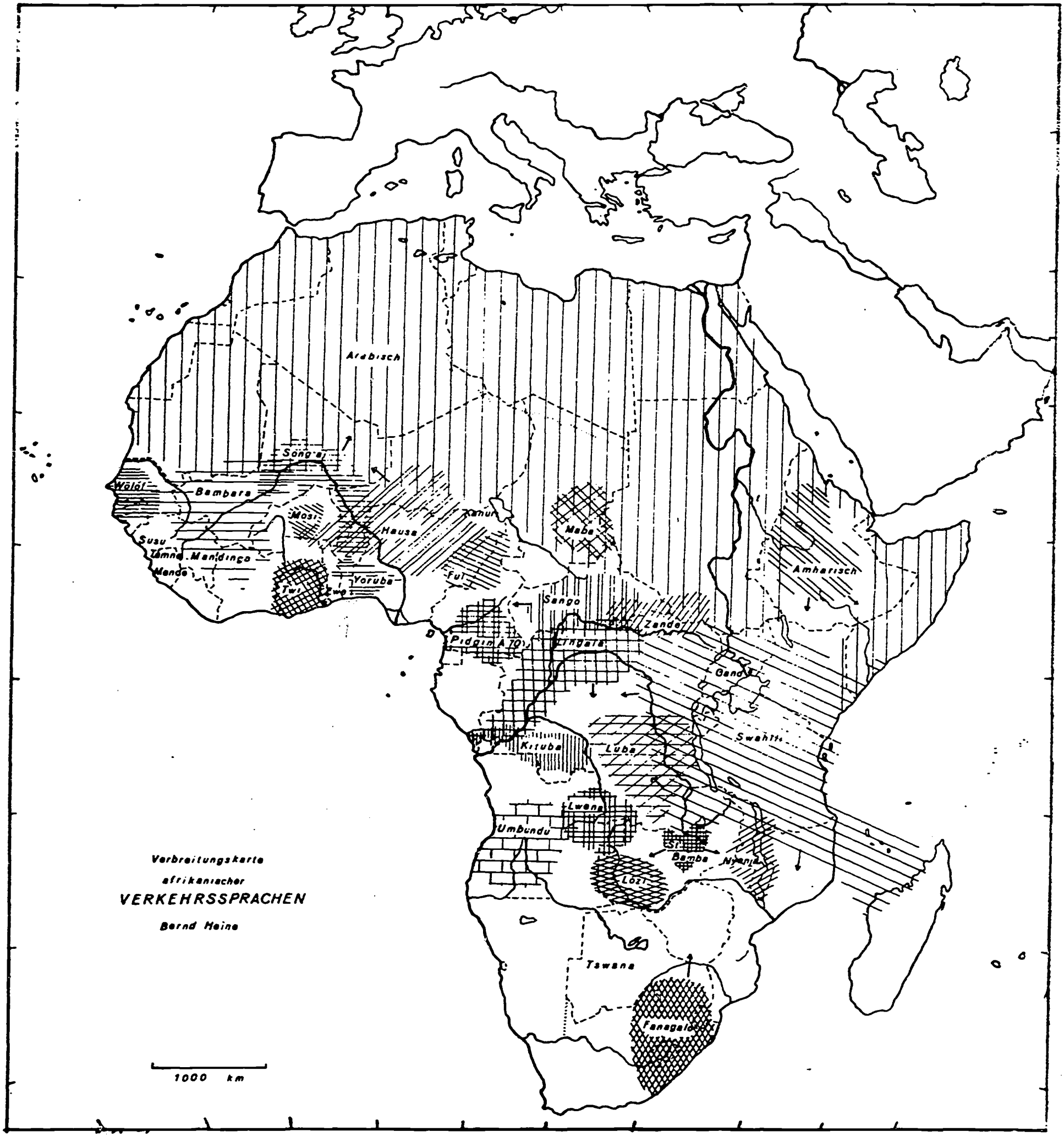

Figure 3.

African Trade Languages

47 - Bernd Heine

must recognize that complex language patterns are not amenable to mass coverage of an area by communications technology. Particular groups will be reluctant to abandon their traditional languages. Official efforts to promote one language over another can lead to tensions. The Ewe speakers of the Ghana-Togo border area felt the pressure of national language policies. India, of course, has had violence in response to language policy decisions in favor of Hindi by the central government. As Abernethy notes, one fortunate aspect of the language situation in sub-Saharan Africa is that there are no indigenous written languages of long standing, whose claim to official status might pit various language groups against each other. The language controversies that have raged in India, Ceylon, and Malaysia have been averted in Africa precisely because African vernaculars were not vehicles for the written transmission of culture before the coming of the European.

Linguistic unity is a factor in the job of nation-building. Tanzania has had this advantage with Swahili, as Swahili evolved from a mixture of the Bantu and Arabic among the traders along the East Africa coast. Its adoption as the official language, therefore, was not a concession or an affront to any ethnic group. Furthermore, Tanzania has not had a dominant ethnic group, or strong factions emerging from the colonial period. The Sukuma of the lakes region are the largest group (about 1 million), but never showed the

cohesiveness or clannishness of, for example, the Buganda in Uganda or the Kikuyu in Kenya. Many African countries, in their new-found independence, are hesitant to install the language of one of the groups within the nation as the nation's official language. Not wishing to divide their people at the crucial moment of nation-building, they tend to choose the language of the former colonial country.

Consequently, most of the official African languages are French or English. Since the colonial administrations used these languages, since most educated Africans speak these languages, since most foreign relations could not be conducted in the African language--there is an obvious logic to using the European language. But above all, it avoids the touchy issue of choosing one tribal language over another.

What are the sensitivities involved in retaining the colonial language? How do the Africans feel about this vestige of foreign political control? Does the European language tend to keep the new nation in the orbit of the former colonial power? Will this retard the development of a true African consciousness, of true African self-reliance? What would it mean for an international agency like UNESCO to suggest communication systems using English or French? What are the long-range plans of the African nations in regard to language? Have new African nations maintained the colonial language as an expedient to national unity in

the short run while hoping to promote an African language in the long run? Will attitudes toward language policy change when the second generation of African leaders emerges--leaders who have not risen through the colonial bureaucracies? In the area of education where colonial languages are also maintained, how does the language influence the curriculum? Does any centralization of language mean that rural development must be put off? These are all questions that must be considered by the field team.

All the emotions and forces that have been at work in this heady period of independence come to play in the language question. A field team must be particularly sensitive to these realities, and gather and consider as much information on language policies as it can so that the question may be treated with candor and respect for the independent nations involved.

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CHAPTER II

POLITICAL REALITIES

by

Rae Goodell

with the assistance of

Peter Spain

Communications systems, especially those involving satellites, call for co-operation among many people if a broad area is to be covered. Large countries like the U.S., Canada, the U.S.S.R., or India can think about satellites just for themselves. For countries like these, the problems that go with a broad system are still numerous but at least they need not be concerned about international implications.

In Africa, broad coverage and efficient use of a large system demands co-operation among nations. Costs must be spread over the coverage area to take advantage of economies of scale. It is as if all the complexities of black Africa have to be filtered through the relatively few channels of a central transmitter. Therefore, we come to a consideration of African politics, with an eye toward the possibilities for international co-operation within Africa.

The Pan-African Movement had its most avid supporter in Kwame Nkrumah. Because Nkrumah was the president of the first black African nation to become independent after World War II, his voice carried. Movements toward African unity have been numerous. In Tables 6-9, a summary of all these cooperative efforts is available. Tables 6 and 7 relate to Pan-African cooperation; Tables 8 and 9 to regional cooperation.

Brief movements toward actual political federation have occurred. None has been realized. More successful have been movements of functional cooperation. The dynamics of actual cooperation and failed federations may provide us a key for thinking about shared communication systems.

In June 1963, the three countries of East Africa--Tanganyika, Uganda, and Kenya--announced through their heads of state that they would federate into one nation. They appointed a working party of high government ministers to work out the details of a constitution. The expectation was that unity would come about before the end of that year.

But unity never came about. Talks broke off formally in May 1964. In retrospect, we can say that the attempt was premature. Uganda had serious problems of internal unity. The Buganda who constitute about one-fifth of the population had always been a force to reckon with in internal politics. They had received certain privileges from the British colonial regime as early as 1900 (the Johnston Agreements). Since then, one dynamic of Ugandan politics has been

TABLE 6

PAN-AFRICAN COOPERATION BEFORE 1960

Organization	Date and Place Founded	Countries Involved (North Africa and Southern Africa countries not named)	Remarks
irst Conference of Independent African States (CIAS)	Accra, Ghana, 1958	All 8 independent countries, including Ghana, Liberia, Ethiopia, and 5 from North Africa	Formed the African Group to work as a caucus in the UN
onakry Declaration	Conakry, Guinea, 1959	Ghana and Guinea then Mali	(1) Ghana-Guinea union (2) Envisioned as the beginning of a union of Independent African States (3) Mali joined 1961, became formally the Union of African States (4) Dissolved formally 1963
anniquellie Declaration	Sanniquellie, Liberia, 1959	Ghana Guinea Liberia	Often viewed as a victory for the idea of federalism as espoused by Liberia's Tubman, over organic unity as propounded by Ghana's Nkrumah
econd Conference of Independent African States	Addis Ababa, Ethiopia, 1960	13 of the 15 independent countries (not Togo or Congo (L) Cameroon Nigeria Ethiopia Somalia Ghana Sudan Liberia	Divided over Nkrumah's unity vs. a looser federalistic union as supported by Nigeria

t this point, independent Africa divided into blocs, as a result of differences over relations with France, the Congo crisis, Algerian independence, etc.

TABLE 7

PAN-AFRICAN COOPERATION AFTER 1960

Organization	Date and Place Formed	Countries Involved	Remarks
"Brazzaville Group" Union of African States and Madagascar (UAM)	Abidjan, Ivory Coast; Brazzaville, Congo; Dakar, Senegal late 1960-61	Congo (B) Ivory Coast Senegal Cameroon Chad Central Afr. Rep. Dahomey Gabon Madagascar Mauretania Niger Upper Volta	Created several organizations including Organization Africaine et Malgache de Cóoperation Economique (OAMCE), which survived nominally until the OCAM was formed. Brazzaville created a bloc, rather than a regional group. UAM dissolved after OAU formed.
"Casablanca Group"	Casablanca, Morocco Jan. 1961	Morocco Ghana Guinea Mali UAR Libya (did not sign) Algerian Provisional	Created a second bloc, differing with Brazzaville on Congo, supporting Morocco's claim to Mauritania, etc.
"Monrovia Group"	Monrovia, Liberia May 1961 Series of meetings following inc. Lagos, through 1962	Brazzaville states plus Liberia Nigeria Somalia Sierra Leone Togo Ethiopia Libya (Sudan stayed away from both groups)	Attempted to unite the two blocs, but in effect created a third, although it was "the largest single gathering of African states."
Organization of African Unity (OAU)	Addis Ababa, Ethiopia, 1963	Now includes all of independent Africa except southern Africa	Successfully brought together the various blocs into one continent-wide organization, still functioning.

TABLE 8

REGIONAL COOPERATION BEFORE THE OAU (1963)*

Date	Organization	Countries	Remarks
1958 (1945 first charter)	Maghreb Federation	includes Mauretania as well as North Africa	Mauretania has been said to be drawing closer to North Africa, away from Black Africa
1958	Pan-African Movement for East and Central Africa (PAFMECA); added South Africa, so PAFMECSA)	Tanzania, Kenya, Uganda, North and South Rhodesia, Nyasaland, Zanzibar	Disbanded after OAU At the time, the "only effective regional political association in the continent"
1959	Mali Federation	Senegal, Mali	Broke up as the leaders involved had problems keeping support at home Formally dissolved 1963
1959	Conseil de l'Entente	Ivory Coast, Niger, Upper Volta, Dahomey (out then back in), Togo (later)	Houphouet-Boigny's counter-proposal to the Mali Federation. Has survived. Met 1970 to discuss common market for livestock and meat. But "fragile"

*Regional groups dissolved themselves shortly after the formation of the OAU, in the interest of preserving the unity of the OAU, but then began to spring up again after disillusionment with the OAU set in.

TABLE 9

[illegible] [illegible]RATION SINCE THE OAU (1963)

Date	Organization	Countries	Remarks
1963	Organization des états reverains du Senegal (OERS)	Senegal Mali Mauretania Guinea	The "dream" of Senegal's Senghor, represents rapprochement of Senegal, Mali, Guinea 1965-7 A UN development program for the Senegal River valley
1964	African Development Bank	NOT Botswana, Central African Republic, Equatorial Guinea, Gabon, Gambia	Under the UN Economic Commission for Africa
1965	Organization commune africaine, malgache et mauricienne (OCAM)	Cameroon, Madagascar, Central Afr. Rep., Chad, Mauritius, Congo (B), Niger, Congo (L), Rwanda, Dahomey, Senegal, Gabon, Upper Volta, Ivory Coast, Togo (Mauretania joined, left 1965)	"Most significant regional grouping on African continent in the recent past" "A rallying point of all the French-speaking moderates in Africa" Created by former members of UAM, after disillusionment with the OAU
1966	Union doanière des états de l'Afrique de l'ouest (UDEAO)	Dahomey, Ivory Coast, Mali, Mauretania, Niger, Senegal, Upper Volta (as of 1970)	Economic and customs unions, for former French West Africa and French Equatorial Africa
	Union doanière économique de l'Afrique centrale (UDEAC)	Cameroon, Central African Republic, Congo (B), Gabon (as of 1970)	Part of the Communauté financière africaine, the Franc Zone
1967	East African Community	Kenya Uganda Tanzania	Threatened recently by reaction to the new Uganda regime resulting from an army coup

the concern of the Buganda for their place of prominence within the country. All efforts at unity under the colonial regime and after independence in 1962 had to deal with Buganda sensitivities. The ruling Uganda People's Congress had held the nation together in the year since independence. The Buganda were satisfied with their position within the new Uganda nation--at least, they were not threatening secession. With the proposal of East African Federation, the Buganda were aware that their position in the larger unit could not remain what it was in Uganda. When they proposed to join the federation as a distinct state, Ugandan leaders shuddered. The Buganda were an important part of their nation, very prominent in the civil service, and located geographically in the middle of the country. Uganda could not be Uganda without them.

But Uganda had more reason to hesitate than the Buganda question. Uganda would be the backwater area of the proposed federation--or felt it would be. The capital would be either in Nairobi or Arusha. Uganda spoke less Swahili than did Tanzania or Kenya. Uganda had fairly well-developed industry, and feared an influx of workers from Kenya's growing numbers of unemployed. Uganda had the oldest and best established university in East Africa--Makerere in Kampala. Union with the University Colleges in Nairobi and Dar es Salaam meant--to the Ugandans--that their university's

quality would be diluted.

For all these reasons, Uganda backed off. Tanzania would have been willing to merge with Kenya. But Kenya had most to gain if Uganda was included, and less to gain from Tanzania. No federation occurred.

Ironically, what happened to the East Africa Federation followed a script that Nyerere had outlined in a speech to the heads of independent African states, meeting in Addis Ababa in June 1960. Nyerere proposed federation with Kenya and Uganda, before independence. At that point, all three were still British colonies. Nyerere knew that his nation would probably be the first of the three to become independent. But he volunteered to put off Tanganyikan independence to wait for Kenya and Uganda. When they were all ready, Nyerere proposed, they should unite and come to independence as one nation. Nyerere was committed to the idea of African unity, but he predicted that independent nations would find federation much more difficult. Vested interests would arise in each nation, not because the officials were bad men, Nyerere said, but because the day-to-day administration of a newly independent nation demanded a commitment that would deepen with each day. Men would be reluctant to give up what they had created amid so much stress. The nation would have become a reality--if not in the minds of all the people, certainly in the minds of the elite who were trying to hold the nation together.

