T O P I C :

"THE DISTRIBUTION AND VARIATION IN THE USE OF PRIMARY SCHOOLS: A CASE STUDY OF BONDO DIVISION, SIAYA DISTRICT, KENYA."

BY:

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THIS DISSERTATION IS PRESENTED TO THE DEPARTMENT OF GEOGRAPHY, UNIVERSITY OF NAIROBI, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR A BACHELOR OF SCIENCE DEGREE 1989/90 ACADEMIC YEAR.

APRIL: 1990

D E C L A R A T I O N

This Dissertation is my original work and has never been presented in any other University.

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DEDICATED TO:-

My parents: Mr. Samuel Mikuma Ogwedo
and
Mrs. Filgona Akoth Mikuma

My brother and his wife: Mr. Alex D. Nyaoro
and
Mrs. Mary J. Nyaoro

Whose toil and encouragement have been the key to my education.

ACKNOWLEDGEMENTS

This paper is a product of a research carried out in Bondo Division (Siaya District) in 1989. In writing this paper, much of which is field-oriented, I had the assistance of a number of institutions and individuals to whom I am greatly indebted.

Foremost, I am greatly indebted to the Department of Geography, University of Nairobi, for the financial support it gave towards this study. I would also like to thank the Government of Kenya for having guaranteed permission to carry out the study, without which this study could not have been undertaken.

Special thanks go to my supervisors Dr. Ayiemba, E.H.O. and Mrs. M.W. Kirimi, for the guidance and assistance they offered during the various stages of the study.

I would like to express my sincere gratitudes to all the headmasters/ headmistresses of the schools visited for their co-operation in providing me with the necessary information.

I am deeply indebted to the Ministry of Education staff (Bondo Education Office), and in particular, Assistant Education Officer (A.E.O.), Mr. Atieno for making sure that I had access to all information necessary.

Thanks to other members of the Department of Geography, University of Nairobi and Mrs. M.Wangoya who did the typing of this dissertation, and all those who assisted and/or co-operated during the actual field study. With the exception of plate 9 all photographs were taken by the researcher. The errors which remain are my responsibility.

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APRIL, 1990

A B S T R A C T

This study investigates and analyses the factors influencing the distribution of educational facilities, and the variation in use of these facilities in Bondo Division, Siaya District. In distribution, factors such as transport network, population distribution, differential income levels and church influence have been examined: While under variation in use, factors such as accessibility, population density of school-age children and income level have been analysed. In achieving the above mentioned objectives, data from primary and secondary sources were used. The former was collected from the field both by field observation and interviews using questionnaires. A total of 36 schools and 45 parents were sampled.

In both distribution and variation in use of educational facilities, the various problems facing the primary schools have been highlighted and possible solutions have been proposed.

Analysis of variation in use of educational facilities has been aided by the formulation of four hypothses of the Null form which are tested using statistical techniques namely the simple correlation analysis, simple linear regression analysis and t-statistic which measures the degree of association between two sets of data. One hypothesis refers to the relation between the population of school-age children and the number of primary schools per sub-location. The second hypothesis refers to the relation between distance and time taken to get to the educational facilities in Bondo Division. The third seeks to test the relationship between the primary school enrolment and distance travelled from places of residence. The fourth hypothesis aims at finding out whether there is any significant relationship between the "quality" of the school and its envolment. This last hypothesis is tested by the use of Spearman rank correlation statistic.

Analysis of the distribution of educational facilities has been aided by the formulation of three hypothesis of the Null form which are tested using one statistical technique namely the Chi Square Test, which measures the difference between the observed and the expected frequencies of the given two sets of data. One hypothesis refers to the general distribution of primary schools in the study area i.e whether they are uniformly distributed or not. The second seeks to test the relationship between transport network and the distribution of primary schools. The third hypothesis seeks to test relantionship between income levels and the number of primary schools in each administration unit. Results of these hypothesis are well discussed in Chapter four.

It was found that the distribution of primary schools in the study area is mainly influenced by the differential income levels, accessibility and also to some extent by the physical environment. It was also found that the variation in use of such facilities is mainly due to the distribution of school-age children (which is uneven), quality of the school and the physical distance covered by the pupils from their places of residence to their respective schools.

For the alleviation of the shortcomings identified in both educational facilities distribution and use, the dissertation makes recommendations which include reviewing of the Ministry of Education criteria for primary schools allocation. Finally, a number of specific recommendations regarding the topic have also been made.

ABBREVIATIONS:

C.B.S.	-	Central Bureau of Statistics
L.B.D.A.	-	Lake Basin Development Authority
K.R.E.M.U.	-	Kenya Rangeland Ecological Monitoring Unit

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1.0 INTRODUCTION

1.1 BACKGROUND OVERVIEW:

"..... But (educational opportunities to 'rise' are not a substitute for a large measure of practical equality, nor do they make immaterial and existence of sharp disparities of income, physical and social conditions. on the contrary, it is only the presence of a high degree of practical equality which can diffuse and generalize opportunities to rise. The existence of such opportunities in fact, and not merely in form, depends not only upon an open road, but upon an equal start. It is precisely, of course, when capacity is aided by a high level of general well-being in the milieu surrounding it, that its ascent is most likely to be regular and rapid rather than fitful and intermittent"[1] (R.H. Tawney, 1952)

This study aims at establishing the present distribution of primary schools in Bondo Division of SIAYA DISTRICT, KENYA and the resulting variation in use of these educational facilities. This is because it has been noted that the effectiveness and accessibility of educational facilities depend intrinsically on their distribution among the population whom they serve. In turn the distribution of population is a result of long term development based on natural conditions such as precipitation, soil fertility, temperature, topography just to mention a few, and the consequences resulting from them such as the administrative divisions of a coutry.

On the other hand, the distribution of educational facilities is always dictated by the level of socio-economic development, infrastructural development and the ability to both the Government and the community to provide such services to boost the development of human resources. Since development is conceived in terms of providing basic needs so as to raise the standard of living and reduce inequality (disparity) among coutries or regions, for developing countries this implies a desire to develop rural areas for it is here that most of the population is found. It has been estimated that in Kenya about 84.9% of the population is rural based. It is therefore not accidental that the Governemt has programmes for the improvement of the quality of social and other services in the rural areas and the whole country at large.

It has been noted that in the field of education, goals and objectives of the Government with regard to education programmes in the country (for example 8-4-4 education programme) forms part of the themes of current and past

development plans. The 1984-88 development plan[2] recognised that good and relevant education is of direct benefit to individuals, families and the society at large. Based on the above argument, the most important change that came in the last development plan (1984-88) period was the introduction of the new curriculum of the 8-4-4 educational system. The aim was to inculcate in the minds of the youth the idea that educated people do not only aim for white collar jobs.

The 8-4-4 curriculum was designed so that the products of the system could be self-employed. The system has incorporated technical subjects which when well taught, would direct the interest of the school leavers into the rural setting. From a national point of view, a healthy nation with a well integrated educational system will learn more rapidly, work more steadily and productively and manage its tasks more efficiently. Effective educational system, which is well integrated, particularly when technical in nature and directed to the rural areas, contributes significantly to the overall national development as the saying goes "education is the key that unlocks the universe"[3]. These statements clearly underscores the Government's concern in the distribution and variation in use of educational facilities which in turn is determined by other factors to be discussed later in the paper.

In the financial years 1970/71 to 1974/75 the Central Government of Kenya spent an annual average of 25% of its recurrent expenditure on formal education. In 1974/75 financial year this amounted to about K£51.2 million, an increase of about 64% from the 1971/72 recurrent expenditure on education. In the same period, the Central Government spent about 5% of the development expenditure on education[4].

In addition to this public input, there is also private expenditure on education which goes to meet recurrent and development costs. Private expenditure on formal education consists of contributions made by private firms, education trusts co-operatives and individuals. These contributions are usually channelled through voluntary educational agencies, self-help school committees, or through bodies which award bursaries to students or pupils. Contributions of this kind are made to all levels of education and have in the past benefitted both rural and urban communities. In the last ten years or so, private funding of educational development has become an integral and indeed an accepted method of financing expansion of education. In short, private/individual efforts have become a major source of educational initiatives.[5]

This private ihitiatiye in education is particularly noticeable in the countryside where rural communities, through self-help groups are responsible for capital development and maintenance of primary schools as well as self-help secondary schools. For rural primary schools, the Central Government provides teachers, pays their salaries and supplies the basic textbooks. The parents of children attending these schools are required to shoulder the remaining costs of educating their children (this is in line with the recently introduced cost-sharing

policy in education). These costs take the form of school equipment, building and maintaining schools, additional books to supplement the text provided, uniforms and the overall costs of maintaining school compounds.

The main point that needs to be noted, however, is that an enormours amount of public and private resources are being channelled into education.

A number of questions may be raised about this expenditure on education. First, in a situation of scarce resources like we have in Kenya, is it rational to allocate about a quarter of the national recurrent expenditure, and another large proportion of private resources on formal education? Would the Division or coutry at large have a better rate of return if part of this money was invested elsewhere? For instance, in provision of health services which are taking about 7% of recurrent expenditure, or economic services which take an average of 11% annually.[6] Do the rural people stand equal chance of benefitting from such heavy expenditures? Is there any disparity in the distribution of schools? A clear indication of public and private benefits accruing from the present rate of investment in education is needed, and especially in view of the increasing demand among the local communities.

Secondly, if it was to be assumed that the objectives of education in Kenya, and the proportion of national resources utilized thereof is justified and wholly acceptable, it can still be questioned whether these resources are being effectively and efficiently utilized.

The third question and this is the main concern of this paper, is how the benefits of the large expenditures on education are distributed between regions and among social classes in Bondo Division. In this paper the assertion that the structure of educational resources and opportunities reflects the socio-economic structure of the society will be treated rather as a hypothesis to be demonstrated or disapproved, in the course of the study of the socio-economic context of the development of education in Bondo Division of Siaya district Kenya. Tentatively, we argue that the distribution of educational resources and apportunities in a given region does not only affect the structure and the nature of the educational system, but has also a strong bearing on issues such as social mobility, income distribution and physical and social differentiation.

Equality in the field of education must of necessity, therefore be seen within the general context of the quest for a strategy for development that benefits the majority of the people. The failure of the economic growth achieved in the fifties and sixties to have any substantial impact in up-lifting a majority of the third world people who live in poverty, has strongly underlined the need for re-defining development in terms that are distinct and which go beyond economic growth as measured by gross national product (GNP) or average income per capita. The emphasis on development, as evident in literature in this field is now shifting to questions of who benefits from economic growth achieved by a particular country, region or group. In quest for new development strategies, the distribution of basic

human necessities such as food, clothing, shelter, health services, land, educati and political power are becoming important indices of development a particular country, region or social group is making.

We must, however, be aware that while a great deal has been written on the need to re-orient development towards the needs of the poor, and both international aid agencies and national governments have incorporated this thinking in their numerous policy statements, there is still lack of serious commitment to the fundamental changes that a different developmental strategy entails. For instance the World Bank, which in recent policy statements, has taken up this theme, betrayed this ambivalence in its 1974 Education Sector Working Paper where it states:

> ....."the growing realization that equitable income distribution is not an automatic corollary of growth has helped turn attention to a development strategy which is directed to sharing the benefits of growth as well as growth itself..... A major implication is emphasis on mass education to ensure that all receive education and training of some kind as soon as resources permit and to the extent that that course of development requires....."[7]

The gap between what is stated in policy documents and in development plans and what is actually implemented is clearly evident in post-colonial Kenya. This has been shown in a number of recent studies, which we need not review here. However, this study will attempt to demonstrate how commitment to overall equality in the development process has not seriously altered the spatial structure of education in Bondo Division - the author's area of study.

However, it is important to note that several factors attempt to explain the nature and the distribution of educational facilities and the resultant variation in their use. In my opinion, these factors may be summarized and listed as follows

1. Population distribution
2. Income distribution of the people.
3. Church influence.
4. Spatial differential of the physical environment.
5. Infrastructure and so on.

1.2 STATEMENT OF THE RESEARCH PROBLEM:

SIAYA DISTRICT boasts of more schools than pupils to fill them. At the beginning of the year (1989), the district had 568 primary schools with a total enrolment of 187,683 pupils (giving an average of 330 pupils per school), but according to the administration, they are under-enrolled, with most of the people in the area preferring to take their children to well-established schools, mainly outside the district. Within the district, there are local variations in the distribution and use of such educational facilities. Ukwala Division of Siaya

District has the largest number of primary schools and Yala Division the least (see table)

TABLE 1: DISTRIBUTION OF PRIMARY SCHOOLS BY DIVISIONS: 1983-88

	1984	1988
DIVISION	PRIMARY	PRIMARY
Bondo	103	119
Boro	98	107
Yala	86	90
Rarieda	104	112
Ukwala	139	146
TOTAL	530	574

Source: Ministry of Education, Siaya.

Bondo Division has a total of 124 primary schools (by 1989 record) which are unevenly distributed in the division. North Sakwa location has the highest density of schools (about 25 schools per 100 square kilometres) while Yimbo location has the lowest density (about 17 schools per 100 square kilometres). Variations in use is also noticeable in the division, with some schools having their total enrolment of over 400 pupils while others have less than 100 pupils.

From the above observation, this study is an attempt to investigate and analyse the factors influencing the distribution of primary schools and the nature of that distribution in Bondo Division of Siaya District, Kenya. The research is therefore intended to identify the pattern of spatial distribution of educational facilities and the factors which have resulted in that pattern to emerge. The resulting variation in use of such facilities will also be studied with an aim of unearthing where possible the problems experienced by the parents and pupils in their attempt to use the existing facilities. From the above objective, it will be gathered that the research is intended to solve two twin problems namely: the distribution and variation in use of primary schools in the researcher's study area. The simultaneous examination of these two problems is deemed necessary since they are so interrelated that to omit one means an incomplete exercise.

It is important to see how spatial and non-spatial factors influence the distribution and use of educational facilities. In the case of distribution, the focus in on spatial distribution. The influence of factors such as population density, religion, income level, "harambee" contribution and other socially determined factors on educational facilities will be studied.

Variations in the use of educational facilities will be studied using social status, demographic factors, accessibility to a given educational

institution and the cost of education services. Also, in dealing with the issue of use, critical factors such as manpower, and number of educational facilities in a given area will be considered.

1.3 STUDY OBJECTIVES:

The objectives of this study can be summarized as follows:-

1. To determine the primary school facility catchment patterns and the influence of distance travelled on the pupils' facility attendance (i.e pupils' school attendance or use).

2. To determine the existing pattern of distribution and density of educational facilities in the study area.

3. To find out if the distribution of the existing educational facilities (i.e primary schools) is in any way related to the population distribution density and to establish factors influencing their location and also analyse problems inherent in that pattern of location and distribution.

4. To find out whether there is any significant relationship between the differential regional income levels and the density of educational facilities.

5. To determine the factors influencing the use of educational facilities in the study area.

6. And finally, to advance proposals and recommendations for change (improvement) in educational facilities in Bondo Division and even in Siaya District as a whole.

1.4 THE NULL HYPOTHESES TO BE TESTED:

A number of hypotheses will be tested quantitatively in order to establish whether the above mentioned factors influence the patterns currently observed in the Division.

1. Ho: There is no significant relationship between the primary school enrolment and distance travelled from places of residence.
   Hi: Alternative.
2. There is no significant relationship between distance travelled by pupils to educational facilities and time taken.
   Hi: Alternative
3. Ho: The primary schools (educational facilities) are uniformly distributed throughout the study area (i.e Bondo Division)
   Hi: Alternative.
4. Ho: Accessibility does not significantly influence the distribution of primary schools in the study area.
   Hi; Alternative.

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5. Ho: The distribution of primary schools at sub-location, is not related to the distribution of the population of school-age children.
   Hi: Alternative.

6. Ho: There is no significant, relationship between the peoples' level of income and the number of primary schools in each administrative unit.
   Hi: Alternative.

7. Ho: The "Quality of the school does not determine its enrolment. (The word "Quality" in this context refers to the pupils performance in National Examinations).
   Hi: Alternative

In connection with this last hypothsis, the quality is used to imply the CPE/KCPE examination performance in terms of average mark score per school. It is therefore, this quality that will be tested statistically, in the text. It is important to note at this juncture that other qualities which will not be tested though important, include teachers, school buildings, extra-curricula activities, proximity to the local dispensary, market and water supply, and all other attributes that make up a good school.

The researcher is optimistic that during the investigation and testing, other hypotheseswill emerge as subsets of the main ones listed above. These will possibly, reveal spatial factors which have not only created disparity in the distribution of educational facilities but also low and high enrolment where such facilities exist.

1.5 LITERATURE REVIEW

In developing coutries and especially Kenya, education has been at the centre of many considerations, whether this be in the political, social or economic fields. Accordingly the question of school opportunity has received the attention of several scholars and/or researchers. However, since school opportunity is closely associated with societal organization, most of these scholars are mainly from the disciplines of sociology and political science.

According to Gardinier, D.E. (1974)[2], there are wide disparities in education opportunity in state of Equatorial Africa, and this trend is mainly attributed to the wide disparities in socio-economic development in the region. Gardinier also discusses the influence of the differential culture among different tribes which was argued to determine the adoption of modern life. In conclusion, Gardinier says that "the level of school enrolment and opportunity in any region of Equatorial Africa is determined by the socio-economic and cultural background of the people".

Gould, W.T.S. (1972)[3]: In his research on "Patterns of lower School Enrolment in Uganda", Gould concluded that there is high lower primary school

enrolment in the southern parts of Uganda (mainly in and around the major towns such as Kampala, Entebbe etc) as compared to the northern parts of the country. According to Gould, this disparity is due to the fact that there are more lower school facilities in the south than in the north. The question which Gould has failed to answer is: What factors have caused such disparity in the distribution of educational facilities in Uganda.

Gould, W.T.S. (1971)[14], analysed the spatial distribution and the factors influencing the distribution of educational facilities and also the regional education opportunity in Tropical Africa, Gould concluded that there is regional inequality in the distribution of educational facilities and hence variation in their use in the whole of Tropical Africa. The spatial distribution, he says is influenced mainly by the level of socio-economic development of any given region.

The 1970-74, Development Plan[15] reiterates the government's commitment to accelerate the development of education services and allocates increased government capital and recurrent funds for this sector. The plan aimed at the reduction of the problem of rampant illiteracy among the people.

The 1974-78 Development Plan[16], on the other hand, places special emphasis on the development of rural educational facilities for the obvious reasons that the majority of Kenya population (84.9%) is rural based. Staff training to serve rural population is also emphasized.

The 1979-83 Development Plan[17] under the District Focus for Rural Development also emphasized on the development of rural education services as away of eliminating rural-urban inequality in the provision of such services, and for the equal distribution of educational amenities which may in turn facilitate socio-economic development in rural areas.

The 1984-88 Development Plan[18] emphasized the construction of more schools which are well equiped with laboratories, workshops and other facilities suited for the proper implementation of 8-4-4 education system and thereby meet the demand from the continuously increasing numbers of school-age children.

But so far, as the researcher's pilot survey revealed, the above stated government objectives have not been met asthere is wide variations in the distribution and use of school facilities in certain rural reqions such as Bondo Division.

According to Coleman, J.S. (1969)[19] "Every child has a right to receive at least some form of basic education". This statement by Coleman calls for a more equitable distribution of educational amenities so that every child will have access to them with no child being denied the opportunity to use such facilities.

According to Anderson, C.A. (1966)[20], there has been a widening disparity in the distribution of educational amenities among regions in Kenya and this disparity

he says, can be attributed to political, historical and socio-economic factors.

Kinyanjui, K (1973)[21] made an analysis of the distribution of education resources and opportunities in Kenya. He emphasized the fact that there is regional inequality in the distribution and use of educational facilities in Kenya, with some regions being favoured as compared to others. He says that Central province has more schools than any other province in Kenya. He also concluded that urban centres like Nairobi, Mombasa, Nakuru etc have more schcols which are highly developed as compared to their "Deprived" rural counterparts.

Kinyanjui, K (1982)[22]: In his paper entitled, "Regional and Class inequalities in provision of primary education in Kenya", says:

> ...."the purpose of this paper has been first to outline the historical and socio-economic background to the emergence of regional and class inequalities in provision of primary education in Kenya. Secondly, the paper has analysed the existing regional and class inequalities in education..... In essence, the paper has attempted to show the relationship between the development of capitalism in Kenya and the unequal development of education between racial communities, regions and among social classes....." [23]

Kinyanjui concluded that the structure and organization of the educational system in Kenya broadly corresponds to the socio-economic structure of the society. In his conclusion he says:

> "....the development of capitalism based on settlers agriculture affected the spatial development of the country which in turn influenced the pattern of educational development...." [24]

From the above quotations we can conclude that according to Kinyanjui K, (1982), the distribution of educational facilities is mainly influenced by the historical and socio-economic factors.

Getis, A. (1974)[25] also made a geographical study of the distribution pattern of educational facilities and the use ofthe nearest-neighbour analysis. In his work, he analysed the factors influencing the use of such facilities in a given region in Kenya. Acc-ording to him, the variation in use of educational facilities is due to accessibility of such facilities. Getis measured accessibility in terms of physical and cultural barriers and cost (in terms of distance and time) incurred in reaching them.

Khatete D.K.O. (1977)[26], found that there is unequal distribution and attendance of primary schools in Mbita Division of South Nyanza District. According to Khatete, primary school distribution and attendance is influenced by the following three groups of factors: Missionary, population distribution and the physical environment. It must be noted that Khatete did a commendable

work by being the first researcher to do a research of that kind at the micro-level.

1.5.1 AN APPRAISSAL OF THE LITERATURE REVIEW:

Regardless of the approaches adopted by various scholars and/or researchers in examining the factors influencing the distribution and variation in use of educational facilities, the existing literature on this topic suffer various weaknesses; and gaps:

(i) They are mainly descriptive, that is, they are qualitative rather than quantitative. Very little effort is made to make use of inferential statistics despite the fact that we are living in a world of quantitative revolution.

(ii) The existing literature are mainly based on researchers carried out at the macro level (i.e continent and country) and hence there is need for further research on the same topic at the micro level (i.e Division, location, Sub-location and so on) as Kinyanjui (1982) puts it:

> ....The need to go beyond inter-district differences in provision of education and focus on intra-district differences is indicated in the paper, but not fully explored. While intra-district differences have been mentioned in passing, inter-district class inequalities have been discussed. The case of class inequalities in provision of education in urban Kenya has been demonstrated using data from Nairobi schools. In terms of further work, the case of Nairobi demonstrates the usefulness of focusing on intra-district and intra-division differences in provision of education. This attention need not only concentrate on class differences, but can also focus on regional differences within each district and/or division....." [27]

The above quotation calls for further research on the same topic at the micro level.

(iii) As observed elsewhere in this paper, the question of the distribution and variation in use of educational facilities has been mainly confined to the disciplines of sociology and political science. Thus the existing literature in this field is marked by some degree of disciplinary biases.

At present, no research relating to the topic has been carried out in the study area. Thus, no factual contributions of other scholars has been made in this field (in the study area), This study seeks not only to make use of a transdisciplinary approach in dealing with the problem at hand but it also seeks to make use of inferential statistics in data analysis.

1.6 CONCEPTUAL THEORETICAL FRAMEWORK

The figure (model) below is a theoretical framework showing the factors

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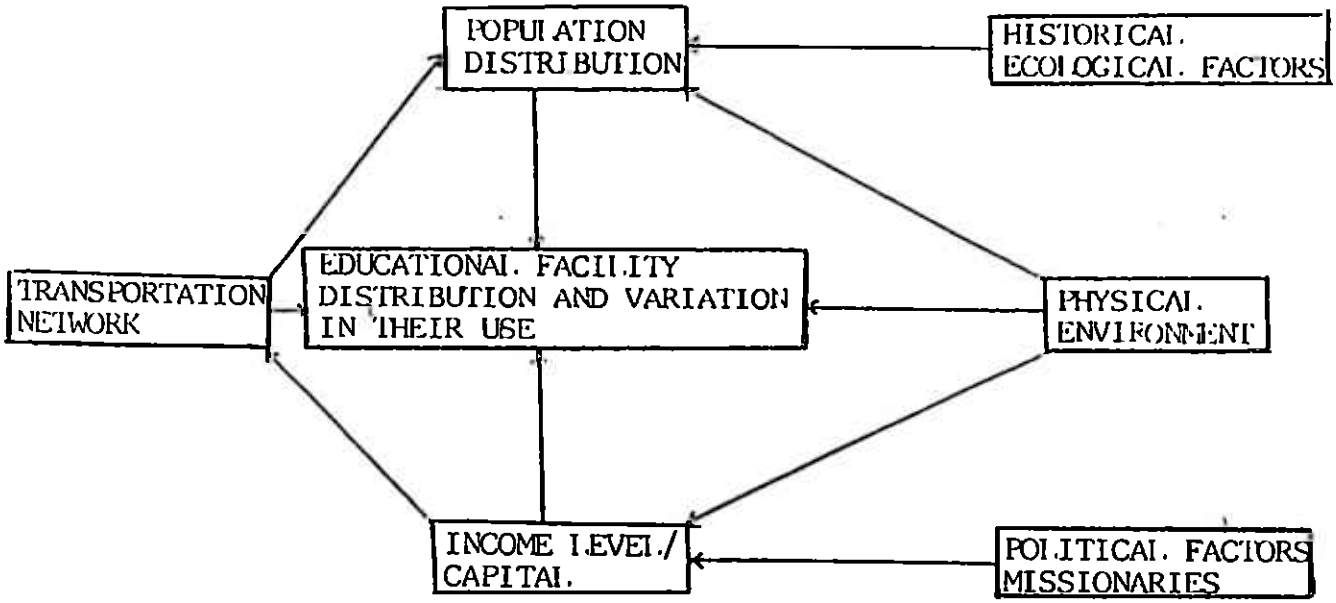
(both human and physical) influencing the distribution of primary schools and variation in their use. The interrelations of these factors are also clearly shown in the model.



SOURCE: Researcher.

1.7 RESEARCH LIMITATIONS:

It is not surprising that in an undertaking of this kind, it is natural that a number of difficulties/limitations have to be encountered by the researcher. Among those faced by the researcher include:

(i) Inadequate background reading material. Very little research and hence literature exists on the factors affecting primary school distribution and variation in their use in a developing country like Kenya. Whatever has been written so far on this subject has tended to embrace a unit larger than a Division or has tended to involve only urban schools.