As ruling parties struggled to consolidate and exercise their power, the tendency to give up what their efforts had won would weaken. Even Nyerere, after a January 1964 army mutiny showed the fragility of his own regime, moved to consolidate his power. Kenya followed Tanzania's lead in moving to a one-party system. The purpose: to maintain the unity and the continuity of the nation.

So while federation in the full political sense has not endured in Africa, what has occurred are functional co-operative movements, like those listed in Table 9. These movements do not demand that sovereignty be yielded to a larger unity. They do allow the nations to retain their identity, and hopefully they contribute to the consolidation of the new nation. The African nations are aware of their individual weakness on the international scene. They have attained political independence, however, and take justifiable pride in that fact. The tasks they all face now, especially the tasks of economic development, give them a unity of spirit, a unity of people experiencing the same stresses. They have found advantages and support in functional co-operation.

After the talks for the East African Federation foundered, Tanzania, Uganda, and Kenya were still able to co-operate by forming the East African Community in 1967. Even the antipathy that existed between Uganda and Tanzania following the January 1971 military coup in Uganda has not broken up the

East African Community.

The Mali Federation of Senegal and Soudan (now Mali) foundered on two points, dissimilarity of history, and the unwillingness of political leaders to dilute their power by merging. Senegal had a direct colonial administration by the French and was, relatively, quite developed politically. Its tradition of political diversity contrasted sharply with Soudan's tradition. Soudan had known no politics until after World War II, when a strong single party developed as a united front against the colonial regime. Senegal looked to federation for economic advantage and greater bargaining power. Soudan saw the federation as political and anti-colonial. Fearing that the monolithic Soudan party would over-power Senegal through the defections of Senegalese minority parties, Senegal dissolved the union before it could be realized.

Federation has proved to be wholly different from functional co-operation. Nations and national elites do have a vested interest now in their own independence. But this has not precluded efforts at functional co-operation. On the contrary, it has been a force for encouraging co-operation on specific matters.

Individual nations do have their quarrels and misunderstandings. It is important for us to know where some of the forces of division are, or have been, at work in Africa. Tensions appear to recur between the following pairs of countries:

1. Somalia and Ethiopia, over unification of the Somali people on both sides of the border.

2. Togo and Ghana, over Ewe reunification.

3. Nigeria and Ghana. Relations are still "at the level of political restraint" after differences between Nigeria and Nkrumah over the unity/federalism aspects of pan-Africanism. Obviously, this has lessened since Nkrumah's fall in 1966.

4. Ivory Coast and Guinea, over Guinea's vote to break with France in 1958.

5. Upper Volta and Guinea, for the same reason.

6. Senegal and Guinea, because Senegal harbors many exiles from Guinea.

7. Sudan and Chad. Sudan and Egypt have helped the Muslim opposition in Chad.

8. Niger and Dahomey, over claims to the small island of Lété in the Niger River.

9. Niger and Mali. Mali harbors the opposition leaders of Niger who were exiled by President Diori. They continue their opposition from Mali.

10. Tanzania and Uganda. Tanzania refused to recognize the new government of Uganda that was installed by the military coup of January 1971, although at this writing the tension seems to be easing.

11. Kenya and Somali, over the border between them.

12. Malawi and a number of other nations, over President Banda's policy toward South Africa.

Divisive issues

From 1958 to 1971, the following issues have been recurring sources of conflict, frustrating efforts for unity:

1. Lack of cohesion within individual countries. This has caused some leaders to draw in upon themselves (as did Nkrumah) with an over-concentration on their own domestic problems. It has also been illustrated by the rise of military rule in many African nations. After a few years of independence, the party that led the nation to independence has in some cases lost its grip; the army fills the power vacuum. The assumption has been too easily made that newly independent former colonies are nations in fact as well as in name. Clearly Zaire (formerly the Congo Kinsnasa) was not. Other countries have had similar struggles for true national unity. None suffered as much as Nigeria.

2. The issue of non-alignment versus alliances with foreign powers. The close ties that many former French colonies maintain with France has often been resented by African nations which seek self-reliance. After the French colonies became independent in 1960, this issue was a factor in splitting the United Nations African Group and the Conference of Independent African States into factions.

3. Language-culture group tensions. Resentment toward

the Francophone group has been voiced at times. Another irritation has been the division of ethnic groups by the arbitrary colonial borders. These groups now seek to reunify. The Pan-Somali movement strains relations among Somalia, Ethiopia, and Kenya. Ewe reunification causes problems between Togo and Ghana.

4. Disputes over territory. The dispute of Niger and Dahomey over the small island of Lété is one example.

5. Leadership roles. Rivalries evolve between the strong leaders of neighboring countries, as between the Ivory Coast's Houphouet-Boigny and Senegal's Senghor, apparent in the early attempts at co-operation in former French West Africa.

6. Organic unity versus federalism, the extent to which countries should give up sovereignty for the sake of Pan-African unity.

The Pan-African movement has been described as consisting of a core of nations which believed in a revolutionary transformation into one African state, and a periphery, which believed only in alliances of the African nations as a means of advancement within the world power game.

African states have consistently resisted political union as proposed by Nkrumah, in favor of functional union, a federalistic approach to co-operation. For one thing, as we have seen in the East African case and in the Senegal-Mali case, they fear the loss of their new-found independence. Liberia's late President Tubman emerged as a major proponent

of the functional approach after the Sanniquellie Conference, and Tubman was particularly influential in the making of the OAU Charter.

7. Accusations of interference in each other's internal affairs. Nkrumah was accused by Niter's Diori of engineering an attempted assassination of Diori in 1963.

8. Israel. French Africa, for example, was divided in the United Nations vote on withdrawal of Israeli troops from occupied territories. The "moderates" chose the softer wording, requesting withdrawal; Guinea, Mali, and Mauretania voted with the Arabs.

9. South Africa. This issue and the Israel issue have occupied much of recent OAU meetings. There has been speculation that the OAU was breaking up after its most recent meeting, in which there was hot debate over whether to establish dialogue with South Africa.

Certain past issues left deep wounds. These would include the handling of the Congo crisis and recognition for the Algerian Provisional Government during its war of independence. Together with the question of non-alignment, recognition of Morocco's claim to Mauretania, resentment of the Francophone group, and the unity versus federalism question, these were the main forces causing the Pan-African movement to break up into blocs after 1960.

Factors encouraging co-operation

Tendencies to pull together have come to the African

nations from the following forces:

1. The struggle for freedom from colonialism. This gave many African nations a fellow feeling, a common bond.

2. A stronger common bond in the sense of black identity.

3. Also encouraging co-operation has been a fear of loss of African identity. This pushes Africans to organize African organizations, not just third world blocs.

4. Colonial bonds. Former French West Africa (AOF) and French Equatorial Africa (AEF) have a history of federalism under colonial rule, and have since been united by a common trade union movement and a political party (the RDA). Except for Mali and Guinea, the former French colonies have linked themselves together by gradual stages since independence: customs unions, the Conseil de l'Entente, the "Brazzavile" meetings, the OAMCE, the UAM. And now could be added the OCAM, the Organisation commune africaine, malgache et mauricienne, formed in 1965, to which most of French Africa belong (again, not Guinea or Mali). This strong regional co-operation might, however, be a hindrance to larger associations.

Relations among the countries change fast. With the many forces and demands released by independence, alliances have had little time to solidify. Stability is not to be expected in such a stressful situation.

However, the stresses toward and against international co-operation, and the sensitivities therein involved must be a major consideration of the field team in deciding whether

and in what form cooperation centering upon a communication satellite would be feasible.

It will be obvious to the field team as to the African governments that any direct broadcast from a satellite intended for a given country is likely also to be receivable in neighboring countries. This must be taken into consideration in planning cooperative arrangements, and in designing the system.

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CHAPTER III

ECONOMIC REALITIES

by

Peter Spain

In 1960, a new economic period began that roughly coincided with the coming to independence of the former colonial territories.

Since 1960, the national rates of growth have consequently changed. Most of the countries that grew most rapidly in the previous period experienced a stoppage of the inflow of private capital, and, in fact, there has been a sizable over-all outflow. Trained personnel from abroad have also departed, in some cases. In such countries, a main problem has been to achieve a successful transition from an economy where most of the exports and dynamic elements were concentrated in the sector owned, dominated, and run by foreigners to an economy run by the local people. Tunisia was the first African country to do so with success. Kenya also succeeded in handling the transfer of political and economic power from Europeans to Africans without an appreciable slowdown in economic growth by the end of the 1960's; then, however, the difficulties of welding many ethnic groups into one nation

began to become economically as well as politically troublesome. In Zaire, the problems of transition lasted longer, and it was almost ten years after independence before the country began to grow economically. Senegal suffered in a different way; the break-up of the Federation of West Africa at independence left Dakar with its nucleus of industries and commercial headquarters, a head without a body to provide it with nourishment. The Ivory Coast, Mauretania, Zambia, and Nigeria, until the outbreak of its civil war, were among the fast growers of the 1960's. The Ivory Coast pursued the old formula of the inflow of private investment and entrepreneurs, helped by the rapid growth of coffee output. Mauretania (iron and copper), Zambia (copper), and Nigeria (oil) are benefiting more than other African countries from mineral development.

In the rest of the continent, countries like Uganda, Malawi, Cameroon, Gabon, Sierra Leone, and Ethiopia continued the moderate rate of growth as in the 1950's while the very poor inland countries--Upper Volta, Mali, Chad, Rwanda--had difficulties in keeping output in pace with population growth. Table 10 presents the figures on population growth, GNP growth, and some sources of GNP for the independent sub-Saharan countries. The table provides a broad glimpse at the situations in different African countries during the 1960's.

Nearly all the African countries, in common with most of the other primary-product exporters of the world, have

TABLE 10

SOME ECONOMIC DATA ON SUB-SAHARA AFRICA

Country	Change in Annual Pop. Growth 1961-67	Change in Annual GNP Per Capita 1961-67	Source of GNP in Percent		
			Agriculture	Mining	Manufacturing
Botswana	3.0	0.7	46.9	0.1	7.5
Burundi	2.0	-0.1	60.0	7.0	-
Cameroon	2.2	0.6	37.3	-	11.4
Central Afr. Rep.	2.8	-1.0	49.0	-	12.0
Chad	1.5	-0.6	54.1	-	4.0
Congo	1.4	1.7	23.4	-	17.0
Dahomey	2.9	0.2	45.9	-	2.8
Eq. Guinea	1.8	4.7	-	-	-
Ethiopia	1.8	2.7	63.8	0.3	6.9
Gabon	0.9	3.5	22.9	18.1	5.9
Gambia	2.1	2.3	-	-	-
Ghana	2.6	-0.1	51.4	2.5	19.2
Guinea	2.5	2.5	53.8	8.9	2.6
Ivory Coast	2.3	5.4	33.7	0.5	9.4
Kenya	3.0	1.1	35.7	0.4	11.1
Lesotho	2.9	1.2	65.3	1.6	0.8
Liberia	1.9	1.5	25.4	29.4	5.1
Malagasy Rep.	2.4	-0.5	31.7	-	10.9
Malawi	2.5	3.2	46.7	-	4.6
Mali	1.9	0.7	54.0	-	6.0
Mauretania	2.0	6.9	37.7	27.2	1.0

TABLE 10 (continued)

Country	Change in Annual Pop. Growth 1961-67	Change in Annual GNP Per Capita 1961-67	Source of GNP in Percent		
			Agriculture	Mining	Manufacturing
Mauritius	2.5	-2.0	24.0	0.1	15.2
Niger	2.7	0.1	-	-	-
Nigeria	2.7	1.1	55.7	3.0	7.4
Rwanda	3.1	1.7	69.0	2.0	14.0
Senegal	2.5	-0.1	33.1	2.5	14.0
Sierra Leone	1.5	1.3	31.4	19.2	6.3
Somalia	3.4	-1.6	-	-	-
Swaziland	2.9	15.4	36.0	14.0	1.0
Tanzania (excl. Zanzibar)	2.9	1.9	53.5	2.6	5.0
Togo	2.4	0.5	44.9	9.2	4.5
Uganda	2.5	1.2	58.5	2.3	7.8
Upper Volta	2.0	-0.6	58.0	-	2.0
Zaire	2.2	-0.5	21.5	6.4	15.9
Zambia	3.1	1.6	9.5	37.2	7.9

Sources:
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IBRD World Tables, December, 1968.
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(from Kamarck, 1970)

suffered from a deterioration in their terms of trade since the early postwar period. Roughly speaking, up to the early 1950's, the products of the developing countries experienced the demand resulting from full employment in the industrialized countries before production could sufficiently expand from the effects of the depression of the 1930's. The terms of trade for the developing countries have thus greatly improved since the 1930's. But during the 1950's and 1960's, the capacity for production of primary products caught up with and in some cases outran demand. Compared to 1950, therefore, the terms of trade for the African countries have deteriorated, by around 10 per cent. And this happened precisely at the critical time of independence in most African nations. Generally, the food and agricultural raw materials producers have been hard hit, while the non-ferrous metals, especially copper, have fared extremely well, particularly in the late 1960's (hence Zambia's recent growth).

Political independence has not ended the African nations' use of trained personnel from abroad. There are still some 35,000 Europeans and Americans working for the governments of sub-Saharan Africa (Kamarck, 1970). Independent African countries are, of course, pushing to replace them with trained people of their own nationality, but inevitably, the expatriates in administration left more rapidly than trained people were able to replace them, and of course re-

placements with even the same training and ability lacked their experience. So the standard of administration has suffered from that. On the other hand, the governments of the independent countries have often found it easier to mobilize the population than the colonial administration did. While in some countries the number of expatriates is now fewer, the number in some other countries may be greater than in 1960. Some of the departing expatriates in administration have been replaced by technical-assistance advisers, the expansion of schools has increased the number of teachers needed before the training schools in Africa have been able to turn them out, and the growth in the economies has brought in more expatriate technicians and managers working for private industry or as consultants to the government.

As compared to earlier periods, the 1960's introduced several new factors than continue to exercise an important influence on African economic growth. Perhaps the most important is the need to create nations out of the colonies and the collections of ethnic groups that had achieved independence. In country after country, this political factor either dominates or strongly influences the pace of development. Sometimes it takes the form of intertribal or sectional rivalries. While there is no reason to believe that this nation-building task is near completion or that new crises will not arise, the record of the 1960's nevertheless provides an optimistic bias to the long-term future. In particu-

Jar, the remarkable achievement of Zaire in pulling itself together by the end of the decade augurs well for the continent.

Among the other factors to be considered in the 1970's, the entrance of Japan into the African scene as a purchaser of African products, particularly minerals, and as an investor in industry deserves special mention. By 1970, Japan had already contracted to purchase all the iron-ore exports of Swaziland and Sierra Leone, and the copper exports of Uganda. Japan was also helping to create industries in Ethiopia and Nigeria. The 1960's showed that Nigeria possessed a major oil and gas deposit, and there were strong indications that the continental shelf lying off Nigeria, perhaps as far west as Ghana and as far south as Angola, also possessed important deposits.

While the early 1960's saw some slowdown in economic growth in most of Africa, by the end of the decade Africa had succeeded in achieving an over-all rate of growth of 4% a year in real gross domestic product--a rate about as good as that of the 1950's. Africa's relative success in the 1960's was due to both a step-up in the amount of external public aid (more than $1 billion a year for Africa south of the Sahara), and the great efforts Africans themselves made to master their problems. Despite her administrative inexperience, Africa's efforts to achieve economic development compare favorably with those of other major developing regions of the world.