(ii) This paper does not intend to discuss the appropriateness of the present content of education. We are aware of the criticisms which have been levelled against the content of Kenyan education for being academic and elitist in orientation, but this shall not be dealt with here. It needs to be pointed out however, that equitable distribution of education also means provision of appropriate education that prepares the recipients to participate gainfully in the economy.

(iii) The time allocated for this research was too short and not all the data required could be collected. This meant that the researcher had to cut down on the sample size to 36 schools, that is only 12 schools could be visited in each of the three locations.

(iv) Data from secondary sources was missing in certain cases, and where it was available, it was very unreliable because certain educational facilities fail to send their monthly returns to district (and division) headquarters regularly.

(v) Financial constraints also limited the data collection because those educational facilities located far from the researcher's centre of operation could not be visited more than ones due to high transport costs and in some cases the researcher had to walk long distances to reach some schools which was time consuming and tedious.

(vi) There was also the problem of co-operation from heads of certain primary schools, who made it very difficult to hold interviews with pupils. This at times necessitated visiting some educational facilities a number of times if the head of a certain primary school was not available to grant permission or comments. Certain heads also gave false appointments which never materialised.

(vii) Data collection on the incomes of the people was the most difficult task the researcher experienced as some people gave wrong information about their incomes which they did either intentionally or unknowingly. The researcher had to avoid using wages and salary incomes only as indicators of class position of a person mainly because of the process which is common in Kenya of straddling between permanent employment and private enterprise. This means that a person may be earning an income from permanent employment, while also employing labour in a private enterprise. This makes it difficult to determine his class position solely on the basis of employment.

(viii) Lastly, we intend to limit ourselves to the discussion of primary education, thereby leaving out pre-school, secondary and post-secondary education.

Nevertheless, the researcher believes that his pioneering work will in future, provide a useful avenue of research by geographers and those in allied disciplines.

1.8 JUSTIFICATION AND SCOPE OF THE STUDY

The significance of this study can best be illustrated by offering an overview of the problems that afflict the rural areas as far as living standards and the provision of educational facilities are concerned. There is every need to improve the quality and quantity of rural educational facilities to meet the prevailing demand and thereby contribute to an improvement of the quality of life in rural areas. This is a significant contribution in the development of this country. Accessibility is also critical to the improvement of rural educational facilities. In the past, haphazard or spontaneous and unco-ordinated harambee school constructions resulted in imbalance of the educational facilities available in many parts of Kenya, but it is important to note that to do such a study at the macro level (i.e country) is rather parochial and does not reveal

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the situation at the micro level (i.e Division, location, sub-location).

On the use of educational facilities, it is important to find out what people consider important in these facilities. This can give an overview to the problems they experience in the use of the existing educational facilities and what they think can be done. Thus, it is significant that the study should identify these shortcomings for future rectification.

It is often stated that it is a right of every child to receive at least some form of basic education. But the concept of basic education varies from country to country and also from time to time depending on the definition attached to it. It also depends on the financial and the overall level of development of aparticular coutry or region.

In Kenya, the facilities which enable every child to acquire primary education, which we shall refer to here as basic education, are normally provided by the government. Indeed, this is an attempt to make primary education universal throughout the country.

On the realization of the meagre financial resources, the Kenya Government has, since independence, accepted to raise funds on harambee basis and this forms part of educational policy (mainly for the expansion of educational facilities to meet the requirement of the increasing number of school-age children). But this spirit of raising funds on harambee basis has several loopholes, one of which being the widespread regional inequality in terms of the distribution and use of educational facilities. For instance, those areas with stronger economic and political power still continue to have more and better school facilities than their contrasting counterparts. Consequently, there has been a widening disparity in the distribution and use of education amenities among regions and even among small administrative units such as Division and locations in Kenya.

As a next step towards the achievement of universal education, the Kenya Government in 1974, offered free education from standard I to IV and in 1979, free education was offered from standard I to VII. But free education decree of 1974 and 1979 also had several loopholes. By the time they were declared, the teaching force throughout the whole country was still inadequate and, in fact this has led to serious regional disparities in the quality of education received. The urban areas and those areas where there were many jobless school leavers managed to gain to the greatest disadvantage of the "depprived" rural areas where the recruitment was substandard. But it is important to note that this is a world-wide problem.

In any case, the above mentioned chain of actions and others not included here indicate the realization, on the part of the Government that basic education is necessary for national development as it is one of the ways for developing human resources. This, then means that, under ideal conditions (i.e. conditions

where school facilities are well distributed, easily accessible and in close proximity to the users etc, every child of school-age should have a desire or urge to be educated. However, it is likely that the urge to be educated will be stronger in the urban areas than in their rural counterparts.

Thus, the provision of educational facilities plays an important role in both the learning and planning processes, especially in a developing country such as Kenya, where there are meagre financial resources. It is also important to note that inspite of the awareness which most Kenyans now have about the value of education, there are certain constraints which limit the successful implementation of their objectives. Some of these constraints may be physical, socio-economic, political, religious etc. All have worked either singly or in combination to have the objectives unrealized. But it is important to note that these constraints vary from place to place, from time to time and also from individual to individual so that they have created variations in the distribution and attendance of primary schools.

It is, therefore important that a geographical investigation and analysis be employed in this research so that we may be able to find out the factors which might have led to the existing spatial distribution of primary schools in Bondo Division. Furthermore, through the same approach, it will also be possible to find out the reasons for the variation in use of the existing educational facilities. During the researcher's pilot survey, it was found that there is a wide variation in use of primary schools as some facilities seemed to be overutilized while others are underutilized.

It should be noted that although this study will be limited to the administrative area of Bondo Division, use of educational facilities in the study area goes beyond the study area because some education institutions have a catchment area going beyond such boundaries.

It is hoped that a number of factors ranging from physical to human and a host of others which affect primary school distribution and variation in their use will be identified during the course of statistical analysis after testing several hypotheses. However, only the most outstanding and important factors will be dealt with.

1.9 OPERATIONAL DEFINITIONS:

Schools: refer to primary schools, standards one to eight.

Educational facilities: refer to primary schools and other learning facilities used by the pupils at the primary school level.

School opportunities: refer to chances of getting into primary schools for a given population or a section thereof.

Educational inequality: refers to the regional disparities in the provision of education i.e interlocation and intra-location disparities. It is used in this context to mean unequal distribution of educational facilities in the study area.

Class: refers to a group of people of more or less the same income level in this context, we can also define class in terms of the position or location of an individual in the process of production, and in the disposal control and sharing of the products of production and also considering wage and salary incomes.

Income: refers to the average monetary monthly earning from wage, salary and other sources.

School quality: refers to the pupils' performance in National Examinations (i.e C.P.E./K.C.P.E.) as indicated by the average mark score per school.

Accessibility: in this context accessibility refers to the location of primary schools in relation to the nearest main road in the region.

CHAPTER 2

2.0 BACKGROUND OF STUDY AREA

2.1 INTRODUCTION:

"..... Regions, owing to their location and physical character seem to have implied certain models of life. But between the physical land-scape and economic response, there exists always man, with his particular abilities, desires and caprice..... which together determine the level of any kind of development in the given region".[28]

This chapter has two main aims: the first is to examine the geographical location, the physical character and human background of the study area in an attempt to grasp or understand the nature and the general spatial structure of socio-economic development characteristic of the study area(i.e Bondo Division). The second is to examine all the natural resources and the existing infrastructure (mainly transport network) of the study area.

It is hoped that an integrated analysis of this kind will certainly give some insight into the geographical factors which influence the distribution and variation in the use of educational facilities which is the sole theme of this paper. Emphasis is put on the major demographic and social features, infrastructure and other natural resources which are thought to be of crucial importance with respect to our research objectives.

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2.2 LOCATION, EXTENT AND SIZE:

Bondo is located within the western side of Kenya, towards the eastern end of Lake Victoria (see figure 1a/1b). Bondo Division borders Boro Division in the North with River Yala being the natural boundary. The Bunyala Region in the Western Province is in the north-eastern side of the division and in the East is the sister division of Rarieda which was splitted from the former giant division by the Presidential Commission for Boundary changes.

To the South and South-West, the area is bounded by Lake Victoria (which form an important transport system and fishing ground which benefits mainly the local people as well as supplying the national and international markets).

The Division is located approximately within latitudes 0°13' S and 0°18' N and longitudes 33° 58' E and 34° 33' E, which enclose Siaya District. It is almost bisected by longitude 34° 10' E.[29]

With an area of 574 KM² Bondo Division covers approximately 16% of Siaya District.

2.3 ADMINISTRATIVE AND POLITICAL UNITS

Bondo Division has its headquarters at Bondo Rural Centre. Initially, the division had 3 locations, with a total of 14 sub-locations. The division is headed by a District Officer. The locations and sub-locations are headed by Chiefs and sub-chiefs respectively.

TABLE 2: ADMINISTRATIVE UNITS IN BONDO DIVISION (UPTO 1988)

DIVISION	LOCATION	SUB-LOCATION	AREA (IN KM^2)
Bondo	South Sakwa	Migwena	54
		Nyaguda	49
		Nyang'oma	81
		Bar-Kowino	41
	North Sakwa	Abom	27
		Ajigo	24
		Maranda	70
		Nyawita	38
		Bondo T.C.	0

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Fig. 1a : A GEOGRAPHICAL POSITION OF BONDO DIVISION

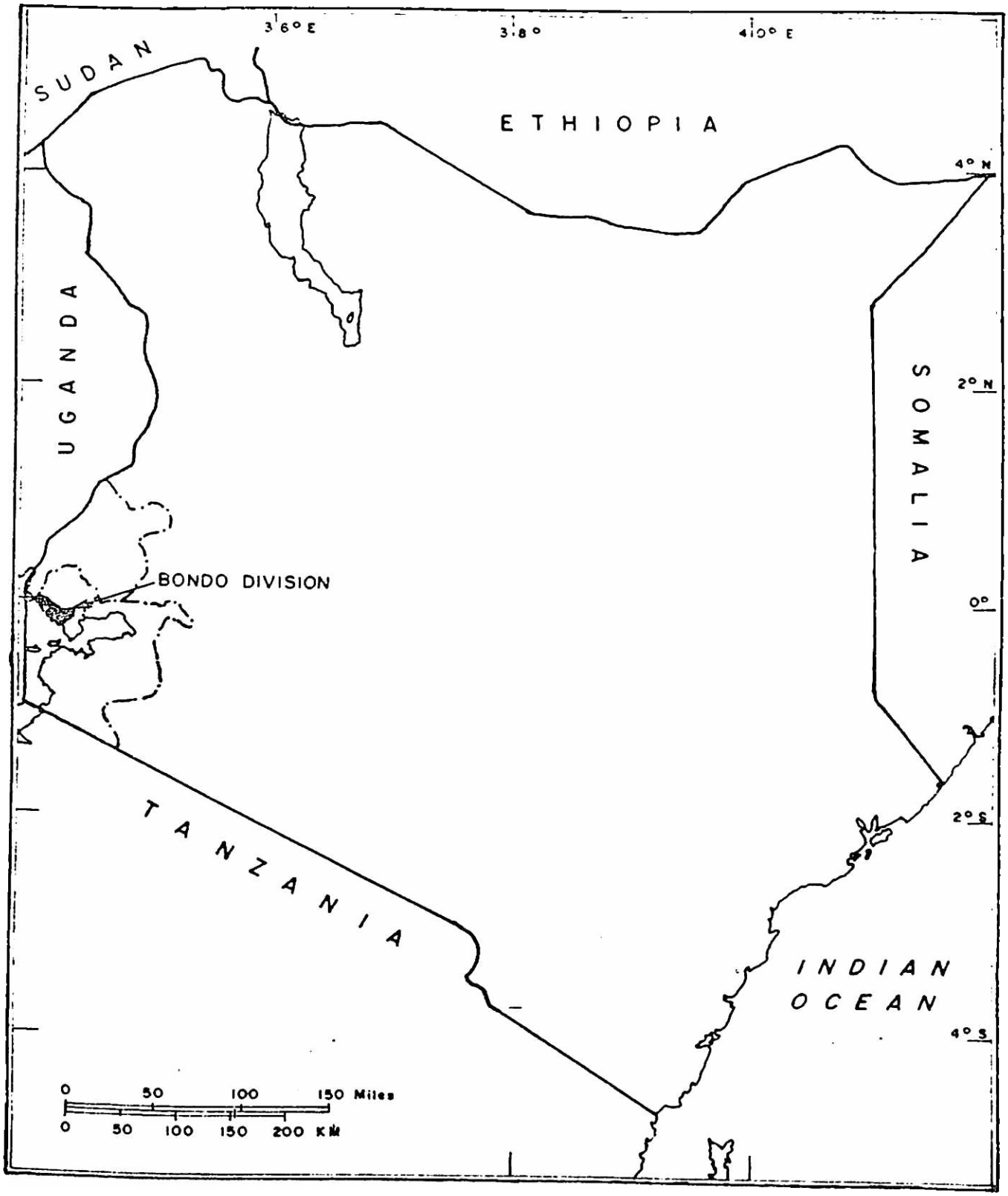
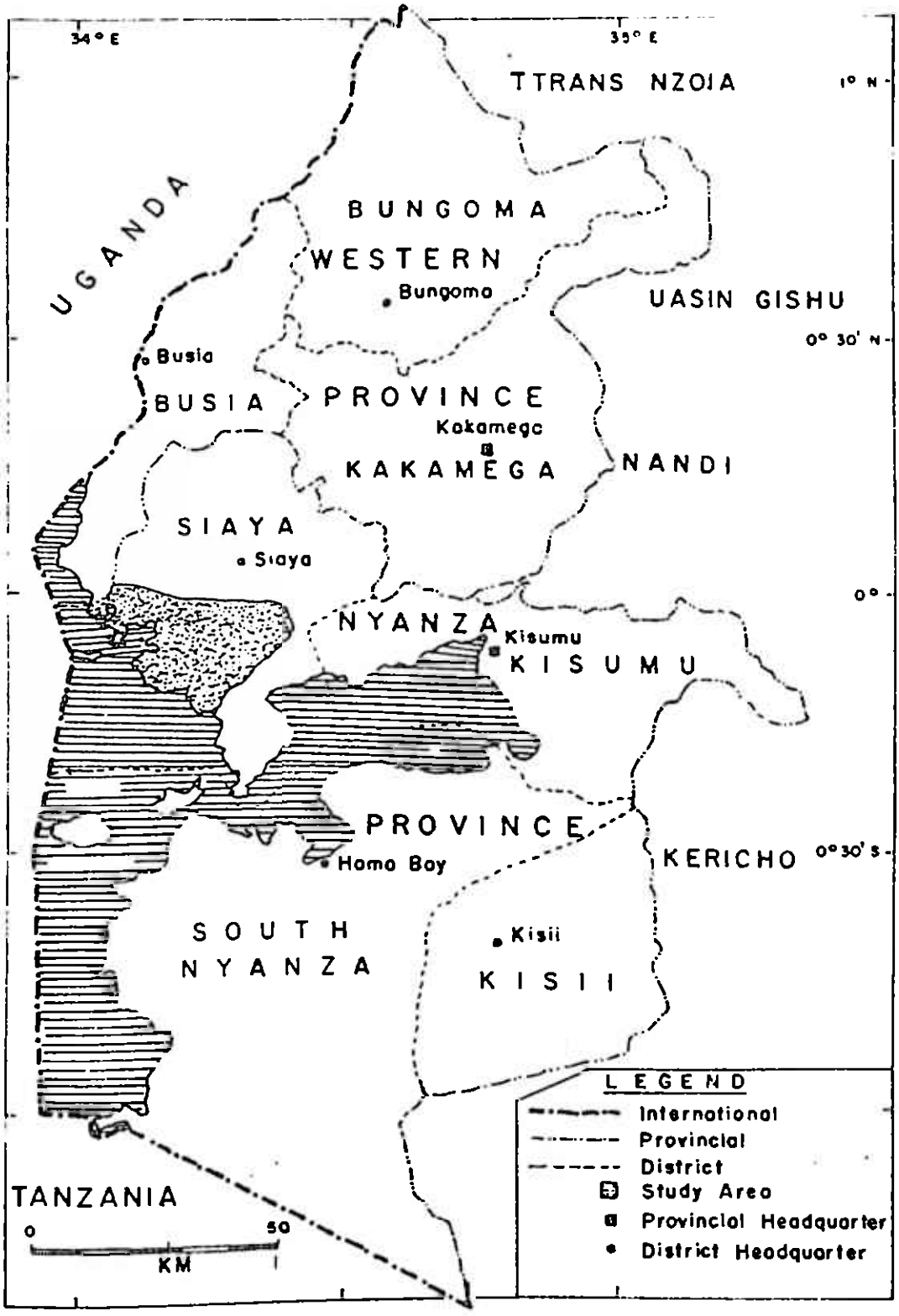


Fig. 1.1 : THE LOCATION OF BONDO DIVISION IN WEST KENYA



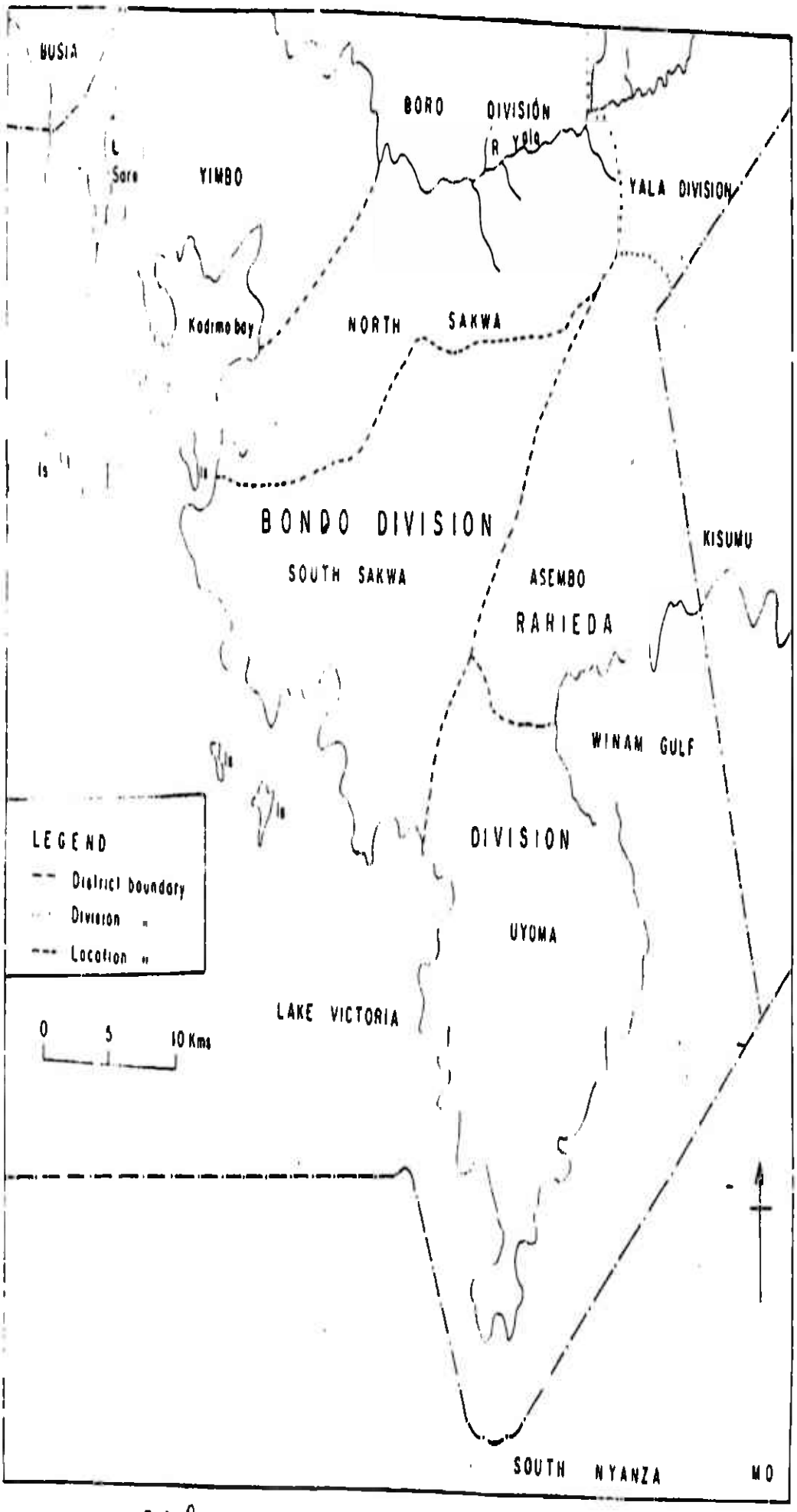


FIG 2 THE LOCATIONS OF BONDO DIVISION

DIVISION	LOCATION	SUB-LOCATION	AREA (IN KM^2)
Bondo	Yimbo	Nyamonye	103
		usigu	47
		Usenge	18
		Got Agulu	11
		Mageta Island	7
TOTAL	3	14	574

Source: Central Bureau of Statistics, "Kenya Population Census 1979 Volume 1"

2.3.1 NEW POLITICAL DIVISION:

The Division which is a constituency of its own is currently having seven locations with twenty two sub-locations altogether. The locations are North, West South and Central Sakwa, East, Central and West Yimbo (see table 3).

Table 3: Current Administrative Units

DIVISION	LOCATION	SUB-LOCATIONS
Bondo	North Sakwa	3
	South Sakwa	4
	West Sakwa	3
	Central Sakwa	3
	East Yimbo	3
	West Yimbo	3
	Central Yimbo	3
TOTAL	7	22

Source: District Commissioner's Office, Siaya District.

Table 4: Current Political Units

Constituency/Council	Ward
Bondo Constituency	East Yimbo
	Central Yimbo
	West Yimbo
	Central Sakwa
	South Sakwa
	West Sakwa
	North Sakwa
Bondo Urban Council	Bar-Kowino East
	Bar-Kowino West
	Nyawita East

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	Nyawita West Ajigo Bondo Town
TOTAL	13

2.4 PHYSIOGRAPHY AND DRAINAGE:

.4.1 PHYSIOGRAPHY

Bondo Division covers that part of the district lying below 915m above sea level, forming about 16% of the Districts total area. The area lies within the Nyanza Low Plateau with a gently but obvious slope towards lake Victoria which shows that structurally it is part of the down-warped lake Victoria Basin. The ferrain of the study area is fairly flat but is interrupted in some places by an abrupt rise in altitude by Serawongo, Got Abiero, Utonga, Usenge and Abom Hills which are spatially scattered over the landscape.

To the west, the study area partly lies within the Nyanza lowlands. This is a relatively minor region. It is a low lying swampy tract of land which is very much prone to flooding and embraces the River Yala lowlands which forms a natural boundary between Bondo Division and Busia District to the West and covers the western parts of Yimbo location.

The lakeshore is very much indented forming minor bays and headlands (for example, Nyamonye Bay, Iwanda Konyimbo Bay, Shinyanya Bay, Utonga headland, Riskis headland, etc) which in turn form the major fishing grounds in the area. Terraces, raised beeches and gravel deposits are also common along the lakeshore.

THE PHYSICAL FEATURES IN RELATION TO ECONOMIC ACTIVITIES CARRIED OUT AT THE MICRO LEVEL.

A critical analysis of the general layout of physiography outlined above indicates that Bondo Division is having the following notable physical features which determine the type of farming activity to be carried out and hence the general development of the area which in turn influences the distribution and variation in use of educational facilities. We therefore divide Bondo Division into three major physiographic regions namely:

1. The Highland regions
2. The Middle land, and
3. The lakeshore lowland.

THE HIGHLAND REGIONS

These are areas which form a continuous belt along the River Yala from the Abom Hills in North Sakwa to Ramogi Hills in Central Yimbo location.

The high altitude (about 1250m) in these regions provide the cool temperature suitable for the formation of the convectional rain which usually occur in late

afternoons in most cases. The hot-wet climate of these places provide room for mixed farming where a variety of livestock raising range from bee-keeping, goats, cattle andpoultry farming.

The other highland regions lie centrally in the division and also in the South-Western tip. These comprise Odiando, Abiero and Serawongo Hills. Due to the insufficient rain in these regions, the farmers are the small scale group who dwell much in cattle raising, goats are the major animals raised since there is plenty of wild plants that they feed on.

THE MIDDLE LAND:

This forms a wide plateau which stretches centrally from the border with Rarieda Division to Usenge Region in the Western side of the lakeshore.

Arable farming dominate farming activity practised by most inhabitants. This is the only alternative due to the fact that most farmers fail to cultivate their land in good time and therefore miss to tap the February rain which is the cornerstone to successful harvesting here.

The crops grown include maize, millet, cassava, vegetables, all of which are grown by small holders.

THE LAKESHORE LOWLANDS:

The lakeshore has a narrow belt of land rather flat in most places. This is occasionally cut by the mouths of seasonal streams which rise from the middle lands.

Mixed farming is highly practised in these region. The wet lands along the lakeshore facilitate irrigation for growing a variety of vegetables which are readily marketed locally. Fishing forms the major economic activity in the region.

NOTE: This physiographic distribution is important and indeed fundamental at the landscape ecology (that is the combined physical and human landscape) in the above named three regions contrast sharply. Generally lowland Bondo is largely a negative environment which presents exciting development challenges. These physical features have a bearing to the division's development potential. Areas with higher altitude and therefore higher rainfall have a higher potential for both agricultural and livestock production. River Yala as well as lake Victoria have high potential for irrigation activities and fishing. Where the altitude is low (as in most parts of South Sakwa and Yimbo location) and hence low rainfall, drought resistant crops have better prospects. The Yala swamp once fully reclaimed, can add to food and cash crop productivity.

Thus these physical features determine the development potential and hence the income level of the local community which in turn may possibly be reflected in the distribution and variation in use of the existing educational facilities in any given region as we shall see in the next Chapters.

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.4.2 DRAINAGE:

With the exception of River Yala which forms the natural boundary between the study area and Busia District, no major river dissects the study area. River Yala drains south-westwards and enter Lake Victoria through the Yala Swamp. There are other small rivers and streams which are of local significance draining either directly into Lake Victoria or being mere tributaries of the much larger river cited earlier (i.e River Yala).