Nevertheless, Africa has some of the poorest countries of the world. Just as the African continent is a diverse mixture of peoples and languages, it is also a diverse mixture of great natural wealth and very little natural wealth. By 1970, measured in per-capita GNP terms, Africa was still one of the two most undeveloped regions in the world, sharing this position with South Asia. A study was presented by the United Nations to the Economic and Social Council in May 1970, attempting to identify the least developed of the underdeveloped countries on the basis of various indices in addition to per capita income (i.e., consumption of energy per capita; school-enrollment ratios, number of doctors per 100,000 inhabitants). Of the nineteen countries classified as least developed out of a total of ninety underdeveloped countries covered by the study, sixteen were in sub-Sahara Africa. They were: Botswana, Burundi, Chad, Dahomey, Ethiopia, the Gambia, Guinea, Lesotho, Malawi, Niger Rwanda, Somalia, the Sudan, Tanzania, Uganda, and Upper Volta. The other three countries: Afghanistan, Laos, and Yemen.

Agriculture in African economic development

The natural conditions which influence the form of agriculture are in Africa very different from those in other continents. The continent is vast, the population is generally spread very thinly across it. Arable lands are separated by vast areas which are not suitable for cultivation or only

marginally so, and even within the arable belts soils are for the most part poor. Against this there are areas which are particularly rich, as for instance the mountains of the Cameroon in the west, and the eastern highlands. Rainfall over large parts of the continent is marginal or erratic, and this is the primary determinant of agricultural potential. However, the widespread incidence of tsetse fly has held back entire regions, and in particular has until recently prevented the development of a rich potential in livestock.

In these conditions agriculture has operated mainly on a very extensive and apparently inefficient basis with considerable use of shifting cultivation. There is very little investment in capital equipment. As a result, heavy demands are made on labor for digging and clearing land, and labor is in many areas the limiting factor. Similarly there is little use of fertilizers, insecticides, or other elements of modern agriculture.

One problem that does not bedevil African agriculture in the way that it does the agricultural sectors in Asia and Latin America is huge inequalities in land holdings. For the most part, land is distributed fairly evenly. This is not to say that inequality does not exist in the rural sector in tropical Africa and, indeed, several countries are concerned about possible development of inequalities in that sector over time. But outside southern Africa, estate agriculture is not very important, except in Kenya, and production comes

mainly for the African smallholder, the peasant farmer.

Subsistence production continues to provide the foundation for agriculture. More specifically it has been stated that "a prominent characteristic of African agriculture is its continued emphasis on subsistence farming. It is probable that as much as 70 percent of the land and 60 percent of the labour are devoted to subsistence production" (de Wilde, 1967, pp. 21-22).

On top of this foundation has been built a superstructure of cash crop production, almost entirely for export. Since 1900 this production for export has expanded and now provides the basis for very great economic and social changes in African countries, amounting in many cases to a complete transformation.

However, an important feature of the African economy is that, although most African countries do import some food, for the most part food production is adequate for feeding the people. Cash crops have been introduced without very much change in agricultural systems. Indeed the main reason that peasant producers were able to show very positive supply responses was that cash crops could be produced without very much investment or very great changes in traditional methods of production.

On the other hand, the introduction of cash crops has been extremely uneven both between countries and within the same country. This has produced very considerable differences in levels of development between countries, many countries

being left almost completely dependent on subsistence production. Since such countries cannot then finance infrastructure, particularly roads, and cannot pay for education, the gap between them and the more fortunate countries has tended to widen progressively over time. The same factors have created serious regional inequalities within individual countries, which pose severe problems of economic planning.

While agriculture in Africa faces a whole range of serious problems, and the promotion of rural development in Africa will be an extremely hazardous affair, it remains true that agriculture will continue to provide the foundation for development as a whole, as most African governments have generally recognized.

In the first place agriculture provides an overwhelming part of gross domestic product in all African countries outside South Africa, and a large proportion of people are employed, or rather self-employed, in this sector. It follows that high rates of growth in national income will not be attainable unless the agricultural sector contributes in a major way. This is particularly so because there is a finite limit to the amount of new industry which can be established in any given period, depending on the industrial base so far achieved, the supply of entrepreneurship, the growth of administrative capacity within government departments and agencies, and the development of general technical education. A rate of growth for manufacturing industry of 10 to 15 per

cent per year is probably a ceiling, and by itself can contribute only 1 to 1 1/2 per cent to total national income growth per year at the most.

A stronger case for rapid industrialization exists where there is land shortage due to pressure of population, resulting in diminishing returns on efforts in the agricultural sector. But, population pressure sufficient to cause acute land shortage exists in Africa only in localized areas, even if high rates of population growth imply a threat for the future.

Moreover, income distribution considerations, which are most important at low levels of income, also suggest a strong agricultural emphasis in the development effort. This is the main reason for the rural development emphasis in Tanzania. Additional industries may directly increase the incomes of only a tiny fraction of the population; to increase the incomes of the mass of the population at all rapidly, agricultural development is essential. The only way to develop a backward region may be to find a suitable cash crop.

As Table 11 shows, African countries are highly dependent on one crop or a very few export crops. The implication is that these countries should diversify their exports. This need not mean that the countries have to industrialize. They can perhaps diversify in agriculture more easily and effect larger numbers of people in the process.

TABLE 11

COUNTRIES DEPENDENT ON ONE, TWO, OR THREE EXPORT COMMODITIES

Nation		Percentage of Total Exports
	One Major Export	
Gambia	Oilseeds	97
Mauritius	Sugar	96
Zambia	Copper	93
Zanzibar	Cloves	86
Chad	Cotton	83
Senegal	Oilseeds	78
Niger	Oilseeds	77
Liberia	Iron ore	75
Ghana	Cocoa	69
	Two Major Exports	
Rwanda	Coffee, cassiterite	85
Sierra Leone	Diamonds, iron ore	85
Somalia	Animals, bananas and plantains	84
Uganda	Coffee, cotton	81
Central African Republic	Diamonds, cotton	70
Upper Volta	Animals, cotton	70
Congo	Logs, diamonds	69
Togo	Phosphates, cocoa	68
Ethiopia	Coffee, hides and skins	68
	Three Major Exports	
Gabon	Petroleum, manganese, logs	82
Nigeria	Petroleum, oilseeds, cocoa	78
Malawi	Tea, tobacco, oilseeds	75
Cameroon	Coffee, cocoa, aluminum	69
	Other Countries: Most Important Exports	
Mali	Cotton, animals	
Ivory Coast	Coffee, cocoa	
Dahomey	Palm and Palm kernal oil, oilseeds	
Zaire	Copper, other minerals	
Kenya	Coffee, tea	
Tanzania (mainland)	Cotton, coffee, diamonds, sisal	
Madagascar	Coffee, spices	

Source: United Nations Yearbook of International Trade Statistics, 1967.

The greatest constraint on industrial expansion in Africa is the generally low level of incomes. Agricultural development by increasing local purchasing power can permit a faster rate of industrialization, and provide the quickest route to an industrialized state. In this respect, even if a decline in the terms of trade robs the less developed countries of a part of the revenue from increased agricultural output, industry may still be capable of a faster eventual rate of increase through emphasis on a major effort in the agricultural sector.

Industrialization in African economic development

To assess the present state of industry and later to examine the development perspectives, it is convenient to use a broad economic classification: first, consumer goods, mainly food and textiles; second, intermediate goods: metals, non-metallic minerals, forest products and chemicals, including fertilizers; third, capital goods: metal products, mechanical engineering, electrical engineering and transport goods.

Most African industry at present is in the consumer goods category. As for intermediate goods, almost all countries produce simple metal products, mainly from imported steel. In capital goods, the industrial map south of the Sahara is almost blank. The broad picture is one of con-

centration on single consumer goods through import substitution, and limited production of intermediate goods, with capital goods virtually confined to Egypt and Tunisia. In much of the existing industry the value added locally is low. Table 12 shows the gap between African countries and industrialized countries in this area.

In its approach to industria_ization, Africa starts with certain natural advantages. The natural resources endowment, even on the basis of far from sufficient surveying and prospecting, is rich: abundant high-grade iron ore, non-ferrous metals, phosphates, potash, marine salt, oil and natural gas, limestone, cotton, timber, the natural potential for meat and fish production on an industrial scale and vast cheap hydropower potential.

The obstacles are also evident. Much of the climate is hostile. There is a lack of management and middle-grade personnel and skilled labor. Distances are vast and, despite recent progress, the transport and communication system is geared to the needs of a colonial system, with the lines running to former metropolitan countries. Although there has been much recent progress, energy is still mainly potential. The agricultural base is weak; industrial growth is soon arrested without parallel agricultural development to provide food and raw materials to meet a growing demand. Finally, most African markets are small. The income per head,

TABLE 12

VALUE ADDED IN MANUFACTURING, 1966

Country	As Percentage of Value Added in Total Commodity Production	Per Capita in U.S.$
United States	73	1,054
Japan	58	219
South Africa	44	122
Central Afr. Rep.	14	10
Ghana	24	47
Kenya	21	12
Liberia	6	11
Malawi	8	3
Senegal	27	27
Togo	15	13
Tunisia	23	14
Uganda	9	7
Upper Volta	7	6
Zaire	34	14

(Kamarck, 1970)

with very limited exceptions, ranges from $50 to $100. There are 23 countries with a population of four million or less; 12 with less than two million, and 7 with less than one million.

In the process of industrializing Africa the earnings of traditional exports will be insufficient to produce the growing amount of foreign exchange needed. The principal way out is through increased trade among African countries, itself only possible by a diversification of the structure of production through industrialization. But there should also be industries capable of exporting beyond Africa. These not only have to be competitive but they also require the same concessions from the wealthy countries as other developing countries--the reduction and elimination by the advanced countries of tariff and other barriers to the import of semi-manufactures and manufactures.

African industry has to develop a physical infrastructure, especially transport links between countries. Some beginnings are being made with the TanZam railway and the trans-Cameroon railway. The cheap hydropower potentially available in much of sub-Saharan Africa can be harnessed only if there are sufficient industrial users. At this stage in its development, African industry must cooperate internationally to develop and use the transport links and power sources that support industrialization.

There remain two more points on industrialization. The first is the training of personnel. This requires a many-sided approach, starting with a greater technological slant in the education system at all stages, including trade schools for training semi-skilled and skilled workers, and institutions and training courses for middle level supervisors and technicians, engineers, and managers. More could be done within Africa by encouraging specialization and interchange among existing universities and institutions, and in the establishment of new ones.

The other point is that the success of a rapid industrial development program depends not only on people but on the political will of the nations and their leaders. Inevitably, in the early post-independence period, much time has been spent on consolidating, sometimes defending, newly established nations. This has diverted attention from economic development and, as is crucial in the case of industry, practical measures for furthering the kind of permanent economic co-operation required among countries.

Mining in African economic development

Obviously, not all countries can use mining as a basis for development. This depends first and foremost on having and finding exploitable minerals; second, on exploiting them; and, finally, on ensuring that the general development

of the country benefits as much as possible from the mineral development.

Unfortunately, even though there is still much to learn about the geology of Africa, it is already certain that the useful mineral deposits are unevenly distributed--some countries are likely to be very fortunate and some comparatively poor in mineral resources. Nigeria, Gabon, and Angola clearly possess the mineral potential that can make successful and rapid economic development possible. Nigerian production of oil and gas has rebounded quickly after the end of the civil war in 1970. With continued stability, the income from oil, and exploitation of her large natural-gas resources, Nigeria should be able to mount a large economic-development effort out of her own earnings by 1975.

Gabon, with a half-million inhabitants in 1970, has manganese, uranium, and oil. During the 1970's the rich and large Mekambo iron ore deposits should begin to be exploited.

There are other nations whose mineral potential, while not as spectacular as Gabon's or Nigeria's, still provides a solid volume of export earnings as a development base: Mauretania, Guinea, Gierra Leone, Liberia, Zaire, and Zambia. In Zambia, the output of the copper, lead, and zinc mines, valued at around $1.1 billion a year, furnishes two-thirds of the gross domestic product; the mines provide almost all the exports and nearly three-quarters of the government

revenue to finance both current and capital expenditures. Zaire also produces about $600 million of minerals a year; Nigeria, $500 million; Liberia, $200 million; Ghana, Sierra Leone, Mauretania, Gabon, and Tanzania, $50-100 million; Kenya, Uganda, Rwanda, and Swaziland, $10-30 million. In Mauretania, the Miferma iron-ore mine is such a large part of the economy that in 1962, when its development was at its height, gross investment was at the level of 70 percent of GDP.

Conclusion

Kamarck sets a GNP per capita of $400 as a point of acceleration for a national economy. He forecasts that an annual growth rate of 7% will bring the whole continent to the $400 level by the year 2000. Nevertheless these per capita statistics would represent uneven incomes. As noted, the industrial and mining development of Africa tends to concentrate the growing income in only a few hands.

The real validity in development occurs when the whole society benefits more or less evenly from the forward movement of the economy. The experiment in Tanzania, while having certain features unique to Tanzania, may have long range effects for other African areas. Its concentration on rural development represents a significant step toward a different kind of development. The European education systems that the colonists brought did not prepare students for rural activi-

ties; the result has been, as in many parts of the world, that education has effectively stripped the rural areas of their best human resources, convincing students that no educated man remains in the rural areas and sending students to the cities where work is scarce.

Economic development in Africa may be better attained in new forms, explored by Africans themselves and fitting to the African needs. The danger of massive human by-products of western development patterns in Africa are real. While Africans are still planning their development strategies, they can perhaps work creatively for more comprehensive development paths.

In presenting these economic data, we have not intended to say that development according to the European or American pattern is what Africa should strive for. Africa is poor, and seems destined to remain so for a number of years, in relation to the "developed" countries. Economic language, as we have used it in this section, tends to carry with it an implicit statement that development is wrapped up primarily in rising economic indicators. But there are other possibilities, and Tanzania is an example of some of them. There development is wrapped up primarily with self-reliance, with the development of the human resources in the nation. While the realities of economics have to be faced (as Tanzania is certainly finding out), they need not completely control the process of development.

The media have a great potential for projecting an image of what development is, what progress is. When the media are wedded to the commercial sector as in the United States, where the media are basically in the business of selling time and space to advertisers, the image of man that comes across is the image of man the consumer. Aspirations relating to consumption are raised. This is a trap which an African communications system must avoid. Just as it seems clear that the development schemes and hopes of ten to fifteen years ago must give way to fresh creative forms of development founded on the people of Africa themselves, so likewise must the uses of communication technology be founded upon the special needs of Africa and take the form that Africa can afford and use best.

This chapter has depended heavily on two sources;

Africa South of the Sahara, 1971. London: Europa Publications, 1971.

Kamarck, A. The Economics of African Development (rev. ed.). New York: Praeger, 1970.

CHAPTER IV

EDUCATION

by

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with the assistance of

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In Africa, as elsewhere, the vital questions concerning the role of education in development have hardly yet been asked, let alone answered.

The question of educational development in Africa shares both the ambiguities of today's theories of education and the ambiguities about the future of Africa. Amid all these uncertainties we are trying to explore the possible introduction of a new element: the use of electronic media for education and information diffusion.

The plan of this section is, first, to give an overview of the characteristics of the precolonial education in Africa; then, the characteristics of the European type of formal education; and, finally, the present situation more than ten years after unified educational goals were set by the African nations meeting in Addis Ababa in 1960. Against that back-

ground, we shall then make some comments on the use of the electronic media in education.