Many streams in the region amount to more gullies draining flood water into the Nyanza Gulf during the rainy periods, and they hardly hold water for more than five months. The seasonal streams that drain into this section of the Nyanza Gulf are essentially parallel streams on the slopes formed by circular or elongated low hills.

It is important to note that most parts of the division are not susceptible to seasonal flooding except areas in the vicinity of Yala River and other localized spots. Thus, generally good drainage is a major feature of Bondo area.

!.5 GEOLOGY AND SOILS

3.1 GEOLOGY:

The geology of the study area like that of the whole district, is dominated by rocks of the Nyanzian and Kavirondian systems, the Nyanzian being the main rock type. These rock systems are pre -cambrian rock formations estimated to be approximately 670 million years old. The two rock systems are treated together because they occur in close juxtaposition and because they have a number of other similarities. 30

NYANZIAN SYSTEM: These rocks consists of great thicknesses of various types of ancient volcanic materials in which basalts, tufts, trachytes, andesites, rhyolites and grey-wacke are very common. The volcanics were inter-bedded with a number of coarse-grained sediments such as conglomerates, quartzites and bandedironstones. The whole system was later intensely altered during archaean times by heat rising from greater depths (thermal metamorphism) and during these processes mineral belts were interjected in association with other instrusions. 31

KAVIRONDIAN SYSTEM: Indications are that these rocks are younger than and may in fact be sedimentary derivatives of the Nyanzian system. Lithologically, they consist of alternating bands of sandstones, grits and mudstones with waterlain conglomerates. 32

It is important to note that relatively little research has been done on these rocks. Their advanced age, their complicated deformations and contortions and their highly altered nature due to both thermal (heat) and metasomatic (chemical) metamorphism have meant that to study these rocks is an extremely difficult task. The Nyanzian system rocks are thus the oldest rocks not only in Bondo but also in Kenya as a whole. They are commonly dated as lower pre-cambrian. 33

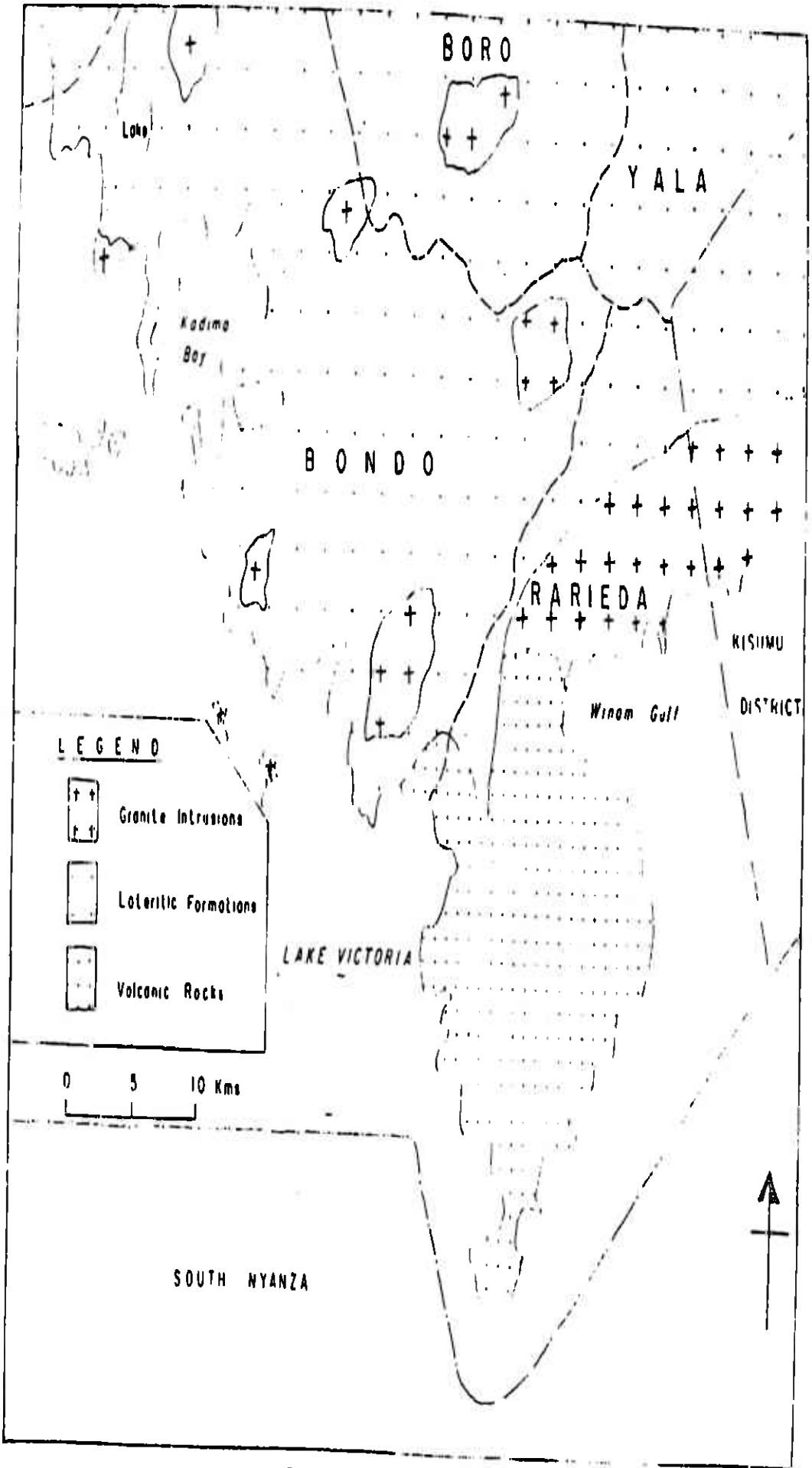


FIG : GEOLOGICAL MAP

The rocks derived from these two systems (i.e mainly from Nyanzian system and partly from Kavirondian system) are of great economic potential as can be seen in table 5 below.

TABLE 5: ECONOMIC USES OF THE EXISTING ROCKS IN BONDO DIVISION

SYSTEMS	REPRESENTATIVE ROCKS	TECTONIC EVENTS	MAIN ECONOMIC USES (AFTER PULFREY, 1960)
Karirondian	Arenaceous and argillaceous sediments. Conglomerates, hornblende, andesites, etc.	Metamorphism with isoclinal folding with N.E. and S.E. trending areas. Granites Syenites and dolerites intruded.	Gold, Silver
Nyanzian	Sandstones, conglomerates, quartzites, phyllites, limestones, pelites volcanics and ironstones.	Slight metamo-ophism of Ablum and Embu Serities Granites epidiorites, Gabbros.	Gold, Copper, Zinc. Chromite, Cobalt, Silver Corundum and other other minor minerals.

Source: Ojany, F.F. and Ogendo, A.B. (1988): Kenya, a study in physical and human geopgraphy, longman.

.5.2 SOILS: SOIL DISTRIBUTION, FERTILITY AND MAJOR CHARACTERISTICS

The land is mainly a peneplain and slopes very gently from east to west. Dominant soils are soils on lower-level uplands (172U, 174U). Some of the upland soils are moderately deep. Inselbergs have shallow soils.

In the middle parts of the division (mainly in Sakwa) a variety of soils occur in the valley bottoms (383V). These soils are mainly poorly drained, often mottled and subject to flooding.

Along the Yala River, young alluvial soils are found. They usually vary greatly in texture and colour over short distances, but may have a relatively high natural fertility (368P1).

Below is a summary of soil types and their characteristics.[34]

SOILS ON HILLS AND MINOR SCARPS

Soils veveloped on undifferentiated Basement system rocks, predominantly gneisses:

27H = Complex of excessively drained to well drained, shallow, dark red to brown, friable, sandy clay loam to clay; in may places rocky, bouldery and stony and in places with acid humic topsoil (dystric REGOSOLS; with LITHOSOLS, humic CAMBISOLS lithiophase and rock outcrops).

SOILS ON LOWER-LEVEL UPLANS

Soils developed on intermediate igneous rocks (andesites, etc)

172U = Well drained, moderately deep to deep, dark reddish brown, friable clay, in many places over petro-plinthite (chromic LUVISOLS, partly petroterric phase; with "murram cuirass" soils).

174U = Association of:

(i) Well drained to moderately well drained, shallow soils over petro-plinthite (about 50%); on interfluves ("murram chirass" soils).

(ii) Well drained, very deep, dark reddish brown to strong brown, friable clay, on valley sides (dustric/eturic NITOSOLS and orthic FERRALSOLS).

Soils developed on acid igneous rocks:

178U = Well to moderately well drained, shallow, dark reddish brown, stony to gravelly clay over petroplinthite; in places moderately deep to deep ("murram cuirass" soils (80%); with ferralo-chromic ACRISOLS).

Soils developed on granites:

179U = Complex of:

(i) Well drained, moderately deep to very deep, reddish brown to yellowish brown, friable clay, over petroplinthite (orthic FERRALSOLS, partly petreferric phase; with orthic ACRISOLS.

(ii) Moderately well drained, shallow, brown to dark brown soils over petroplinthite (about 30%) ("murram cuirass" soils).

SOILS ON SWAMPS

370s = Very poorly drained, very deep, very dark grey to black, firm, cracking clay, with acid humic topsoil (seasonal swamps) (humic GLEYSOLS).

371s = Very poorly drained, very deep, dark grey to balck, firm clay, with acid humic topsoil; in many places peaty (permanent swamps) (humic GLEYSOLS and dystric HISTOSOLS).

SOILS IN MINOR VALLEYS

383V = Complex of well drained to poorly drained, deep dark reddish brown to black, firm silty clay to clay; in places colcareous and/or cracking.

In summary, we can say that the major soils in Bondo Division are orthic ferralsols and vertoluvic phaeozones (black cotton soils). Much of the land is plain and slopes gently from the east to the west. Much of the soils are developed on granite and mudstones. These soils tend to be well drained, very deep, dark red