Precolonial education

This category should not be considered only as chronologically prior to the European system, but also as parallel to the formal system existing today. This is true especially in the rural areas; indeed, in some of the rural areas, it remains the only form of education.

Just as we use the terms "vocational" and "liberal" in speaking of formal education, we can apply them to precolonial education. "Vocational" precolonial education included four basic areas: training in survival in the natural environment, the use of tools, the making of handicrafts, and methods of self-support-subsistence agriculture and house-building. "Liberal" precolonial education refers to the learning of rules, values, hierarchies, and cosmologies, and the initiation into the ceremonies and mysteries of the society.

With a very European measure of value, Murray, an English colonial administrator prior to World War II, asserted that "neither of these types of education goes very far and their bias is conservative and communal rather than towards encouraging initiative and originality." He labels certain elements of the precolonial education--discipline and self-restraint, acceptance of leadership, fatalism in regard to life, the pride of membership in a group, responsibility for other people, and skill in recognized crafts--as "caste

education," even though the category of caste does not correspond to the tribal organization.

With a more contemporary perspective, Moumoni presents a penetrating view of the integration of precolonial education into social life. He assigns to it these four basic qualities:

1. the collective and social undertaking of the task of education
2. the intimate linkage with social life (material and spiritual)
3. the comprehensive nature of the education
4. the gradualness of the education, following the psychological and physical development of the child.

The preparation of children has been a sacred duty of the family to the community. From the child's birth to his adolescence, the family takes care of his education. For the first six or seven years, the mother carries the child everywhere, trying to familiarize him with the social physical environment in which he lives. From 6-10, the father gives the most guidance, and from 10-15 the child receives more community attention. Initiation into adult status follows.

The learning of productive skills is done within the tribe under knowledgeable adults who take the children as companions while they go about their work.

Social relations are also taught by way of games, plays, tribal ceremonies and rites, and through general relations

with adults. It should be remembered that education is seen not as a specialized commodity given out in specialized circumstances; it is seen as a generalized task for which all tribe members have a responsibility.

Education is thus comprehensive, taking in physical aptitude, moral development, language learning (through words, tales, and legends), and mathematical skill (generally through games).

These four areas should be understood as different elements combined in the same experience, like a hunting expedition mixed with games and story-telling.

Psychological aspects

The psychological aspects of African life should be taken into account when trying to understand this precolonial form of education. The Scientific Council for Africa South of the Sahara, in a Congress held in Lagos in 1960, suggested some of the elements to consider in introducing innovation--to preserve the culture intact and to allow the innovation to be adapted.

1. The family structure is of first importance for group interaction. Behavior is always considered in terms of its effect on the family. For example, the education of the children is an investment of the family which the student should honor after graduation, by returning the services or money which enabled him to learn. Individuality as conceived by the classical Western ideologies is of secondary importance.

The entire mental life of the African seems to be based on the group concept, and this strongly affects behavior.

2. The rearing of African children tends to give the fullest opportunity to the development of their potential.

3. Magic ritual and spiritual life (including ancestral worship, sacrifice and witchcraft) probably have mixed effects on the people. On the one hand, they may be potent psychotherapeutic aids in the communities, but on the other hand witchcraft is supposed to be largely responsible for most of the tension and neurotic manifestations in the average African adult.

4. Formalism in the interpretation of facts has a tremendous impact on the precolonial education (and carries over to formal education situations). Murray gave the example of a classroom situation where the children laughed at the teacher who stood at the left of the blackboard because in the textbook illustration the teacher stood on the right. Not only is form as important as content, but also possibilities for success are related with the ability to perform certain formalities. While this may be one of the forms of intratribal oppression, as Murray insisted, it is also a way of maintaining the cohesiveness of the tribe.

Education in the colonial system

An official document sent in 1933 by M. Brevie, Governor General of French West Africa, gives a good picture of the

introduction of European "formal education" into French Africa: "The colonial responsibility and the political needs impose on our educational task a double purpose: First, to form the native cadre that will become our auxiliars in all fields and to assure the elevation of a carefully chosen elite; and, second, to educate the masses in order to get them near to us and to transform their way of life. . . . From the political point of view the goal is to make them know our efforts and intentions to include them in French life, at the respective place. From the economic point of view, the goal is to prepare the producers and the consumers of tomorrow."

The British did not have such a generalizable policy. They left a great deal more of the education work to the missionaries than did the French. While the French consciously sought to create an elite who would practically become French, the British provided more education at all levels and did not seek to integrate the Africans into British ways.

The colonial system of education reproduced in Africa the characteristics of the system existing in Europe and developed on European traditions. The system was divided into three levels, primary, secondary, and higher--corresponding to the class structure and needs of the industrialized countries. The system did not satisfactorily account for termination below the level of the final diploma; this made for frustration and a waste of time and money for the

"drop-outs," or non-university graduates. The curriculum based on European models; the idea of the professional teacher; education as an institution segregated from the rest of the social activities; the non-use of the other members, places, and institutions of the community as elements in the educational process; the orientation of the studies to fill the positions of the new administrative and commercial bureaucracy of the colonies--all these were some of the transplanted characteristics of the colonial system.

The scope of African education in the last 20 years

The number of formal students has increased rapidly since World War II. The average increase for French Africa from 1950 to 1960 was 292% for the primary school enrollment, 539% for the secondary schools. For all sub-Sahara Africa the increase over that decade was 215%.

Nevertheless, the basic problem from the point of view of formal education is that the non-schooled children were and remain the vast majority of the population. The tremendous increase, percentage-wise, is due to the small number of students at the time the comparisons began. In 1951, all of French Africa had only 693,000 primary students and 22,200 secondary students. In 1961, in the former French areas, 46% of children of primary school age were in fact in school, 6.3% of those of secondary school age were in school. Corresponding figures are lower for the whole of sub-Sahara Africa.

The rates for drop-outs and repeaters remain high. The education system has had to provide twenty-one student years to produce one primary school graduate (six years). In Gabon, where the rate of primary enrollment is 80%, the drop-out rate for the same period was 90%. Because the repeater rate is high, the enrollment figures are also inflated upward.

Some of the causes of the high drop-out rate are presented by Mihindou-Mi-Zamba. The proffered education has not been fitted to the social environment nor to the poor situation of the students. Parents see the schools undermining their own authority and destroying the customs of their tribe. Children tend to value their family milieu less, and to resist the parental and community network. The emphasis on individuality, which is such a European characteristic, comes through in the school system and represents a threat to the African's values.

Health factors also come in. Just as disease cuts into the manpower strength of African labor, it limits the number of days a student can attend school. Further, schools may be at some distance from many homes and the children may be needed to work at home during planting and harvest seasons.

Also, the less experienced teachers are often assigned to the primary grades. These are the grades with the most students in them, so they are more demanding. It is very difficult for these teachers to adapt the content of the

lesson to the African realities and to the thought structures of the children, since the lessons are often the products of European curricula.

This is in no sense to derogate the contribution of colonial education to the African countries. Rather, the intention is to point out some of the difficulties it faced, and raise some questions about its use as a model for educational development in the future.

The Addis Ababa Conference on African Education, 1961

The Conference of African States set down in 1961 their goals for the application of the United Nations Declaration on Human Rights and the UNESCO Constitutive Act to African education. Their statement included the following points:

1. Formal education is seen as the essential tool for the transmission of knowledge and therefore it should be expanded. It was considered necessarily related to economic development.

2. The goals for the expansion of the school system were considered exclusively in quantitative terms.

3. The goals were designed supposing regional homogeneity. National disparities in demographic structure, educational needs, financial capacity, and so forth were neglected; an overall plan was recommended.

4. Funding for educational expansion was based on increasing the external debt and therefore external dependence. Attention was given neither to the difficulties of maintaining

the system after outside aid ceased, nor to the burden of repaying the debt.

5. Greater output from the educational system was seen to depend on the amount of financial input.

Ten years later, the balance of achievements and results presents this picture:

Enrollment targets--71% at the primary level, 15% at the secondary level--were not achieved. The actual rates in 1971 were 46% and 6.3% respectively for primary and secondary education in French-speaking Africa, and lower overall. Inequalities between countries indicated the extreme disparity of resources of the different national systems (see Table 13 and Figures 4 and 5).

The ten-year period presented unexpected and rather negative outcomes. The system of European formal education in Africa was reinforced. Instead of becoming Africanized, the system seems to have become even more resistant to change. The system still lacks an African rationale; intermediate degrees still have little value. The education remains academic, and has been little related to the social situation. The graduates tend to fill bureaucratic positions that do not call for technical skill. The education bureaucracy has expanded, become less flexible, less innovative, and less able to consider the social aspects of education. Lack of teachers has meant that unqualified people had to be hired, especially for the rural areas.

TABLE 13

SCHOOL ENROLLMENT AND SCHOOL FUNDING
IN SOME AFRICAN COUNTRIES

nation	primary school age population group (thousands)	percent in school	secondary school age population group (thousands)	percent in school	higher education enrollment	education budget (millions)	percent of national budget	percent of gross national product
Botswana	117	70	68	8	-	-	-	-
Burundi	655	31	458	2	348	-	-	-
Cameroon	907	100	875	8	196	37.4	28.7	4.1
Central African Republic	358	50	337	3	62	-	-	-
Chad	531	30	534	2	-	-	-	-
Congo	201	116	174	19	-	-	-	-
Dahomey	435	40	409	5	266	-	-	-
Ethiopia	3,599	57	3,096	4.5	3,870	32	17	3.6
Gabon	76	133	74	14	172	-	-	-
Gambia	56	30	47	11	--	-	-	-
Ghana	1,816	68	1,246	22	4,700	-	-	-
Guinea	601	32	503	12	1,555	-	-	-
Mali	766	27	643	5	731	-	16	-
Mauretania	193	15	163	3	-	-	-	-
Niger	572	16	551	1.3	-	4.1	-	-
Nigeria	12,000	31	10,360	3.1	8,076	108.0	20	2.8

(continued)

TABLE 13 (continued)

nation	primary school age population group (thousands)	percent in school	secondary school age population group (thousands)	percent in school	higher education enrollment	education budget (millions)	percent of national budget	percent of gross national product
Rwanda	567	75	461	2	-	-	-	-
Senegal	614	41	591	9	4,163	20	11.8	2.2
Sierra Leone	439	35	374	9	1,329	-	-	-
Somalia	581	8	241	3	964	3.2	5.6	-
Tanzania	2,400	33	42	2.5	520	42	20	3.8
Togo	320	69	319	6	263	-	-	12.2
Uganda	1,548	43	59	5.4	1,741	28.3	22	3
Upper Volta	851	12	818	1.2	194	-	-	-
Zaire	3,322	88	2,834	9	84	-	-	-
Zambia	779	95	460	14.5	-	56.4	16.5	5.0

Source: BREDA, Dakar
(Data mostly about 1970)

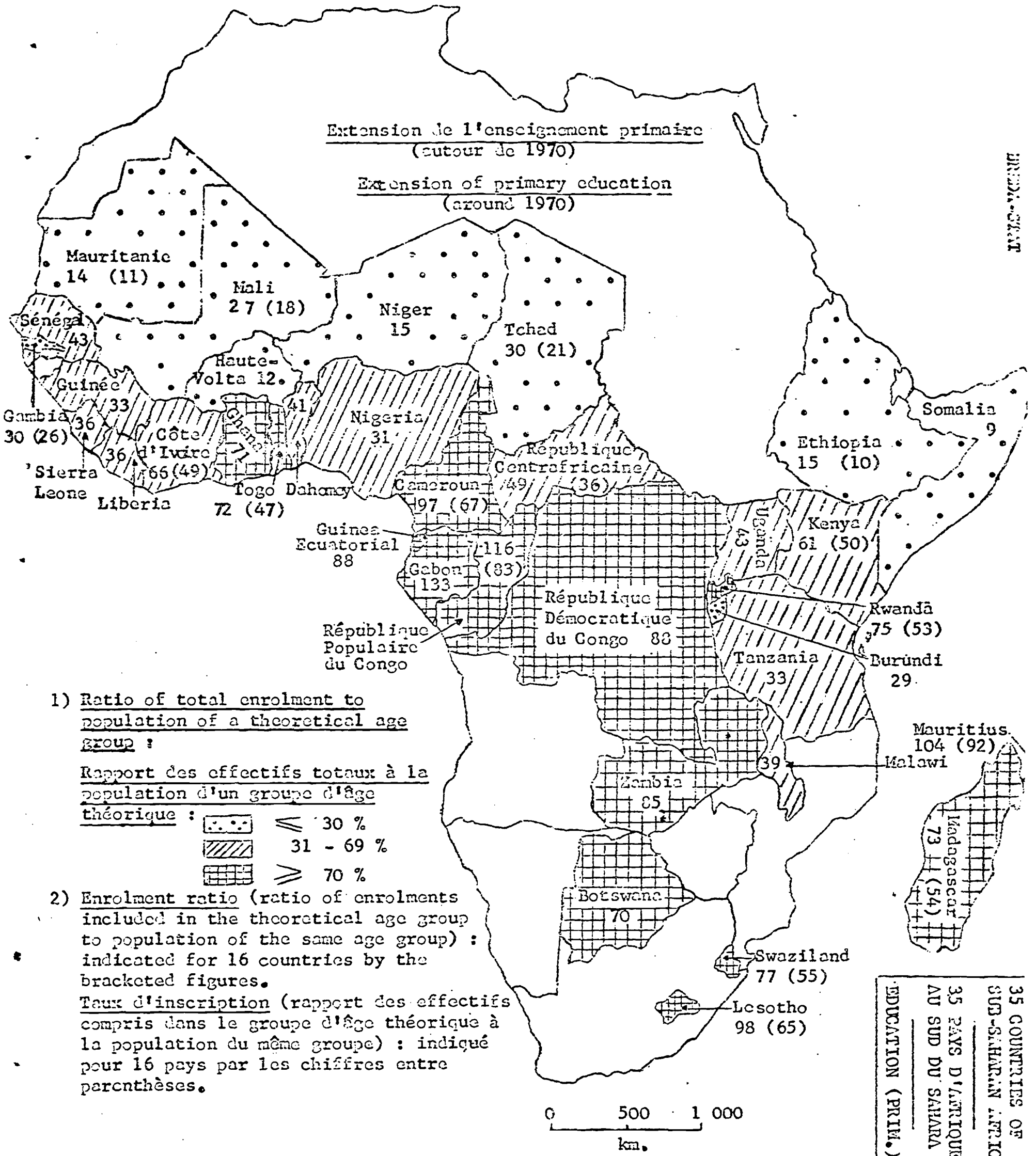
Extension de l'enseignement primaire
(autour de 1970)
Extension of primary education
(around 1970)
Mauritanie
14 (11)
Mali
27 (18)
Niger
15
Tchad
30 (21)
Sénégal
43
Haute-
Volta 12
Guinée
33
Gambia
30 (26)
36
Ghana
41
Nigeria
31
Somalia
9
Ethiopia
15 (10)
Côte
d'Ivoire
66 (49)
36
Sierra
Leone
Liberia
Togo
72 (47)
Dahomey
71
Cameroun
97 (67)
République
Centrafricaine
49 (36)
Guinea
Ecuatorial
88
116
Gabon
133
(83)
Ouganda
43
Kenya
61 (50)
République
Démocratique
du Congo 88
Rwanda
75 (53)
Burundi
29
République
Populaire
du Congo
Tanzania
33
Mauritius
104 (92)
39
Malawi
Zambia
85
Madagascar
73 (54)
Botswana
70
Swaziland
77 (55)
Lesotho
98 (65)
1) Ratio of total enrolment to population of a theoretical age group :
Rapport des effectifs totaux à la population d'un groupe d'âge théorique :
⩽ 30 %
31 - 69 %
⩾ 70 %
2) Enrolment ratio (ratio of enrolments included in the theoretical age group to population of the same age group) : indicated for 16 countries by the bracketed figures.
Taux d'inscription (rapport des effectifs compris dans le groupe d'âge théorique à la population du même groupe) : indiqué pour 16 pays par les chiffres entre parenthèses.
0 500 1 000
km.
35 COUNTRIES OF SUB-SAHARAN AFRICA
35 PAYS D'AFRIQUE AU SUD DU SAHARA
EDUCATION (PRIM.)