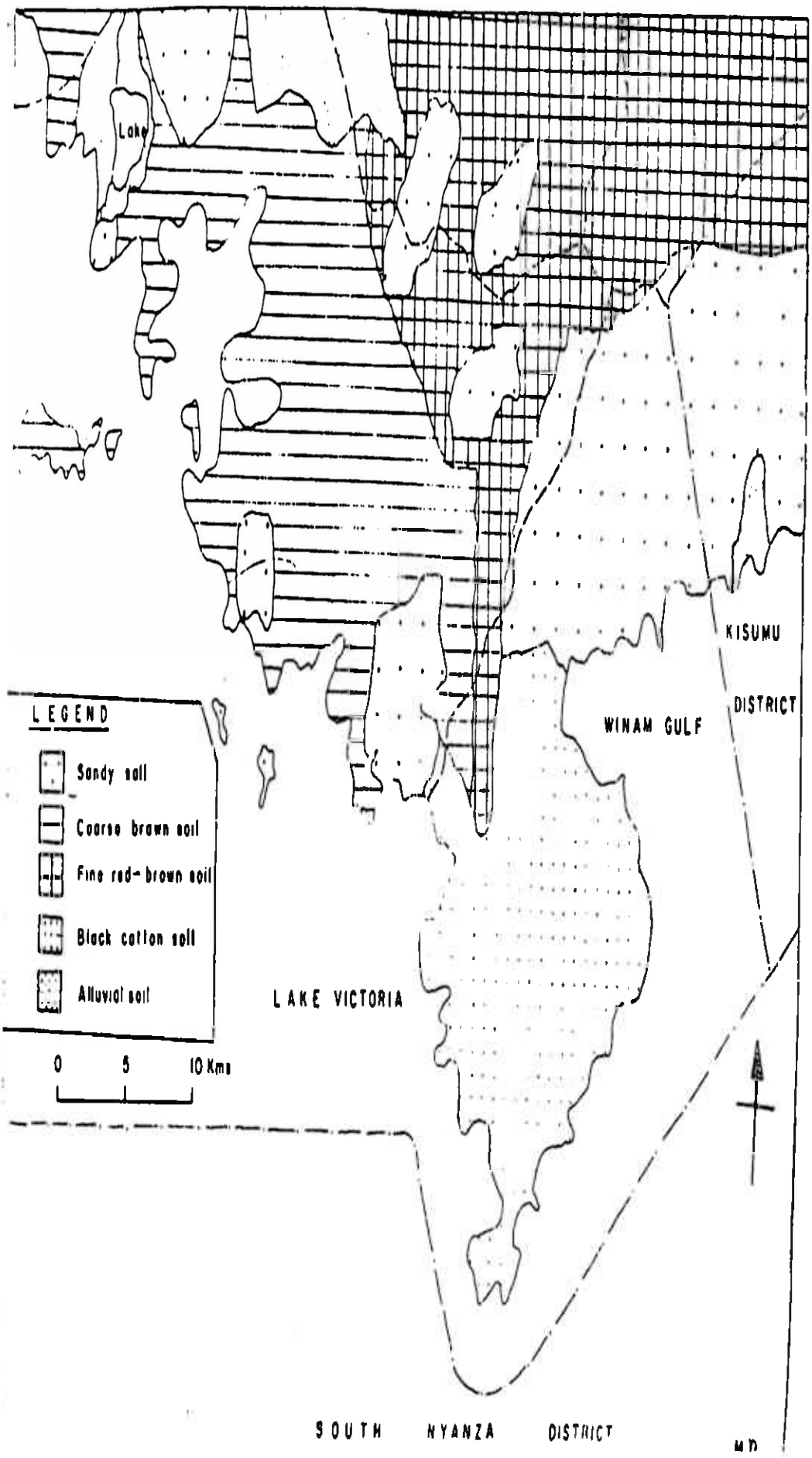
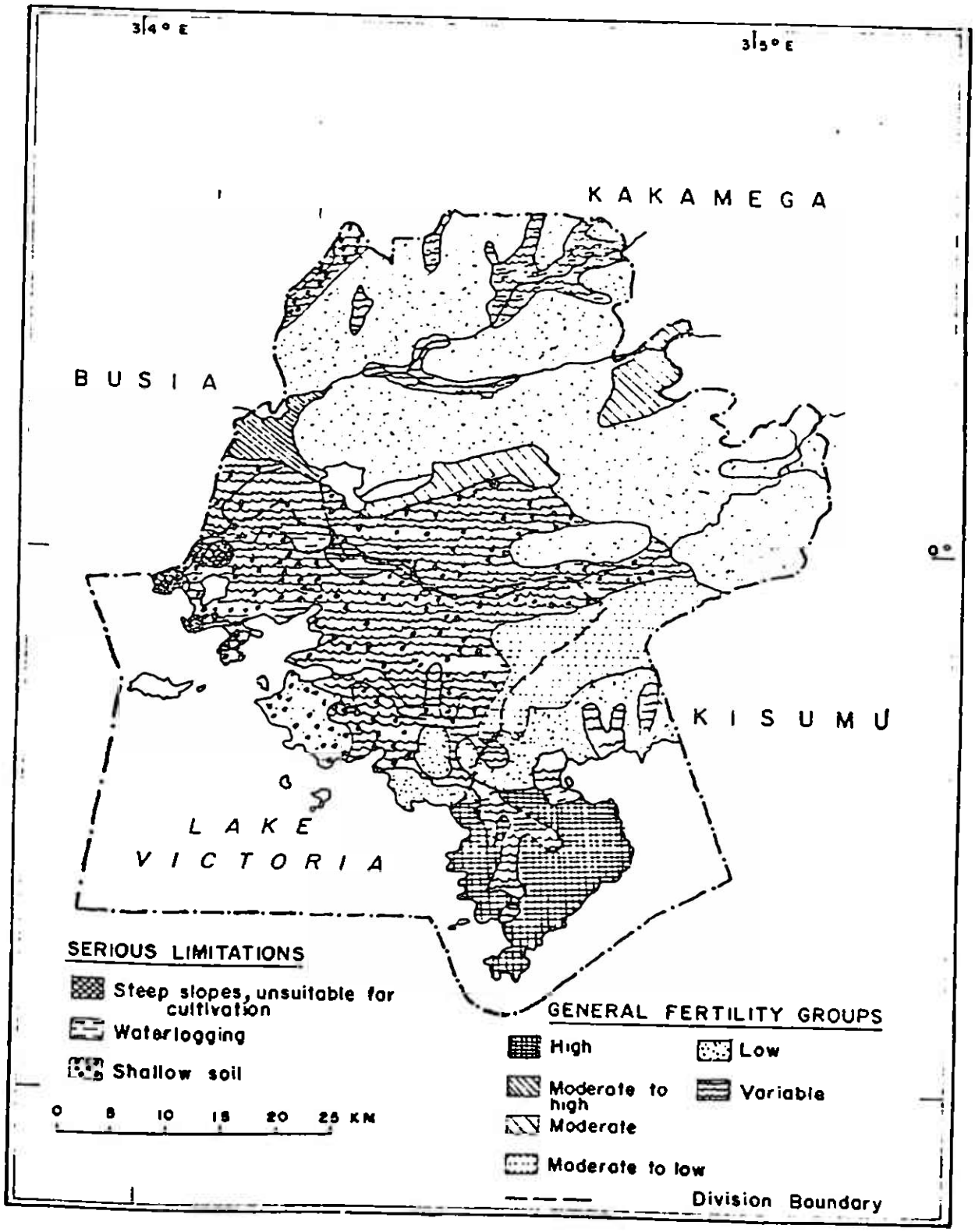

Lake
KISUMU
DISTRICT
WINAM GULF
LEGEND
Sandy soil
Coarse brown soil
Fine red-brown soil
Black cotton soil
Alluvial soil
LAKE VICTORIA
0 5 10 Kms
SOUTH NYANZA DISTRICT

Fig. : SOILS



Source: Farm Managment Handbook of Kenya Vol II by Jaetzold and Schmidt

to yellowish red friable to firm, sandy clay to clay with acid humic top soil. The fertility of these soils is moderate to low but with modern farming technology quite a number of crops, like maize, sugar cane, coffee, millet, beans etc can be grown. The narrow lakeshore flats are covered by lacustrine sand and sandy clay.

The distribution of the above soil types are illustrated in figure 4 and 5.

2.6 CLIMATE:

In Bondo, as in the whole Kenya and any other East African countries, ;the systematic collection of all weather data is done by the East African Meteorological Department. This is one of the major scientific organisations of the East African Community and was first established in 1929 although the measuring of rainfall had been started in Mombasa back in 1891. Since agriculture plays a dominant part in Bondo economy a thorough understanding of climatic characteriestic and variations is of the utmost importance.

The study area experiences the modified equatorial climate of the Lake Victoria basin. The climate is thus considerably affected by humid westerly air stream coming across Lake Victoria from the Zaire. Here also, modifications result from relief and the influence of this body of water.

Although there is no really dry month, rainfall totals in the region show considerable variations and are, in any case, much,

TABLE 6: MEAN ANNUAL RAINFALL FIGURES IN MM

	YEAR					
MONTH	1983	1985	1986	1987	1988	AVERAGE
JANUARY	16.30	92.50	35.20	17.60	56.80	43.68
FEBRUARY	37.60	26.60	18.10	38.30	118.90	47.90
MARCH	44.60	100.70	125.50	117.00	50.10	87.58
APRIL	53.00	147.20	184.60	317.00	76.40	155.64
MAY	183.30	85.70	79.00	49.90	214.70	122.52
JUNE	50.30	123.80	26.00	105.90	84.40	78.08
JULY	115.60	53.40	26.00	66.00	37.70	59.78
AUGUST	25.00	91.80	7.00	19.00	55.30	39.62
SEPTEMBER	181.30	51.10	NIL	55.30	120.80	81.83
OCTOBER	40.80	71.60	38.60	33.50	58.80	48.66
NOVEMBER	222.80	137.20	64.90	23.40	78.10	106.28
DECEMBER	153.93	56.25	45.50	20.80	107.00	76.70
TOTAL	1124.53	1037.90	624.40	869.55	1059.00	948.27

Source: Ministry of Agriculture, Bondo.

lower than in a typical equatorial climate.

2.6.1 RAINFALL

This part of the Lakeshore suffers from a rather irregular rainfall that ranges from 750 mm to 1000 mm[35]. Though the rainfall pattern is characterized by great variation between one year and another it is clear that the pattern is influenced by proximity to the lake. The year to year rainfall variation is so great that drought has become a serious possibility that occdurs all too frequently. Monthly rainfall also varies considerably from year to year and the highest coefficient of variation is found for the months January to April and May (i.e. the rainfall can be most surely predicted for April and May).

The rainfall generally occurs as local showers or storms caused by convection aided by topography. These storms occur mostly in the afternoon. However, since this area is located in the immediate lakeshore where the day temperatures are lower (due to the cooling effect of the lake), storms occur also in the early morning when the land has cooled and convention takes place over the relatively warmer lake.

In general, the rainfall in the area may be termed as bimodal. The long rains occur from March to May while short rains come between September and November. However, the short rainy season is too short to adequately support crop cultivation so that for all intents and purposes, there is only one season in Bondo (i.e the long rain season).

There is marked drought (which occasionally result in late planting and high animal mortality) in January and February. Between March and May, there is adequate rainfall which is more or less unevenly distributed in the region, but the rain diminishes from June onwards.

It is important to note that rainfall distributioin and amounts in the division are highly influenced by the altitude and wind direction. The division is relatively dry in the southern and south-western parts near the lakeshore (covering most parts of Yimbo and South Sakwa locations) where the altitude is low, but tends to be wet about 10 Km. in the the hinterland with many transitions in between as the altitude increases.

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TABLE:7: RAINFALL FIGURES FROM VARIOUS STATIONS

having at least 10 years of records up to 1976.

NO. AND ALTITUDE	NAME OF STATION	YEARS OF REC.	KIND OF REC.	ANNUAL RAINF. MM	Monthly rainfall in mm. JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
9034021	Usigu	32	Average	864	38	58	105	164	137	41	35	41	33	48	86	76
1234M	Disp		60% prob[1]	727	3	16	66	136	88	14	12	24	18	23	47	53
9034036	Bondo	28	Average	1106	40	57	107	182	135	67	51	83	88	104	108	86
1219M	Water Supply		60% prob[1]	996	13	46	85	174	133	49	39	55	68	96	89	63

1) These figures of rainfall reliability should be exceeded normally in 6 out of 10 years

Source: Jaetzold, R. and Schmidt, H. (1982): Farm Management Handbook of Kenya, Vol.II/A

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.6.2 TEMPERATURE Though elsewhere in the country, height and aspect are the two main factors which exert the greatest influence on temperature, the influence of Lake Victoria is more important in the study area. But below 152m above sea level and around Lake Victoria the influence of land and sea breezes is more important than any other factor. The cooling effect of Lake breeze reduces maximum temperatures. The mean monthly temperatures vary by about 1.5°C between the lowest and the highest. The annual temperature variations are equally limited, the mean monthly differences being less than 3°C. The mean maximum temperature is about 28.5°C while the mean minimum temperature is as low as 15.9°C giving a total average of 22.4°C.

The variations in temperature are well correlated with the movements of the sun. The lowest mean monthly temperatures occur in July and January when the sun is respectively further North and South. The highest mean monthly temperatures occur in March and October just before the arrival of the rains.

Diurnal changes in temperature is less due to the cool lake breeze reducing the maximum temperature. In the absence of rain, the temperatures exhibit very remarkable scorching effect and often render the ground devoid of grass within a short period.

TABLE 8: AVERAGE RAINFALL, TEMPERATURE, HUMIDITY AND WIND SPEED IN THE STUDY AREA

TABLE 8 : AVERAGE RAINFALL, TEMPERATURE, HUMIDITY AND WIND SPEED IN THE STUDY AREA

MONTHS CLIMATIC VARIABLES	J	F	M	A	M	J	J	A	S	O	N	D	AVERAGE TOTAL
RAINFALL (IN MM)	19	67	195	191	125	33	17	35	30	35	90	28	865 mm
TEMPERATURE (°C)	22.3	23.7	23.2	23.1	22.0	21.0	21.0	22.0	22.0	23.0	23.0	22.0	22.4
RELATIVE HUMIDITY (%)	68.1	68.1	75.0	81.0	80.0	80.0	78.0	76.0	71.0	69.3	69.1	69.0	73.7
WIND (KM/HR)	3.7	4.2	3.8	3.2	2.7	2.0	3.1	3.2	3.6	3.6	2.5	3.1	3.2

Source: Meteorological Observation Records (1969-79) Usigu Meteorological Station

As noted earlier, temperature varies with the altitude rising from 21°C in the north-west to about 22.5°C along the shores of Lake Victoria in the South.

6.3 WIND:

The general wind patterns are modified by convection causes near the lake. The alternate heating and cooling of ~~of~~ the land causes lake breezes during the afternoon and land breezes during the night and early morning. In May and June, winds are generally at their lowest (see table 8). They attain the speed of 2.7 Km/hr and 2.0 Km/hr respectively. The most windy month is February when winds travel at 4.2 Km/hr). Wind behaviour regulates navigational links between Bondo and different parts of the lake. Such contacts are minimal in June when winds are at their lowest speed.

3 HUMIDITY

Humidity is relatively high with mean evaporation averaging between 1800mm to 2000mm per annum.

The dew point usually shows little variation(+±1) during the 24 hours. Naturally, dew points are higher during the wet months (see table 8). Thus between March and May, the relative humidity goes beyond 80% as compared to 68% during dry months.