Figure 4

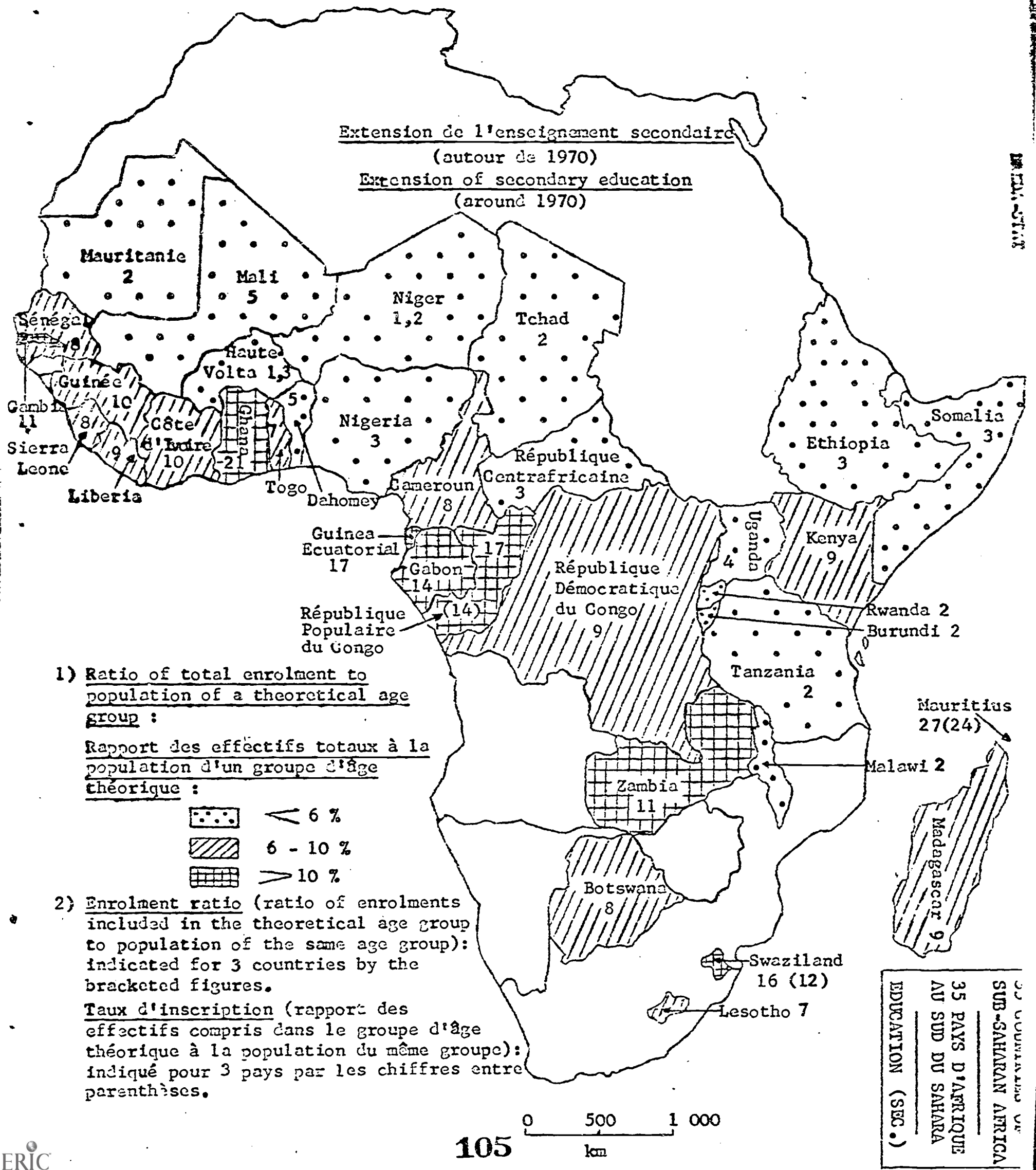
Extension de l'enseignement secondaire
(autour de 1970)
Extension of secondary education
(around 1970)
Mauritanie 2
Mali 5
Niger 1,2
Tchad 2
Sénégal 8
Haute Volta 1,3
Guinée 10
Gambia 11
Côte d'Ivoire 10
Ghana -2
Sierra Leone 9
Liberia 8
Togo 5
Dahomey 7
Nigeria 3
Cameroun 8
République Centrafricaine 3
Guinea Ecuatorial 17
Gabon 14
17
(14)
République Populaire du Congo
République Démocratique du Congo 9
Ethiopia 3
Somalia 3
Ugan 4
Kenya 9
Rwanda 2
Burundi 2
Tanzania 2
Mauritius 27(24)
Malawi 2
Zambia 11
Botswana 8
Madagascar 9
Swaziland 16 (12)
Lesotho 7
1) Ratio of total enrolment to population of a theoretical age group :
Rapport des effectifs totaux à la population d'un groupe d'âge théorique :
< 6 %
6 - 10 %
> 10 %
2) Enrolment ratio (ratio of enrolments included in the theoretical age group to population of the same age group): indicated for 3 countries by the bracketed figures.
Taux d'inscription (rapport des effectifs compris dans le groupe d'âge théorique à la population du même groupe): indiqué pour 3 pays par les chiffres entre parenthèses.
0 500 1 000
km
105
SUB-SAHARAN AFRICA
35 PAYS D'AFRIQUE AU SUD DU SAHARA
EDUCATION (SEC.)

Figure 5

The growth that has occurred in the system has magnified a need of basic teaching aids. School materials from Europe have not been replaced by locally produced materials, and this lack of African material for the school system is one serious problem hindering the Africanization of the system. Most of the growth in educational budgets has gone to salaries; a decreasing percentage has gone to basic development of curricula and school construction.

In certain countries, the growth of the educational system unbalanced other systems within the society. With approximately 40% of the possible age group in primary school but without the possibility of continuing on to secondary school, the "primary graduates" became a new breed of youth seeking clear definition of where they fit into the society. The disparity between this new large group and the non-schooled worsened the situation for the latter.

The limited number of places in secondary school as compared with primary school puts great pressure on the examinations at the end of primary school. Further, the de facto termination of so many students after primary school has not been related to the needs of African society. In some countries like Kenya, even the secondary graduates have difficulty finding jobs that take advantage of their skills; this reflects not only the lack of jobs in the society at that level, but also the limited scope of training received in secondary schools. Where private schools are not under

government control, the growth of these schools and the limitations of their curricula add to the problems of the job market.

The need for asking hard questions about formal education in terms of the demands of the new African nations becomes more and more evident.

Some paradoxes of the past ten years in African education have also become clear. The quantitative targets set in 1961 were inadequate, not only because in most cases they were far ahead of the possibilities, but also because in some cases the problems created in trying to achieve them were greater than were the positive effects of increased education. The Ministries of Education became the "Ministries of the Schools," more preoccupied with the administration of the schools and the school population than with the non-schooled people, the majority of the population. The school system and its basic technology proved to be of very low productivity in terms of graduates per unit of investment. The quality of education was down in comparison with the elite system that preceded this expansion, and student unrest was a growing problem in many countries.

These problems are also complicated by the continuing ties to the former colonial country, particularly in the French areas. In most of the French-speaking countries, the French language and culture have a predominant position in all the levels of education. The issuance or validation by

equivalence of diplomas is controlled by France, since most of the tests and examinations are prepared there. Teaching positions that cannot be filled by nationals are guaranteed by the French Ministry, without the possibility of accepting scholars or teachers from other countries. Control of entrance into the higher education stage stays in the French Ministry, through the control of the baccalaureate examination. The situation in the former English colonies is somewhat different, because ties to Britain are much looser.

Facing the future

There is agreement among scholars in many fields about certain elements that should be included in the planning of future education in Africa. Any speculation including new technologies should take these general points into account.

1. Education should reinforce the conscious and active participation of the people in the resolution of social and personal problems.

2. Education should awaken the creativity of both children and adults; the rote systems of the past should be rejected.

3. Education priorities should be on means of improving the conditions of life (health, education, nutrition, productive skills).

4. Education should be related to the specific social and economic needs of the country. Any project of education should be conceived as an essential part of community de-

velopment in general. Education in itself has no effect.

5. Education should consider the new role of women in African societies and provide educational opportunities accordingly.

6. Education should take into account the traditional institutions of Africans, and try to maintain and use the specific values they have for Africans.

7. Education should stress group experience and community life as a basic realm of the educational process. Education should be considered as a task performed in the home, in the community, and in the school.

8. Education should consider the effects of urbanization on the different institutions of African culture.

9. Education should promote and develop the vernacular languages as vehicles of basic education and literacy. This would include the development of vernacular literary production and publishing.

10. Education should probably not offer French or English as a second language until the age of 10 (although this may vary with conditions in the particular country).

11. The idea of education as a commodity to be paid for should be supplemented by the more traditional concept of education as voluntary interaction. Non-paid monitors, elders, and peasants--during the non-agricultural months--should be used in the programs.

12. Educational investment plans should be realistic,

considering the proportion of local resources needed outside the classroom.

13. Educators should consider the real power of the government to carry out any proposed plan. A wide administrative decentralization allowing the communities the most choice about their programs and the most participation in their programs should be seriously considered. The Central Ministry should back up the local communities by preparing and supplying the best curricula and materials.

There is a growing awareness that the traditional educational system is costly and wasteful, and that most of the knowledge dispensed is not adapted to needs; and that education is not linked to overall or sectoral employment needs and possibilities and is already generating a large number of educated unemployed. It is true that a qualified minority has arisen out of the classical school system, but if progress is to be solidly based, much more practical and technical training must be given to the population at large at every level, and the productivity of educational investment must be increased.

Anne de Lattre reports the following conversation with an educator from Upper Volta, in her very readable report of a trip through West Africa to study the education situation. It is worth citing at length: ". . . Schools are foreign islands in the African environment; they resemble sacred churches where esoteric rites meaningless to most people

are carried out for initiation alone. The buildings are made of concrete with a tin roof, drastically different from the straw huts in the village; strange facts are taught in a foreign language. Often there are travel agency posters on the walls: a flamboyant oak tree clad in autumn colors which contrasts with the hairy baobab in the courtyard, a replete Normandy cow or an Alsatian town with storks on the roof.

"Those who enter the sanctuary will be uprooted forever. They are selected out of thousands of applicants. Parents look upon them as raw material who, after being processed, will be turned into nice clean civil servants. The curriculum which makes no reference to anything familiar cuts the child off from his culture, his history and his people.

"Too often, the school is an economic dead-end and a nursery for revolutionaries. In 1967, there were about 10,000 candidates for the primary school final examinations in Upper Volta and about 6,000 for the secondary school entrance examination. Only 1,500 places were available. Three-quarters of the children were eliminated but they had no intention of going back to their villages. Their aim was to search for work in urban areas. But they had no qualifications apart from a varnish of general knowledge.

"The situation is bad. Statistics in Upper Volta register about 1,000 students having completed four years of high school and soon there will be several thousands. We

will not be able to offer them jobs. In Dahomey already, many high school graduates have no employment at all. When I relate this situation to the human and financial investment put into it, I feel that we are spending scarce resources to create ourselves additional burdens. I feel, also, that the tiny number of university graduates generated by the present system does not entail its justification. I wonder whether our schools are not creating problems rather than solving them."

From a teacher in Niger: "Instead of putting youngsters in a position to discover and define themselves and to raise questions, we foreigners come and propose recipes. We should be searching with all the resources of critical minds for new methods and new formulas together with Africans. Up to now, very little curriculum adaptation has been carried out. In some cases we have replaced encyclopedic programs by different ones which are just as encyclopedic. New experiments are largely useless because they are punctual. French technical assistants can only teach what they know, which is not what the people need to know. . . .

"We are giving out instruction but not education. The literates become removed from their people. We are fabricating small oligarchies which will be interested in maintaining their privileges."

From an economist in the French Secretariat of State,

who was dealing with African education: "Education is much too costly. It is accelerating rural exodus at a time when industrialization is developing very slowly so that the ranks of educated unemployed are increasing and urbanization is becoming anarchic. . . . If investment in education were particularly profitable, it might be legitimate to give it priority. But what do the facts show?

"Let us look at Cameroon. If we compare trends of school enrollment and urban population we see that the curves run closely parallel. But we know that the number of salaried workers is increasing slowly. Therefore the conclusion must be that the surplus urban population is not finding employment in proportion to its increase and its training. The risk is that education will soon appear as a machinery set up to produce more urban unemployed. Meanwhile, rural areas are being emptied of their most dynamic elements."

Abernethy's study of the extensive school system in Southern Nigeria provides further light on the complexity of the development task, and the limitations of investments in education. School enrollments in Southern Nigeria were greatly increased during the 1950's, but other sectors of the society could not cope with the flow of graduates. Large numbers of young people were mobilized for participation in a modern economy and polity at a time when the economy could neither employ them nor afford what was in effect a costly

social welfare scheme. The political system lacked resources to adapt to new demands. The very success with which Southern Nigerian leaders in the 1950's met their educational commitments hindered the re-allocation of resources in the 1960's to meet new employment and output goals. The drive for equality in access to primary schools made inequality at the secondary level more difficult to eradicate and more visible to a frustrated populace. Just as the introduction of education in Southern Nigeria had as its unforeseen consequence the overthrow of the British colonial elite, so the expansion of enrollments in recent years has contributed to the overthrow of the Nigerian elite that introduced universal primary education, and to the serious problems that any ruling group must face in the future. Herein lies the dilemma of popular education: it is both a necessary condition for political development and quite possibly a sufficient condition for political decay (Abernethy, pp. 280-81).

The hope of an expanding school system in the traditional style is slowly being dissolved by events. In its place, new forms of education will have to be implemented. The process of education will come to be seen as something much wider than the school system; Africans may be moving toward the traditional setting for education, the setting that prevailed before the Europeans came. But the African world today is not the world they knew then; the educational forms of the past will not be enough. What the past does contribute to the

present is its broader conception of education as a full-time community project, and as something that is eminently practical within the community.

Rural development calls for rural-oriented education. New media if used for education will have to have this orientation--otherwise the new media will simply accelerate the flow of school graduates who can neither contribute to the rural sector nor find employment in the city. While new media can bring to the rural areas forms of education that could not reach them before, the task of the media is not to bring the urban values to the countryside but to mobilize and bring out the values which are already there. Educational media will have to resist the temptation to provide more of the same. The assumptions behind the formal school system have not proven to be what is needed in the rural areas at this time. To entertain the thought of an expanded media system that can be used in education demands basic alterations in the concept of education.

A few system questions that should be considered by members of the field team dealing with education

1. How can the system be designed to make maximum use of existing institutions--e.g., hospital reception centers, industries, government offices, markets, agriculture and health centers, houses of tribal leaders, as well as schools?

2. How many different program origination centers will

be desirable, and how will the programs get from there to the transmission centers?

3. How many courses will the system need to carry simultaneously?

4. What radio language capacity should accompany each visual channel?

5. How important will it be to make reception possible without special antennas (e.g., in homes rather than schools or village centers)?

6. What gatekeeper arrangements will be necessary by which a given country or school system can select one program rather than others from the space link?

7. Are there some costs that might be saved by acceptable changes short of an entire new system--adding teacher aides, increasing class size, using school facilities for other purposes such as adult or technical education, introducing double shifts?

8. Can radio or television help to reduce unit costs of education by making possible the use of monitors not highly trained in teaching, or by serving classes organized in villages where there are no schools?

9. How much and what kind of preparation of materials for class or teacher use will be required in order to make the new system effective?

10. How many skilled people will have to be trained or retrained in order to make the new system effective?

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CHAPTER V

THE EFFECTIVENESS OF INSTRUCTIONAL MEDIA

by

Wilbur Schramm

This material is presented to arm the field team against possible questions.

Learning from instructional media

Literally hundreds of experiments now testify that students can learn efficiently from the newer instructional media, as well as from textbooks, face-to-face teaching, and personal observation. These experiments are reviewed in such volumes as:

Hoban and Van Ormer, Instructional Film Research, 1918-1950 (1950)

May and Lumsdaine, Learning from Film (1958)

Allen, "Audio-visual Communication Research" (in the Encyclopedia of Educational Research, 1960)

Lumsdaine and Glaser, Programmed Teaching Machines and Programmed Learning (1960)

Schramm, The Research on Programmed Instruction (1963)

Travers, et al., Research and Theory of Audio-visual Information Transmission (1964, 1966)

Duke and Nishimoto, Survey of Educational Media Research and Programs in Asia (1963)

Ely, Survey of Educational Media Programs and Research in Latin America (1963)

Harrison, editor, European Research in Audio-visual Aids (1966)

Reid and MacLennan, Research in Instructional Television and Film: Summary of Studies (1967)

Chu and Schramm, Learning from Television: What the Research Says (1967)

UNESCO, The New Media: Memo to Educational Planners (by Schramm, Coombs, Kahnert, and Lyle) and The New Media in Action: Case Studies for Planners (both, 1967)

Many of these reviews are widely and readily available. The evidence they report that students can and do learn effectively from the newer media is overwhelming. Students learn from television, radio, films, slides and strip-films, programmed instruction, computer-assisted instruction, and other such devices. They learn in less developed as well as in more developed regions. They learn almost any subject in the school curriculum, and many topics of adult and developmental subject matter. They learn in-school and out-of-school, individually and in groups.

However, this is not to say that all students learn any subject equally well from any medium, or in any situation. Indeed, one finding that emerges clearly from the research studies is that the newer media of instruction are best used as part of a teaching-learning system, in which a number of different kinds of learning opportunities (usually including face-to-face teaching, and almost always including printed text or workbooks) are combined.

Therefore, a decision to use one of the newer instructional media with or in place of more conventional teaching must depend on a number of related considerations:

What can a particular medium contribute most effectively to educational needs presently unmet?

What kind of system can be built, using one or more of these media, to meet those needs most effectively?

Considering cost-efficiency, what are the trade-offs between using one medium vs. another, one system vs. another?

We shall have something to say about each of these questions.

The special usefulness of different media

Fortunately, the research backs up any teacher's common sense view of where one medium might be stronger than another. If the objective is predominantly to learn something visual--such as a process, a demonstration, the appearance of an object, person, or place, or the nature of an event--then

television or films will have an obvious advantage. Television has the advantage over films of liveness and easy distribution. Films have the advantage of being available for showing at the precise time when most needed, rather than on a predetermined schedule, and of making it possible to repeat the showing, or to stop it in the middle for discussion or practice or questions. On the other hand, the problem of delivering the right film to the right place at precisely the right time proves to be an almost insoluble problem for a less developed country as soon as they are used extensively or over a very wide area. Compared with slides or strip films or other pictures, both television and film have the advantage of movement, and television has the additional advantage of liveness and of easy delivery.

On the other hand, however, slides and strip-films and other stationary pictures also are effective learning experiences. They are inexpensive, they are repeatable, they may be kept on as long as necessary (at least until the film begins to burn), and they can be inserted into a classroom at the most appropriate time if they are available. The point that surprises some teachers and some researchers is the great adaptability of students to different learning experiences. They can learn from anything, if it is relevant and interesting to them, if it is clearly and systematically presented, and if they can practice, preferably by applying it to the world around them.

If the objective is chiefly to learn something that is said or heard, then radio or recordings have a certain advantage. For example, television may be an unnecessary luxury for language drills or music demonstration, and in fact the visual track may distract attention from the audio. Tape recorders, in the form of language laboratories or tape loops, have proved their effectiveness on every continent.

Programmed instruction, and its less formalized cousins in the form of self-correcting drill sheets and work books, are especially effective when the student works alone. They are not threatening. They permit the student to set his own pace. They take a certain amount of responsibility for drill off the shoulders of the teacher. If the material is truly programmed, then it is tested and improved as it is made (which is why good programs are costly), and a high degree of learning is almost assured if a student will work through the program. On the other hand, not every student will have the motivation to practice by himself, and a printed drill sheet may not provide much motivation.

Print, in the form of textbooks or workbooks, remains the staple "learning aid." Undoubtedly, textbooks could be much improved with what has been discovered in the last 20 years. But they still remain the basic reference and subject matter resource available to both teacher and student.

The question of "replacing the teacher" is out-of-date and irrelevant. The teacher has certain functions of direct

relationship and two-way communication with students, which nothing can replace. Even a poorly trained teacher has certain advantages over the most elaborate teaching by media. The question is rather what kind of help can be given to a teacher and a class. Television or films can bring in audio-visual material and demonstrations that are beyond the local possibilities of almost any classroom. Simpler visual devices like filmstrips can offer an opportunity for visual learning that few teachers could otherwise offer. Radio can bring an expert demonstration of foreign language that most classroom teachers could not equal. Tape recorders offer a student an opportunity to practice against models which he would otherwise not have available. Programs and work books, as we have said, offer a student an opportunity to do alone what is most efficiently done alone, and usually done most inefficiently by classroom drill. And any of these devices can bring into a classroom the teaching or the learning products of a country's most skillful teachers, to help the classroom teacher. The question is, what combination of learning aids is most needed and most effective in the situation?

Where teachers are not available, then motivated students have proved able again and again to get a very good education from media experiences, working by themselves. Examples are the use of radio and correspondence study to teach hundreds of children in the remote interior of the Australian continent to teach primary and sometimes secondary school, after which

these students are able to transfer to city schools or enter the university; and the use of television and correspondence study in Japan, or television alone in Chicago, to teach homebound students, who, when they are motivated, typically do at least as well in examination as classroom students at the same level.

Therefore, the pressing needs of the educational system, the nature of the students and their motivation, are all factors to be considered in choosing from among media aids to learning. But one of the greatest sources of variance in the effect of learning from these media is the skill with which the lessons are made. Many scholars feel that there is more variance in learning due to the educational method and content of media instruction than to the nature of the media themselves. An extremely skillful use of radio may overcome much of the lack of visual elements, even where they would seem to be necessary. Well-made television lessons in foreign language will add something to the effect obtainable from radio alone. A poor program may be less effective than a good class drill or a radio or television exposition with plenty of practice built in. When nothing else is available, then even an indifferent use of the media will probably bring about a considerable amount of learning, especially if the students are motivated to learn. But the general finding where instructional media have been used in

schools and in the field, is that excellent teaching on any of the media is more important, relatively, than excellent teaching in the classroom. And therefore any country should hesitate to undertake the use of instructional media like television, radio, or programmed instruction unless it is prepared to invest considerable time and effort in achieving high quality in its media presentations.

Instructional media as part of a system

Long experience with the use of instructional media has contributed another conclusion of great generality: that media such as television and radio are almost never used alone for instruction, and are most likely to be effective when built into a system of related and mutually-helpful teaching and learning experiences.

When television or radio is introduced into the classroom, the classroom teacher and the television or radio teacher are usually considered as full partners in the enterprise, and the ideal is a kind of team teaching, with each teacher doing the part of it he can do best. The classroom teacher is usually given some help, through training, workshops, and/or teachers guides, in how to make most effective use of the media in his own teaching. His students are usually provided with workbooks related to the lessons on the media. Where possible, other learning aids also are provided in the classroom.

When the media are used outside school, some two-way link is almost always provided in addition to the media lessons. Australia uses radio and correspondence study. Kenya offers its teachers advanced courses, in-service, by radio and correspondence study. Japan teaches a complete secondary school curriculum by radio, television, and correspondence study, and brings students into a residence school for a week or two each year. The British Open University teaches a university curriculum by television, radio, correspondence study, science kits for home experimentation, opportunities to consult with a tutor at a nearby center, and several weeks of study in residence each year. In India, where the radio rural forum has proved so effective that it has come into use also in a number of African and Latin American countries, the radio was used mostly to stimulate the discussion of a group of village leaders carefully organized and aided by the field service.

Thus, any decision to introduce one of the instructional media, like radio or television, is ordinarily taken in system terms. What combination of teaching and learning experiences, within available resources, can best be provided for students? Which media, which experiences, can most effectively be combined and delivered? What specific use should be made of instructional media in such a combination?

Very often, the introduction of any massive technology catalyzes important changes in the entire system. For ex-

ample, when El Salvador, in the late 1960's decided to introduce instructional television, it decided on a wide-sweeping educational reform. The curriculum was revised and modernized. The national system of teacher training was revised and upgraded. Every teacher, before he was assigned to a classroom with television, was given a full year of retraining both in the substance of the new curriculum and in modern methods of pedagogy. New and improved classroom materials were prepared. Utilization supervisors were trained and sent into the schools, not primarily to pass judgment on the teachers, but to help them make the most of the television and other learning resources available to them. And an evaluation system was introduced to keep track of the results.

This is an important example to be considered by the educators of Africa. They, like educators in other countries, will want to consider the possible introduction of sophisticated electronic technology in terms of their entire instructional system. If they decide upon such new technology, then, because it will require major commitments of resources, they will wish to maximize the effectiveness, not only of the new technology, but of all the elements in their system. And they will find that the time of introducing such dramatic new technology will possibly be the best opportunity they will ever have to make broad changes and improvements in their total educational offerings.

Considerations of cost-effectiveness

The educators of Africa, in considering new electronic technology, must make certain important estimates of cost-effectiveness.

It is hardly necessary to point out that radio is much less expensive than television. The operating and programming costs are different in the two media by a factor of not less than 1 to 5. The cost of receivers and meeting power-needs in the absence of power mains is substantially less for radio. Furthermore, maintenance costs are less, fewer skilled people are needed, and less complex equipment is placed in the classroom or village. On the other hand, against there cost advantages must be weighed the advantage of being able to bring the visual stimuli of television into the classroom or the village.

The total cost of doing the television job with films rises very rapidly as the number of users and the coverage area increases, and as the number of films begins to approximate the number of television programs. Rather early in the process of expansion, therefore, the cost of delivering films to a large number of classrooms or villages to do the same job television does, begins to exceed the cost of delivering the same amount of television. Furthermore, it usually takes longer to make films and is usually more expensive than television programming. Therefore, these disadvantages must be weighed against the flexibility of films. The usual conclusion is that films are not used to do the same job tele-

vision does; they are used less frequently, and for special tasks. And if television is available, they are often delivered by television. The less expensive visual media, such as slides and filmstrips, are also used typically for special tasks to which they are specially adapted.

Truly effective programmed instruction is very costly to make. To use it, as television or radio might be used, to carry a major part of the instruction, would require an expenditure of truly major proportions. Therefore, programs, too, are typically used for special purposes.

It must not be forgotten that the cost of preparing, printing, and distributing textbooks and workbooks is a major one. This will be especially significant if the curricula within Africa are Africanized, and if native languages are employed, so that textbooks from the former colonial countries will no longer be so readily usable.

With school classes, or in teaching literate adults, however, printed material will probably continue to be the staple of any educational system. In relation to it, any electronic or programmed instructional materials are likely to be used for special purposes, to add certain special learning opportunities. They are likely to consume a relatively small proportion of the total teaching and learning time, although their impact may be quite out of proportion to the time.

In this respect, the experience of the British Open

University may be instructive. This enterprise, which has more than 30,000 students in its second year of operation, uses television for direct teaching by gifted and eminent teachers, and for documentary and artistic supplements to the study material. It uses radio for some of the other kinds of communication these teachers might give in the classroom: for example, answering the most common questions that have been raised about the lessons, or guiding students through different problems or assignments. It uses textbooks, work-sheets, and correspondence assignments for the student's individual study. The University estimates that only 10 per cent of the time a student actually spends on study is devoted to television and radio, but that nearly half the cost of preparing learning materials (the broadcast programs, the texts, and so forth) were put into the television and radio programs. On the other hand, the University has shown no sign that it regards that amount of expenditure on broadcast instruction as not cost-effective.

However, any country proposing to add sophisticated electronic instruction to its educational system should not count on saving money thereby if the new instruction is simply added to the old. In that case, it must be justified, if at all, on the grounds of added quality.

The situations in which it is possible to save money by such newer technology are those in which it makes it possible to expand educational opportunities without building new schools, or without adding a large number of highly-

trained teachers. One of the chief justifications of the British Open University was that it could nearly double opportunities for higher education in Britain, without requiring the highly expensive creation of new residence universities. Similarly, Mexico offers secondary school by television (in the many places where no secondary schools exist) to any town or village that will organize a class and provide a room; and by radio succeeds in expanding many three-year primary schools to six-year schools, without adding a building or a full complement of teachers. Kenya, as we have noted, offers its teachers, by radio and correspondence, the kind of courses which they would ordinarily have to take in advanced teachers colleges or the university. Niger made television programs of a kind that permitted the use of monitors, rather than certificated teachers, in primary schools; if the system had been expanded, as planned, it might have made substantial savings. Numerous countries have used the media to bring educational opportunities to rural regions where they have previously been unavailable. In an expansive situation like that, a major use of electronic media may save money over any other acceptable alternative. In a situation where the media are simply "added on," there will be no such savings.

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CHAPTER VI

DIRECT BROADCAST SATELLITES

by

Daniel C. Smith and James M. Janky, consultant

The age of the Direct Broadcast Satellite (DBS) is upon us. Since a detailed study of satellite communication systems for national development purposes was completed in 1967 in the Stanford University School of Engineering (ASCEND) many other studies have been made. Pilot projects are now underway for the distribution of radio programs from the ATS-1 satellite. Demonstration projects with direct broadcast television from the ATS-F satellite will take place in the Rocky Mountain States area of the United States in 1973. Experiments in India will continue shortly thereafter. Low-cost ground terminals have been designed and actually constructed. Technological improvements in satellites are being made constantly and the rate of progress could easily be speeded up. There are no technological barriers to DBS systems in Africa by 1975 and pilot projects could be started sooner so far as the technology is concerned.

The range of possible services is very large indeed--from one TV channel and a few audio channels serving the sub-continent to a few TV channels and hundreds of radio channels for a much smaller group of countries. Some of these alternatives will be described.