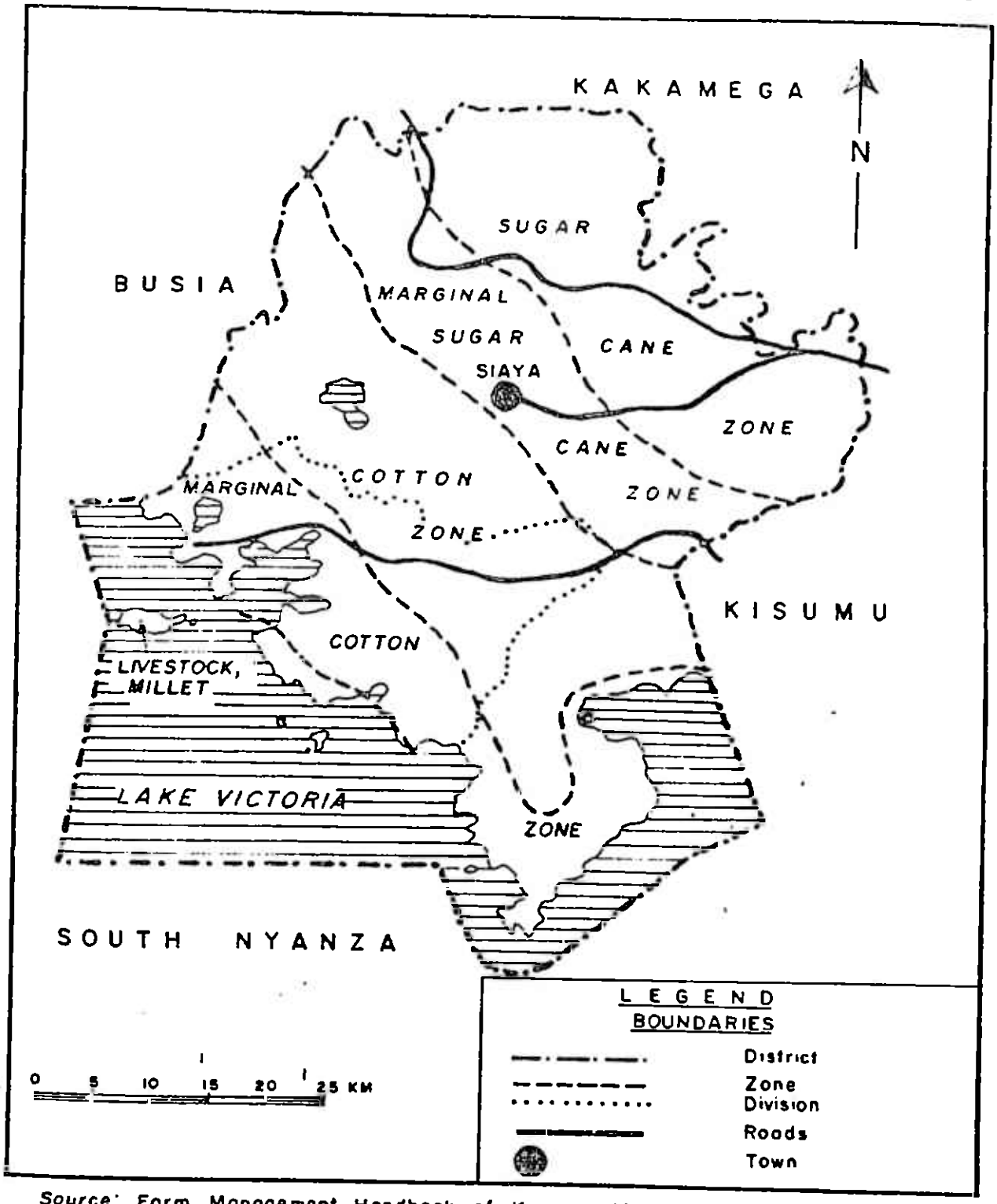
The diurnal variations in temperatures cause corresponding (but inverse) changes in relative humidity. Relative humidity is lowest in the afternoon (about 3 p.m.) when the temperatures are high, but rises rapidly with falling temperature. Values of over 85% are common at down shortly before and during the rainy season. Relative humidity is also affected by wind speed and cloud amounts. Thus the most windy month has the lowest relative humidity (i.e February 68%).

AGRO-ECOLOGICAL ZONES

The foregoing environmental variables determine the inherent ecological potentiality in Bondo Division.

The Siaya District (in which Bondo is located) can be classified with four agro-ecological zones but we shall only limit our discussion to the zone(s) which covers Bondo Division. The Kenya Soil Survey and the Integrated Regional Development Master Plan for the Lake Basin Development Authority (LBDA) have shown that the lower parts of ghe division and especially the Lake Victoria shores, can be classified into semi-humid, semi-dry lower midland zones. These zones cover the whole of Yimbo location in Bondo Division. Due to its low moisture availabilit the agricultural potential is rather low and only drought resistant crops such as sorghum, millet and cotton can do well. However, the zone has a higher potenti

Fig. : SIAYA DISTRICT — SIMPLIFIED AGRO-ECOLOGICAL ZONES



Source: Farm Management Handbook of Kenya, 1982

for irrigation as water resources are available and the soils tend to be fertile.

The lower central and northern parts of the Division covering the whole of South Sakwa and North Sakwa locations are classified in the low midland zone. This zone is more or less similar to the low midland zone but its moisture availability tends to be higher, giving rise to a slightly higher agricultural potential. Coupled with irrigation, especially within the Yala swamp, the zone tends to have a higher potential for agricultural production. Crops such as cotton, maize and sugarcane have better prospects. Livestock ranching can also do well.

Table 9 gives the distribution of the agro-ecological zones showing the areas covered, the acreage, and the annual rainfall as well as annual potential evaporatic

TABLE 9: AGRO-ECOLOGICAL ZONES

ZONE	AREA (KM^2)	LOCATION	CLASSIFICATION	AVERAGE ANNUAL RAINFALL (MM)	AVERAGE ANNUAL POTENTIAL EVAPORATION (MM)	PLANT GROWTH POTENTIAL AND POSSIBLE CROPS
1	387	Whole of Sakwa in Bondo Div.	Semi-humid	800-1,400	1,450-2,200	High to medium, cotton groundnuts sorghum, millet, cassava, potatoes, livestock.
2	187	Whole of Yimbo in	Semi-humid	600-1,100	1,550 2,200	Medium cotton, sorghum and groundnuts, livestock

SOURCE: Land use in Siaya District, KREMU (1986) and Ministry of Agriculture.

2.8 NATURAL RESOURCE BASE

Bondo Division is not well endowed with natural resources. Apart from the few scatteredwoodlots there are no gazetted forests. The basic natural resources of Lake Victoria which provides some people with incomes through fishing and its related activities.

Water resources potential in the division is therefore very uncertain except for Lake Victoria's waters. The only one major river is Yala River, which flow south-westward draining into Lake Victoria through the Yala swamp. In addition there are a few streams which either become tributaries of river Yala or drain directly into Lake Victoria. Lake Kanyaboli which tends to be salty, add to the surface water potential. The Yala River has an average annual rain ranging between 21.3 cu.m/sec. and 27.7cu.m/sec giving high prospects for mini-hydroelectric power.

Bondo Division is poorly endowed with sub-surface water resources. In the central parts of the division, although exhibiting greater potential, underground water tends to occur at slightly deeper levels (15-25m deep). To the south, especially along the shores of Lake Victoria, underground water has less prospects and when found, (over 25m deep) the water tends to be saline.

In general, the division has a high potential sub-surface water resources and when fully exploited, it should meet the demand for a certain period both for human and livestock consumption as well as irrigation activities.

There is a direct need therefore to conserve these two natural resources (i.e land and water). Of late the aquatic life in Lake Victoria has been threatened by effluent disposal from the small-scale industries in the lake basin region. Studies done by the Kenya Academy of Sciences and the Lake Basin Development Authority (LBDA) (1982) have shown that fish have been dying as a result of affluent disposal from the manufacturing concerns. Though these studies are not conclusive, there is still a need to have this affluent disposal continuously monitored.

The other natural resource, land is also being threatened. The natural vegetation, for example, has been heavily affected by dense settlement, widespread cultivation and the cutting of trees for fuel, house construction and making charcoal In addition, erosion and overgrazing has depleted the grass cover in many parts of the division and especially in Sakwa locations. With an active campaign in soil conservation measures and afforestation programmes, this problem should be able to be arrested.

Apart from these two natural resources, there are no other major resources. Mining or mineral resources, for example are not significant in the Division. The LBDA conducted a study on the mineral resources in the whole lake basin and recommend that there was a need to strengthen the exploration activities for minerals having export potential especially gold, copper, rare earth and niobium, which seem to exist in the region. In Bondo gold deposits occur along the Yala River and around Wagusu Beach/market. It is difficult to estimate the gold production level as most mining is done secretly and illegally. However, potential exists in the Division and therefore measures should be taken to legalise mining activities which will in turn raise the income levels of the local people.

2.9 LAND USE PATTERNS

The total area of agricultural land in the division is over 41,000 hectares. Because of the limited rainfall and low fertility of the soils only 15130.952 ha. can be termed to be agriculturally productive.

According to the Farm Management Handbook of Kenya Vol.2 the average house-hold agricultural land holding was only 2.14 ha. giving about 0.39 ha per individual This calls for an intensification of agricultural productivity in the whole Division if the situation for small scale farmers is to improve.

However, the Kenya Rangeland Ecological and Monitoring Unit (KREMU) in Siaya District Technical Report No.123 (1986) has shown that much of the total agricultural land in the division (54% or 309.96 Km^2) is either left for grazing or is fallow. An additional land area of about 5% is under swamp and marsh. Table 10 depicts a clear picture of the land use types in the division.

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The distribution of this land use pattern varies with the potential of the land from one area to another. In the marginal cotton zone much of the land is either fallow, bush or left for grazing.

NB: Bondo Division has more of its land in the marginal zone.

TABLE 10 (a): LAND USE PATTERNS BY DIVISION (HECTARES)

DIVISION	Agricultural Area (Km2)	Maize	Sugar	Grazing	Fallow	Bush	Cassava
Bondo	574	3,930	0	12,290	18,290	12,020	380

SOURCE: Technical Report No.123: Land use in Siaya District KREMU (1986)

The overall picture shows that there is still room for expansion of agricultural land use. The little agricultural production being undertaken in the division is of a subsistrence nature. Very few modern agricultural production techniques have been infused in the farming system. Hence, there is a need for the division's residents to utilize arable land using modern agricultural production techniques.

TABLE 10 (b)

Division	W lots	Cotton	Sorghum	Bareground	Swamp	Hedge
Bondo	90	670	1,580	1,360	5,340	1,240

SOURCE: Technical Report No.123: Land use in Siaya District, KREMU (1986)

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TABLE 11: AEZ - LAND AREA AVAILABLE PER LOCATION DIVISION AND PER HOUSEHOLD AND PERSON

LOCATION/ DIVISION WITHOUT TOWNSHIPS	in '00 ha = Sq.Km					in '00 ha =Sq. Km						in ha.	
	Area total census 1979	Non-agric. land			Agricultural land	Area in agro-ecological zones A E Z						Agricultural land per	
		Unsuit. Steep Slopes	Forest Res., lakes Swamps	Others (roads, home-steads, rivers, etc)		UM1	IM1	IM2	IM3	IM4	IM5	Household	Person
South Sakwa	226	13	Sw.4	23	186				63	103	20	4.33	0.71
North Sakwa	161	8	Sw.2	16	135			6	110	19		4.54	0.69
Yimbo	187	10	Sw.33 lake 7	19	118				36	82		3.47	0.60
Bondo Division	574	31	46	58	439			6	209	204	20	3.49	0.56

SOURCE: Jaetzold, R. and Schmidt, H. (1982): Farm Management Handbook of Kenya, Vol.II/A

2.10 THE EFFECTS OF PHYSICAL ENVIRONMENT ON THE DISTRIBUTION AND VARIATION IN USE OF PRIMARY SCHOOLS

The natural environment of an area has an important influence on the distribution and variation in use of educational facilities in the study area. The presence or absence of such facilities may be related to the relief, availability of water, climatic elements and so on. Further provision of educational facilities may also be influenced by the country's available natural resources from which she must find the funds to pay for facilities and services. It is therefore important to identify how the environment of the study area influences the existing distribution and variation in the use of educational facilities.

Relief influences population distribution/settlement which in turn influences the distribution of primary schools. Settlement is mainly to be found where land is more or less level and also where there is good drainage. Areas with very rugged terrain have very few human settlement hence there are few or no schools which are located in such areas. Swamps and marshy lands also possess no schools as such areas are unhealthy for human settlement, for example, Yala Swamp in Yimbo location. Areas with rugged terrain include Got Agulu and Mageta Island sub-locations.

The knowledge of rainfall pattern and other climatic elements is important because it not only relates to social and economic activities like agriculture but also to environmental health. The difficulties of natural environment have considerable effects on agricultural production and hence the income level of the people which in turn influences the distribution and variation in the use of primary schools in the study area.

A look at agro-ecological zones of the study area reveals that most parts of Yimbo fall under the marginal zone where the prevailing climatic hazards limits agricultural production and therefore most people in the location have very low incomes. This situation is reflected in the low density of schools in the location (about 17 primary schools per 100 square kilometres) as most parents cannot afford to build schools on 'harambee' basis.

The availability of land and soil fertility influences agricultural production which as we have seen influences the distribution of primary schools in the area. It is also important to note that most schools tend to locate near water sources and therefore areas with little or no water supply (for example, northern parts of Nyamonye sub-location) have very few or no schools.

In conclusion, it can be argued that physical environment determines land use patterns in any given region and this is reflected in any kind and level of development (for example, education). It is also important to note that the mineral resources in Bondo when fully exploited will raise the income level of the local people and therefore contribute significantly to the development of education under the recently introduced cost-sharing policy in that sector.

2.11 HUMAN BACKGROUND

2.11.1 INTRODUCTION

It is important to note that the main aspects of human population which the geographer is most interested in include: the total number of people in the particular country or place (the population size); the spatial distribution of that population including density per unit area, patterns and types of settlement including rural/urban ratios, age-sex structure and composition growth rates and mobility. Other vital statistics required include nuptiality, fertility, mortality, education and employment. Apart from the above, demographers, that is those who study vital population statistics are also interested in the interrelations of population and economic/social developments. For a development plan of any country to be sound it has to take into consideration demographic variables as well as socio-economic factors. For instance, when planning for schools, the number and age-sex of children have to be considered as well as the spatial distribution of that population. Similarly, population mobility has to be considered while its distribution will influence the location of distribution and service centres, infrastructure and tertiary industries.