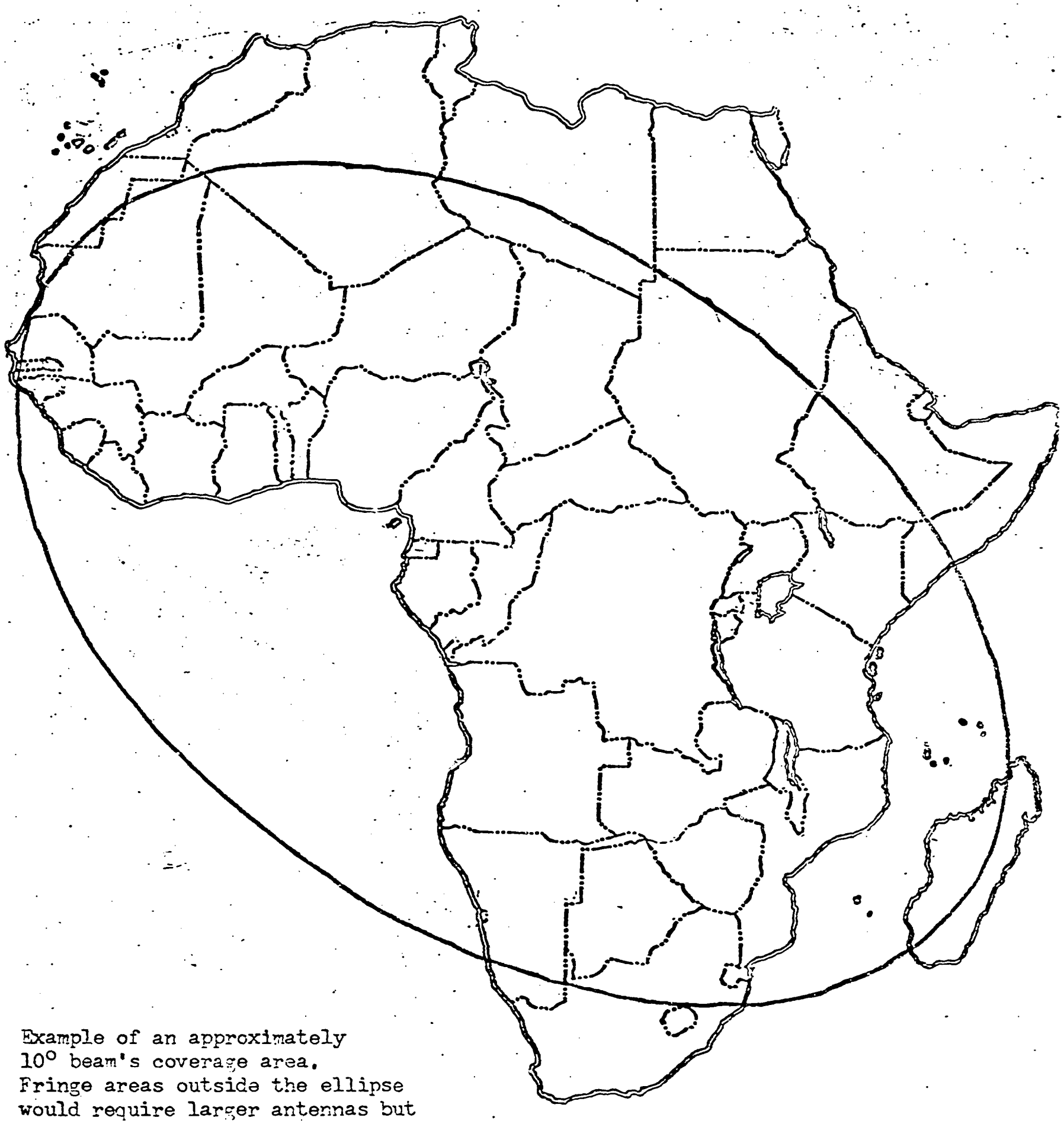
First among them is a choice of one or several satellite beams. The coverage area of one beam might look like that of Figure 6. An alternative pattern of four beams is shown in Figure 7.

For a number of reasons, regional coverage--rather than sub-continental coverage (Figure 6)--from one or more satellites makes better sense. Not the least of these reasons is that gradual introduction of a DBS system is permitted with smaller coverage areas and smaller satellites. Other reasons will become clear following a review of certain parameters of satellite technology.

System parameters

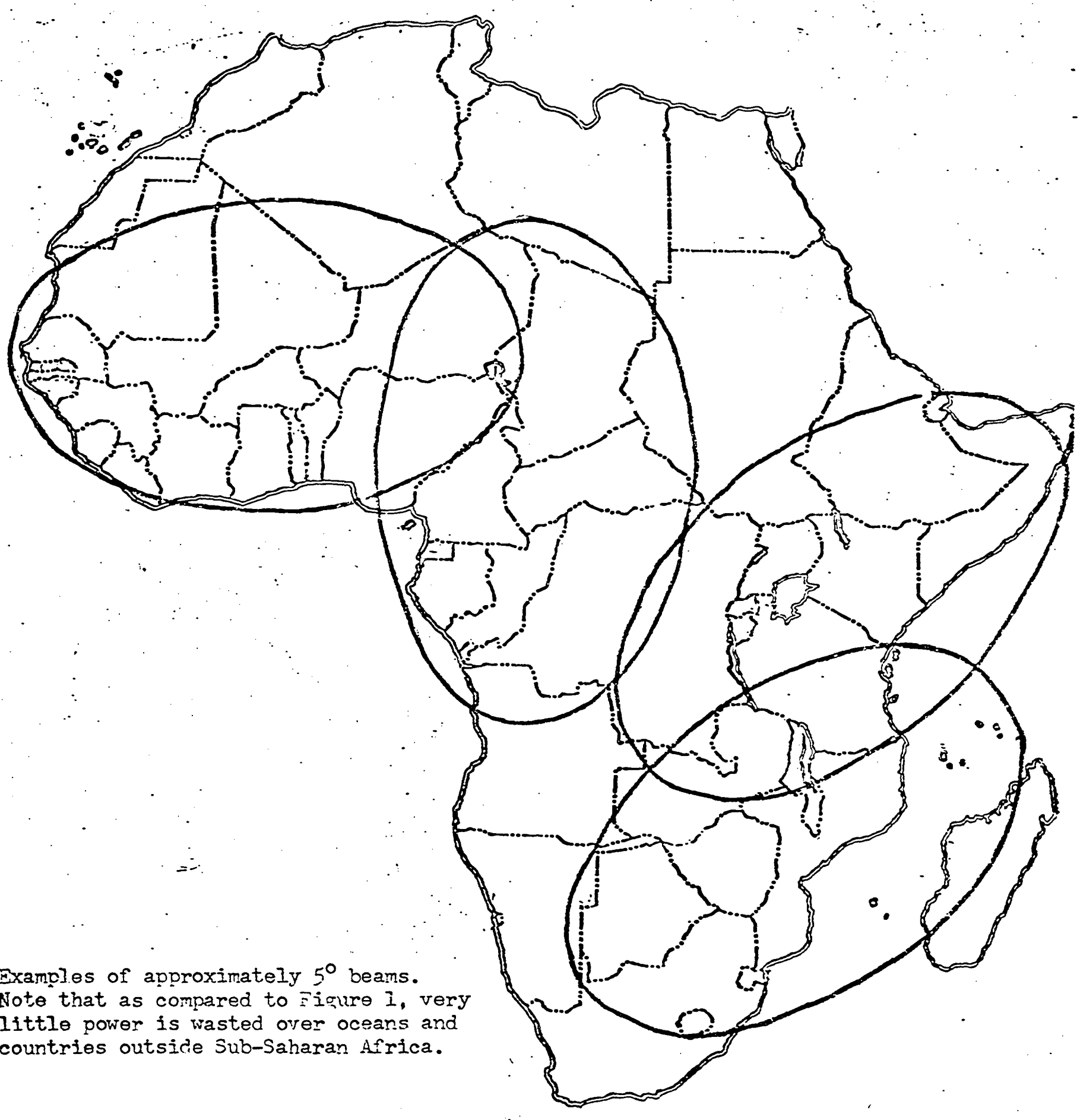
The major system parameters we must select are frequency, receiver characteristics, satellite transmitter power, coverage area, and type of service. Each of these will be considered in turn.

Frequencies available.--There are five frequency bands available for an African DBS system. These spectrum allocations were made at the World Administrative Radio Conference for Space Telecommunications in 1971. Two of the bands



Example of an approximately 10° beam's coverage area. Fringe areas outside the ellipse would require larger antennas but would still be able to receive signals from the satellite.

Figure 6.



Examples of approximately 5° beams. Note that as compared to Figure 1, very little power is wasted over oceans and countries outside Sub-Saharan Africa.

Figure 7.

available to Africa, 41-43 GHz and 84-86 GHz will not become practical until the appropriate technology is developed. We anticipate that operational systems in three lower bands will exist for a number of years before the upper two become useful. See Table 14 below.

TABLE 14

SATELLITE BROADCAST BANDS AVAILABLE TO AFRICA

	Band		
	620-790 MHz	2.5-2.69 GHz	11.7-12.5 GHz
Bandwidth (MHz)	170	190	800
Primarily Allocated to Satellite Bdcst. Service?	no	yes	yes
Useful Time Period	1972 on	1974 on	1976 on

The maximum power flux density which may be produced at the surface by a DBS is specified for each band in the ITU's Radio Regulations.These maxima will not hamper the services contemplated here. However it is important to note that the 700 MHz band is not allocated primarily to satellite broadcasting, and the antennas required to confine the satellite beam to the desired areas are rather large. Some use of this band can be made quite economically. However the bandwidth will quickly become filled.

In the lower two bands a TV channel would occupy about 30 MHz, whereas 36 MHz would provide a little more noise margin in the 12 GHz region. A block of 100 radio channels would occupy about 5 MHz. Spreading the signals out via wideband FM modulation substantially reduces the transmitter power requirements for a given signal to noise ratio.

If the bands became full, more channels could be provided by placing another satellite in orbit at a different location. No immediate shortage of "parking spaces" is anticipated.

Receiver and antenna.--Janky and associates in Stanford's Electrical Engineering Department have determined that a desirable form of mass-produced receiving antenna for the 2.5 GHz band is a semi-parabolic dish with a diameter of about 210 centimeters. This antenna is formed from 10 petal-shaped pieces of aluminum. The choice of a 210 cm. diameter is based on an engineering compromise between ease of aiming, departure from a true parabola, and manufacturing cost. In the fringe areas a larger antenna (3 meters) would be needed. The cost will be about triple the cost of the smaller antenna.

A 210 cm. diameter antenna for reception at 700 MHz would permit very inexpensive satellite designs. The antenna could be assembled by the user.

An antenna for the 12 GHz band would have to be truly parabolic. Any diameter over 180 cm. would be very difficult to aim and the supporting structures necessary to maintain

the pointing accuracy become very large and expensive. Further, a professional installation crew would be required.

The adaptor which converts the FM signal from the satellite into the conventional AM television and radio signals must be cheap to produce, sensitive, and seldom if ever require adjustment in the field. It should also have low power consumption for operation in areas without regular electricity. The Stanford unit uses three to four watts of power. The receiver system parameters assumed for the various bands are summarized as Table 15 below.

TABLE 15

RECEIVER TERMINAL PARAMETERS

	Band		
	700 MHz	2.6 GHz	12 GHz
Receiving Antenna Diameter (cm.)	210	210	180
System Noise Figure (db.)	4	7	6

A brief note is in order on the implementation of the suggested multi-channel radio system. The idea is to assemble audio channels into groups of up to 100 and transmit them via an FM modulated carrier to the ground receivers. In the microwave adaptor the FM signal is converted to standard AM sig-

nals which are receivable on conventional AM radios which are cheap and available. Of course a school in one country could receive broadcasts intended for other countries unless counter measures were taken at both ends.

Transmitter power and coverage area.--All other things being equal, we can trade coverage area for transmitter power. Roughly speaking, if you cut the coverage area in half, you cut the required transmitter power in half. Thus, if one country or a small group of countries wants a satellite service of its own, savings can be made by reducing the transmitter power.

Given the above mentioned frequency and receiver assumptions--all very realistic--we can calculate, as shown in Appendix A, the transmitter power required. If more or less channels are desired, the transmitter power is adjusted accordingly. Typical examples are shown in Table 16.

The higher power levels shown in Table 16 can be attained if the need is expressed. Dr. Henry Kosmol of NASA has estimated that it would take only $1,000,000 and three years to develop satellite transmitting tubes in the 200 to 500 watt range. Still higher power is not far off.

The ATS-H and CATSAT (joint Canadian and NASA effort) will be demonstrating the technology at 12 GHz about 1975-1976. By that time much experience will be available at 2.6 GHz. African planners can be assured that sufficiently high powered satellites could be available by 1975 if they

desired to have regional systems operating by then.

TABLE 16

REQUIRED SATELLITE TRANSMITTER POWER LEVELS (Watts)

Coverage Area and Services	Band		
	700 MHz	2.6 GHz	12 GHz
1 ch TV	215 watts	600 watts	3500 watts
10° 100 ch radio	34	95	448
1 ch TV	54**	151	875
5° 100 ch radio	8.5**	24	112
1 ch TV	13.5**	38	219
2 1/2° 100 ch radio	2.2**	6	28

** very large satellite antennas required

Satellite costs.--Satellite costs are estimated from Table 17 which shows the costs of two existing and one proposed system, together with the launching costs. They are representative of commercially available satellites. In the discussion below on possible system configurations, the prime power of the spacecraft is taken to be fixed near the listed values and various schemes for dividing it among transmitters are considered.

TABLE 17

SATELLITE CAPABILITIES AND LAUNCHED COSTS

Satellite	Number of 36 MHz Channels	Total RF Power	Prime Power	Cost	Launch Vehicle	Cost	Total
HUGHES HS-336	12 @ 7.3w	88w	220w	$6.3M	THOR-DELTA	$7M	$13.3M
INTELSAT IV	12 @ 10w	120w	740w	$12M	ATLAS-CENTAUR	$16M	$28M
MCI-LOCKHEED	48 @ 14w	672w	4.4kw	$21M	TITAN IIID-AGENA	$23M	$44M

Note: This table is intended only to illustrate the costs associated with various levels of prime power. The satellites for a DBS system could be obtained from many manufacturers.

For example one might decide to begin satellite radio broadcasting with an HS-336 type satellite serving the whole sub-continent. One hundred radio channels could be provided at 2.6 GHz. (We assume that 40 to 45% of the prime power can be converted to radio frequency power when there are only a few transmitters.) The HS-336 type is quite a small satellite and is limited to about a 180 cm. diameter antenna. Of course, its launch costs are much lower also.

Using an INTELSAT IV type satellite about 300 watts of transmitter power could be obtained. With the MCI-Lockheed type of satellite about 1800 watts of power output could be available.

While it is possible to cover the entire sub-Saharan Africa area with one beam (Figure 6), it seems more desirable to cover the same area with a number of smaller beams (Figure 7). Smaller coverage units have the advantage of making regional cooperation more realistic, lowering development costs, making the satellite system more immune to failure, and wasting less radio energy. There is some cost involved in designing more complicated antenna systems. However we should be encouraged about the possibility of constructing a satellite with four 5 degree beams since the antenna diameter required (at 2.6 GHz) is only about 165 cm. This is about the size of the spot beam antennas (of which there are two) on INTELSAT IV satellites now in service.

Of course there may be some value in being able to

transmit to the entire sub-Saharan Africa region at one time. It would be a simple matter to provide this service even with a multi-beam satellite.

It should be noted that reductions in the cost of ground receiving equipment and satellite transmitter power could be made by using 700 MHz instead of 2.6 GHz. The cost reductions would be partially offset by increased satellite antenna costs. Since spectrum space for broadcasting from satellites is severely limited, this band should not be neglected even though it is shared with other services. It is particularly suited to equatorial and southern Africa since it would be much easier to control spill-over into Europe.

Some possible systems

The following Table 18 outlines the characteristics of some satellite broadcasting systems. They are ordered by cost to show the kinds of costs associated with various levels of service. When the exact number of schools, transmitting ground stations, etc. is known along with a target implementation date, more precise figures can be calculated.

Beginning with radio, and on a regional basis rather than a sub-continental one, the cost is $42 million (System 1). This is assuming seven participating countries, each with its own up-link ground station for originating programs directly. (For details on the components entering the cost of each system see Appendix B.)

TABLE 18

SEVEN SATELLITE BROADCAST SYSTEMS

	System						
	1	2	3	4	5	6	7
Total RF power limit (watts)	100	300	300	100	1800	300	1800
Frequency band or bands	2.6 GHz	2.6 GHz	700 MHz	2.6 GHz	2.6 and 12 GHz	2.6 GHz	2.6 GHz
Services and coverage	400 radio ch. to 5° area.	2 TV ch. to each of two 2-1/2° areas. 400 radio ch. to 5° area.	4 TV ch. to one 5° area. 200 radio ch. to 10° area.	100 radio ch. to 10° area.	4 TV ch. to one 2-1/2° area (12GHz). 4 TV ch. to one 5° area (2.6 GHz). 400 radio ch. to one 5° area (2.6 GHz).	1 TV ch. and 100 radio ch. to one 5° area. 100 radio ch. to 10° area.	2 TV ch. and 200 radio ch. to each of four 5° areas. 100 radio ch. to 10° area.
Capital cost (millions of U.S.$)	42	62.6	79.8	115	128.7	204	225

The principal variable costs in each case are the amount of reception equipment and the number of ground stations. See Appendix B for the components of each system and an estimate of the annual operation and maintenance costs exclusive of programming.

For 20 million dollars more a few countries could be served with four TV channels and 400 radio channels (system 2).

Going to the largest satellite considered here, the possible combinations of services become very numerous. Two are sketched out as systems 5 and 7. System 5 would utilize the 12 GHz band. Waiting a number of years--say to 1980--would mean the $25 million development cost could be saved but this saving must be evaluated against the lost opportunity costs.

Great flexibility is provided by covering the subcontinent with a number of small beams rather than trying to blanket the area with a 10 degree beam. System 7 proposes four 5 degree beams to serve the countries of sub-Saharan Africa. It is significant to note that when we are talking in terms of 100,000 radio reception terminals, 100,000 TV reception terminals, 500,000 AM radios, 500,000 TV sets and 50,000 small electricity power sources, the reception components exceed the cost of the satellite and 30 transmitting ground stations.

We would like to emphasize that actual system configurations depend on the applications settled on. The reader can compute the costs for different systems from the data presented here. Small flexible systems will have lower cost because they can be filled to capacity in a short time. Of course political agreements are easier among small groups of countries.

The number of ground stations for transmitting could be reduced by using terrestrial microwave telecommunication systems now under construction between countries. It does not appear that any of the purely intra-Africa terrestrial systems will have capability for video in the next several years. Of course there is always the possibility of sending programs by air post to a ground station. Since countries would probably like to use excess radio channel capacity for internal telecommunications, it is probably not realistic to plan on much sharing of ground stations, except in the case of small countries.

Receiver terminal costs.--A recent estimate by Janky (1971) of the cost of the Stanford 2.6 GHz antenna and adaptor is $450 per unit in quantities of 1000. In the estimates here we have assumed the installed cost to be $200 per unit for quantities in the vicinity of 100,000. This is a reasonable estimate because of the quantity and the fact that all the difficult research and development work will have been done in the first half of the 1970's by interested parties in the U.S. and at their expense. Furthermore, the cost of some of the new electronic components used in the adaptor will surely decrease dramatically in the years to come. In large scale production much of the circuitry can be incorporated on one integrated circuit chip.

A basic price for a 12 GHz terminal is estimated to be $600 in quantities of 10,000 or more. More research on

this question is needed.

TABLE 19

SOME 2.6 GHz RECEIVING TERMINAL COSTS
(100,000 quantities)

1 ch. TV or 100 ch. radio	$200 ea.
2 ch. TV, or 1 ch. TV and 100 ch. radio, or 200 ch. radio	$250 ea.
3 ch. TV, etc.	$300 ea.
4 ch. TV, etc. (use two 2 ch. units)	$500 ea.

Several things must be kept in mind. While $200 is not much as satellite terminals go, it is a large investment for an individual, especially in a developing country. The systems considered here are basically for community reception at a school. Distribution could easily be made to the surrounding community by cable or even very limited direct broadcasting from the terminal. If the cost of the terminals is higher than expected then the size of the community for which it is economical to install a rebroadcast facility goes down. Using a slightly optimistic figure of $200,000 for a satellite rebroadcast facility, it would take a reception area with more than 1000 reception points to justify the establishment of a rebroadcast facility. In urban areas such facilities are justified. (There are about 90 cities

in sub-Saharan Africa with a population of more than 100,000 that might have surrounding areas of sufficient size to justify rebroadcast facilities. This is a matter for further study.)

A suitable TV set for classroom use is assumed to cost $100 delivered in large quantities. The cost would be higher if small-scale domestic production were chosen. Annual tube-type TV set maintenance has run as high as 100% of acquisition cost in some systems. We believe that transistors, integrated circuits, and use of modular construction will drastically reduce maintenance costs.

Use of single frame video storage units with each TV reception terminal may vastly increase the number of video channels for instruction. The costs are not yet clear, however.

Increasing radio and TV coverage by conventional means

It is easy to demonstrate that direct satellite broadcasting of TV signals is less expensive than by terrestrial means when we are concerned with complete coverage of sub-Saharan Africa. If it is assumed that a TV rebroadcast facility will cover 20,000 km^2, it would take 850 facilities to cover the 17,000,000 km^2 land area. At $200,000 for each station (two channels) the cost would be $170,000,000. Interconnection and receiving equipment would still be needed. While such a system would be much more expensive

than a satellite system, it would provide the opportunity for more localized programming. The value of such localized programming must be assessed in relation to these costs. Furthermore, by choosing to cover areas selectively--omitting the areas where population is less dense--the cost of a ground system could be substantially reduced.

Radio by conventional means is not so clearly inferior to a satellite system. Assuming that an AM radio broadcast station could reliably cover 200,000 km^2, only 85 would be needed. Approximately 250 transmitters were in use in 1971 for domestic service to sub-Saharan Africa. However some countries have more than one channel available to the population. Despite the fact that the terrestrial radio broadcast bands are crowded, it would probably be possible to add 85 stations or so. This would give one additional channel per country at a cost of about $20,000,000.

However such a system could not be used for telecommunications, and expansion would be severely limited if large amounts of instructional radio looked attractive. AM radio is subject to severe interference at night, also. Linguistic reasons could also dictate that a country demand a larger number of radio channels than terrestrial systems could economically supply.

Another way to look at the matter is to ask what is the per channel cost in a direct satellite broadcast system? By inspection of System 1 discussed earlier, that cost seems to be just over $100,000. Thus in order to be cost effective,

a high-powered terrestrial radio station system must cost less than $100,000 per channel. Sharing a satellite with neighboring countries would be superior when a number of channels were desired.

Electrical power in remote areas.--If regular electrical power is unavailable, then other provisions must be made. The most practical are animal power and small gasoline generators. Wind could be used in areas where winds are dependable. Animals could be used by having them pull a cart around to charge a battery via a generator. The cost of animal power is estimated to be $50 for the initial investment and $10 per year to amortize the battery. We estimate that a small (100 watt) generator would cost $100 delivered and require $100 per year for fuel and parts for 12 hours per day of operation. This could power two TV sets of careful design.

The multi-channel radio contemplated here has the advantage that ultimate reception is on conventional AM radios. The use of radio poses a very small problem of obtaining electrical power.

The extent of regular electricity is a matter for study by more detailed missions.

Adding two-way capability.--With a multi-channel DBS and signals covering whole countries it would seem desirable to add some basic two-way communication capability for isolated areas. When the satellite was not being used fully

for instructional purposes it could be used for transmitting medical or governmental information, for example. Program distribution to terrestrial broadcast stations is another obvious use.

The link calculations in Appendix C show that the power levels required by the up-link transmitter for a single audio channel are rather small. A safe estimate for the unit cost of such transmitters--given receiving terminals--is $1000 installed.

Slightly more complicated terminals could provide excellent telecommunications capability for small cities using unoccupied radio broadcast channels. Still more complex terminals could make better use of the satellite capacity in normal telecommunication usage.

Adding limited two-way capability to a DBS would raise the cost of the system by a few percent.

Program costs.--In order to compare the hardware costs with the programming costs we can make the following assumptions. Take the cost of adequate quality ITV production to be $5,000 per hour including planning, etc. Instructional radio we assume to be $1000 per hour. Thus for 12 hours per day of ITV, over 300 days the cost is $18,000,000. For radio the cost might be about $3,600,000 although there is an unknown factor here in the amount of written material necessary to accompany the lessons. These costs do not seem so high when you realize that $3,600,000 might deliver

a whole mathematics curriculum. Of course if programs can be taped or filmed and used in following years the costs will decline.

Some actual ITV programming costs are shown below.

TABLE 20

SOME INSTRUCTIONAL PROGRAM COSTS
(dollars/hour)

Program or System	Cost
El Salvador	1,300
NHK	2,500
Bavaria	12,000
Samoa	2,300
U.S. costs:	
PBS, in general	40,000
Sesame Street	48,000
World Press Review	4,500
The Advocates	50,000
The French Chef	17,000

Conclusions.--Technology is not a barrier to a DBS system in sub-Saharan Africa. However because a DBS is expensive, detailed feasibility studies should be carried on while at the same time experiments in teaching by radio and TV are conducted. Any bottleneck is in software.

It would be wise to begin with the smallest cost-effective system rather than wait for big systems.

We have not calculated any cost-per-student figures

because they would be sheer speculation. However at least one would be instructive. Suppose that a DBS serves 10 million students and has the following annual costs: hardware, $20 million; operation and maintenance, $11 million; programming (mixture of radio and TV), $20 million. The total annual cost is $51 million for a per student cost of $5.10. These numbers could fit System 3 above. The reader can construct much more optimistic systems.

APPENDIX A

Link Calculations

The system components are related by the formula

$$CNR = \frac{P_T A_T A_R}{L_p k BW T_e}$$

where
- CNR = carrier to noise ratio
- P_T = satellite transmitter power
- A_T = satellite antenna gain
- A_R = receiver antenna gain
- L_p = free space attenuation
- k = Boltzmann's constant
- BW = bandwidth
- T_e = noise temperative of the receiver

We take CNR to be 31.6 to 1 or 15 db which is sufficient for the wideband FM modulation system used.

The satellite antenna gain (A_T) is fixed by the coverage area desired.

Receiver antennas are taken to be 210 cm diameter at 700 MHz and 2.6 GHz, and 180 cm at 12 GHz.

Receiver noise figures are set at 4, 7 and 6 db for the 700 MHz, 2.6 GHz and 12 GHz bands respectively. A 5 db rain factor is allowed at 12 GHz.

The modulation index is 3.

Typical Link Calculations (in logarithmic form)

	1 video chan. 2.6 GHz 5° coverage BW_{rf}= 30 MHz	100 audio ch. 2.6 GHz 5° coverage BW_{rf}= 4.8 MHz	1 video chan. 12 GHz 5° coverage BW_{rf}= 36 MHz
k	-228.6	-228.6	-228.6
BW	74.8	66.8	76.0
T_e	30.6	30.6	29.5
L_p	193.0	193.0	206.0
CNR	15.0	15.0	15.0
rain	0.0	0.0	5.0
$-A_T$	-30.5	-30.5	-30.5
$-A_R$	-32.5	-32.5	-43.0
P_T	21.8 dbw or 151 watts	13.8 dbw or 24 watts	29.4 dbw or 875 watts

APPENDIX B

SYSTEM CAPITAL AND OPERATING COSTS

Notes:
1. Figures are in millions of US dollars.
2. Annual operating cost of the satellite is for management.
3. Operating costs do not include programming.
4. Limited two-way capability would add a few percent to system costs and boost operating costs in proportion to the scope.

System 1

	Capital Cost	Annual Operation and Maint.
Satellite and launch	14	1
7 ground stations and studios	14	1.4
25,000 radio ~~rcvr.~~ receiver terminals--100 ch.	5	1.3
125,000 AM radios	2.5	.6
12,500 power sources	1.5	1.3
Engineering	5	
Total	$42	$5.6

System 2

	Capital Cost	Annual Operation and Maint.
Satellite and launch	28	1
3 ground stations	6	.6
10,000 radio terminals--100 ch.	2	.5
50,000 AM radios	1	.3
20,000 TV terminals--2 ch.	5	1.3
100,000 TV sets	10	2.5
5,000 power sources	.6	.5
Engineering	10	
Total	$62.6	$6.7

APPENDIX B (continued)

System 3

	Capital Cost	Annual Operation and Maint.
Satellite and launch	28	1
7 ground stations and studios	14	1.4
25,000 radio terminals--100 ch.	5	1.3
125,000 AM radios	2.5	.7
25,000 TV terminals--2 chan.	6.3	1.6
125,000 TV sets	12.5	3.2
12,500 power sources	1.5	1.3
Engineering	10	
Total	$79.8	$10.5

System 4

	Capital Cost	Annual Operation and Maint.
Satellite and launch	14	1
30 ground stations and studios	60	6
100,000 radio ~~rcvr.~~ terminals--100 ch.	20	5
500,000 AM radios	10	2.5
50,000 power sources	6	5
Engineering	5	
Total	$115	$19.5

APPENDIX B (continued)

System 5

	Capital Cost	Annual Operation and Maint.
Satellite and launch	44	1
7 ground stations and studios	14	1.4
20,000 TV terminals (12 GHz)	12	3
20,000 TV terminals--2 ch.	5	1.3
200,000 TV sets	20	5.
25,000 radio terminals-100 ch.	5	1.3
125,000 AM radios	2.5	.7
10,000 power sources	1.2	1.
Engineering and development	25	
Total	$128.7	$14.7

System 6

	Capital Cost	Annual Operation and Maint.
Satellite and launch	28	1
30 ground stations and studios	60	6
100,000 radio terminals--100 ch	20	5
500,000 AM radios	10	2.5
100,000 TV terminals--1 ch.	20	5
500,000 TV sets	50	12.5
50,000 power sources	6	5
Engineering	10	
Total	$204	$37

APPENDIX B (concluded)

System 7

	Capital Costs	Annual Operation and Maint.
Satellite and launch	44	1
30 ground stations and studios	60	6
100,000 radio terminals--100 ch	20	5
500,000 AM radios	10	2.5
100,000 TV terminals--2 ch.	25	6.3
500,000 TV sets	50	12.5
50,000 power sources	6	5
Engineering	10	
Total	$225	$38.3

APPENDIX C

Link calculation for return audio

Assume a 180 cm diameter satellite antenna, and a 210 cm transmitting antenna on the ground.

	700 MHz	2.6 GHz	4 GHz
k	-228.6	-228.6	-228.6
BW	44.0	44.0	44.0
T_e	29.0	30.6	30.6
L_p	181.5	193.0	196.5
$-A_R$	-20.0	-31.0	-35.0
$-A_T$	-21.3	-32.5	-37.0
CNR	15.	15.	15.
P_T	-0.4 dbw or 0.9 watt	-9.5 dbw or 0.11 watt	-14.5 dbw or 0.032 watt
Nominal power likely to be available to give good margins.	10 watts	1.1 watts	0.5 watts

Clearly the transmitter power levels required for simple audio return links are small. The estimate of $1,000 for the cost of a transmitting terminal is safe given an existing receiver.

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