The characteristics of population are also important. These include, the standard of living of the people (per capita), means of livelihood, percentage of literacy of that population, and employment opportunities available to the working population.

2.11.2 POPULATION DISTRIBUTION AND DENSITY

Bondo's population is very unevenly distributed. In absolute terms, Bondo is a division of a moderately low population density at only 114 persons per square kilometre.

A breakdown of divisional density into location and sub-location level reveals great differences and highlights pockets of acute population pressures and overpopulation.

The present distribution and density of population in the area are due not only to ecological factors, but also to historical circumstances. The study area was settled by lineage or clan groups and the amount of land occupied by each clan depended largely on the vigour with which such clans pushed their claims against those of their rival groups. Sakwa clans, for instance, were able to force Uyoma andAsembo folks out of the area thus enabling them to occupy Anyuongi, Migwena and Got-Abiero areas. Consequently these three areas have the lowest population density (see Table 12).

However, the initial settlement was greatly influenced both by drainage and ecology. In choosing settlement sites different clans tended to avoid poorly drained areas (which in most cases were infested with tsetse fly and mosquitoes) in favour of freely drained raised grounds which, besides settlement, were

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favourable for strategic reasons. The present population distributio in the area reflects the influence of these two basic factors i.e ecological-historical influence. High population density areas are experienced in freely drained raised grounds while the lakeshore flats and stream valleys are often set aside for communal grazing. In 1979, the location with the highest population density per square kilometre was North Sakwa (120). It was followed by South Sakwa (113) and then Yimbo (107). A further breakdown into sub-location reveal even higher levels for rural and peasant populations. For example, Mageta Island, Usenge, Abom, Got Agulu, Ajigo and Bar-Kowino sub-locations had densities of 234, 213, 186, 163, 150 and 137 persons per square kilometre respectively. Within these sub-locations, some villages had very high densities. Similar cases are common especially in North Sakwa.

TABLE 12: POPULATION DISTRIBUTION IN BONDO DIVISION, SIAYA DISTRICT

	1969			1979		
	TOTAL POPULATION	AREA IN SQ.KM	DENSITY OF POPULATION	TOTAL POPULATION	AREA IN SQ.KM	DENSITY OF POPULATION
BONDO DIVISION	50,761	597	85	65335	574	114
YIMBO	14,960	212	71	20073	187	107
Nyamonye	4,819	122	40	8578	103	83
Usigu	3,478	51	68	4122	47	86
Got Agulu	2,183	13	167	1879	11	163
Usenge	4,480	26	172	3853	18	213
SAKWA	35,802	385	73	45262	387	117
Maranda	3,581	72	50	5249	70	74
Nyawita	3,749	39	95	4637	38	121
Ajigo	3,176	27	120	3705	24	150
Abom	4,593	27	169	5208	27	186
Nyang'oma	6,752	82	82	8360	81	103
Migwena	3,804	55	70	5634	54	102
Barkowino	4,327	40	109	5679	41	137
Nyaguda	5,820	44	131	6088	49	123

SOURCE: Kenya Population Census, 1969 Vol.I and 1979 Vol.I

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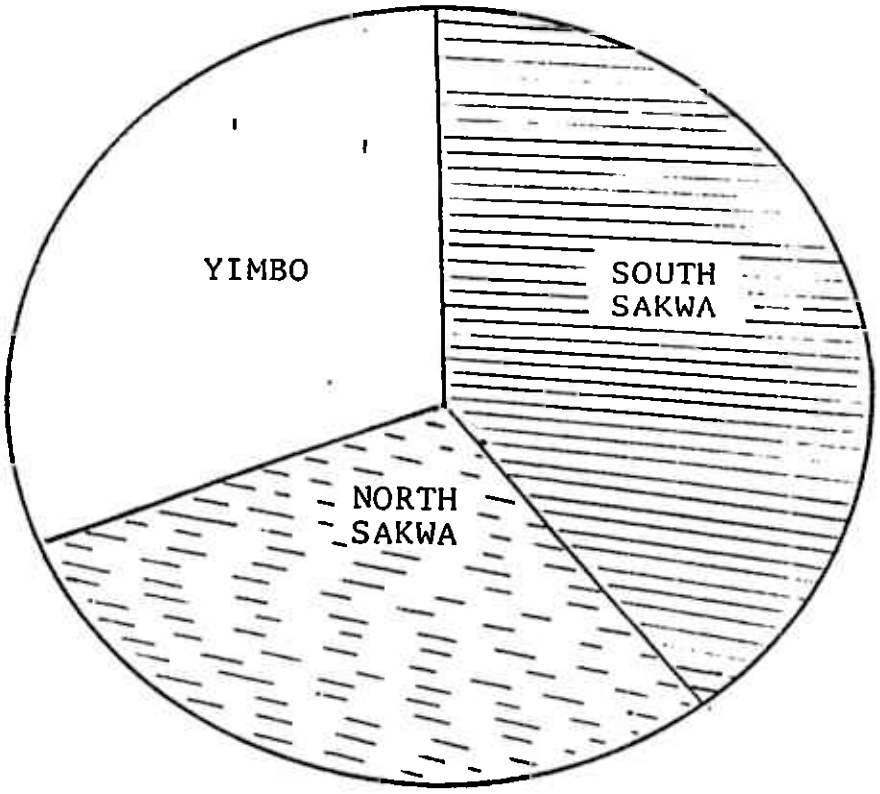
TABLE 13: POPULATION BY SEX AND SUB-LOCATION

ADMINISTRATIVE AREA	MALE	FEMALE	TOTAL	NUMBER OF HOUSEHOLDS	SQUARE KILOMETRES	DENSITY
MIGWENA	2623	3011	5634	1106	54	102
NYAGUDA	2792	3296	6088	940	49	123
NYANG'OMA	4034	4326	8360	1366	81	103
BAR-KOWINO	2524	3155	5679	907	41	137
SOUTH SAKWA	11973	13788	25761	4319	226	113
ABOM	2336	2872	5208	612	27	186
AJIGO	1650	2055	3705	679	24	150
MARANDA	2420	2829	5249	838	70	74
NYAWITA	2110	2527	4637	718	38	121
BONDO T.C.	333	369	702	138	0	219
NORTH SAKWA	8849	10652	19501	2985	161	120
NYAMONYE	4062	4516	8578	1659	103	83
USIGU	1929	2193	4122	645	47	86
USENGE	1764	2089	3853	594	18	213
GOT AGULU	883	996	1879	235	11	163
MAGETA ISLAND	788	853	1641	315	7	234
YIMBO	9426	10647	20073	3448	187	107
DIVISION BONDO	30248	35087	65335	10752	574	114

SOURCE: 1979 KENYA POPULATION CENSUS VOL. I

DIAGRAM 1: BONDO DIVISION POPULATION TOTALS BY LOCATION



Source: Republic of Kenya; Central Bureau of Statistics, 1979 Population Census.

POPULATION GROWTH AND MIGRATION: Population growth rate in Bondo Division is low relative to the national growth rate of about 4.0%. According to the 1969 and 1979 censuses, the area had an estimated gross population growth rate of 2.5%. The lake shore sub-location of Nyaguda, Usenge and Mageta Island have the highest population growth rates of 2.7%, ~~and~~ 4.6% and 2.8% respectively. Low growth rates are experienced in the interior sub-locations of Bar Kowino, Maranda and Nyamonye. Low growth rates in these areas may, to some extent be attributed to high mortality and out-migration rates.

The high rates of growth in the immediate lakeshore sub-locations is mainly due to low level of out-migration high level of in-migration, rapid growth of fishing villages along the shore, and less frequent incidence of malnutrition. Thus high population growth rates in Nyaguda, Usenge and Mageta Island may be attributed to rapid growth of fishing villages such as Usenge, Wichlum etc. These fishing villages consist of conglomeration of buildings sprawling away from the lakeshore with shops, hotels, and flour mills. giving them something of an urban outlook. They are best

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known for their busy fish markets and some very decent social and lodging facilities that have been reputed in the entire Siaya District. The population, both local and from other parts of the country is sophisticated by rural standard and the rate at which people multiply is high. Fish and fishing are the axis around which life rotates in these "Towns". Malnutrition is therefore practically non-existent among the local people. Thus Usenge, Wichuum and other fishing villages act as areas of local in-migration, while sub-locations far removed from the lake form zones of out-migration.

AGE-SEX DISTRIBUTION: Like in the case of most rural areas in Kenya, Bondo area is characterized by high proportion of childfen and low proportion of old people. In 1979, children accounted for 49.0% of the total population (see Table 14).

The relatively high proportion of children in the population means that fertility rate is very high in the region resulting in rapid population growth which is currently estimated at 3.8% per annum.

TABLE 14: POPULATION OF CHILDREN BY LOCATION

ADMINISTRATIVE UNIT	CHILDREN	ADULT	TOTAL	CHILDREN (%)
South Sakwa	12819	12942	25761	49.8
North Sakwa	9507	9994	19501	48.8
Yimbo	9677	10396	20073	48.2
Total/Mean	32001	33332	65335	49.0

Source: The table is based on 1979, Kenya Population Census (data).

MORTALITY: The level of mortality is relatively high in Bondo Division. It is estimated that out of 100 babies born 85 die between ages 0 and 15 years. The relatively high death rate in Bondo area is mainly due to the frequent out-break of malaria (especially between April and July following the long rains). Inadequate medical facilities in the area is yet another factor accounting for high death rate in the area. For along period an area of 574 KM^2 has been served by a single health centre - Bondo. Malnutrition resulting from poverty in the region (especially in South Sakwa and Yimbo locations) is another prominent factor

for the high level of mortality in the study area. Directly related to high death rates is the low life expectancy estimated to be 38 years for Nyanza Province.

THE EFFECTS OF POPULATION CHARACTEREISTICS ON THE DEVELOPMENT OF EDUCATION IN THE AREA

The above discussed demographic traits have profound effects as far as the development of education in the area is concerned.

As we shall see in the next chapter, primary school distributior tends to follow that of population. The high populationgrowth rates means that educational facilities will have to be expanded in order to meet the increasing demand from the increasing population of school-age children.

In areas where there is effective resources utilization and conservation (as is the case with agricultural land in North Sakwa), the population will increase in size through natural increase and in-migration, rural income levels will rise and therefore the local people will be able to build their own schools on "Harambee" basis. These factors and others not mentioned above have probably governed the distribution and variation in use of educational facilities in the study area. These facilities as will be seen in the next chapters, are few (in some cases) and sporadic and are often poorly equipped but this is a reflection of the spatial population distribution and differential income levels which are in turn determined by the physical environment.

THE ECONOMY OF THE AREA

Agriculture and fishing dominate the economy of the study area. Maize (zea mays) is the major food crop grown by majority of farmers though some of it is sold for cash. Due to poor returns most farmers have tended to practice mixed farming instead. Bananas, potatoes (both Irish and English), sorghum, millet, cassava and beans are grown as subsistence crops. Pawpaws and a wide range of vegetables are grown also for both home consumption and for market.

Poultry and livestock keeping are essentially carried out for domestic use, though sales are made at times. A few people engage in lumbering (as in the case with Utonga forest).

Mining is the only non-agricultural activity (apart from fishing) in the study area, Though it is a new field of economic activity, it has attracted alot of participants. The main minerals mined (mainly in North and South Sakwa) include Gold, Silver and Iron ores.

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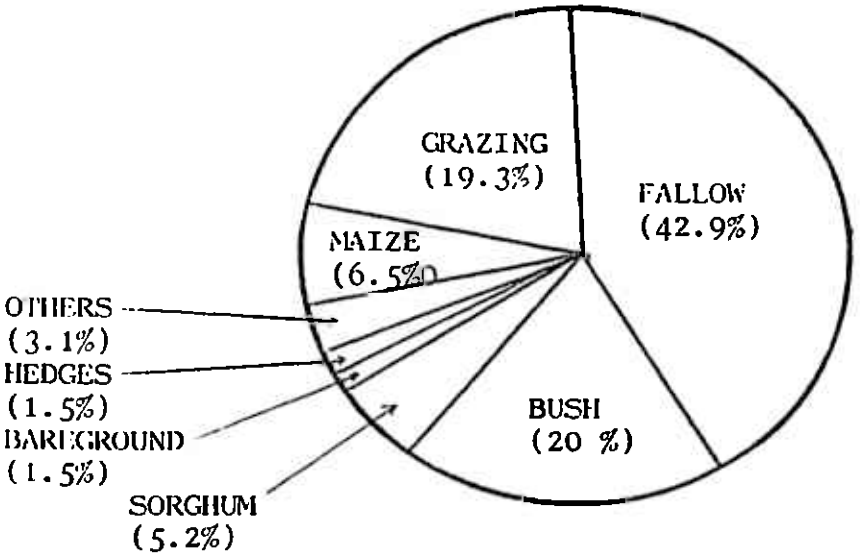
GOLD: The main rock formation concerned is the gold-bearing Nyanzian and Kavirondian rocks.

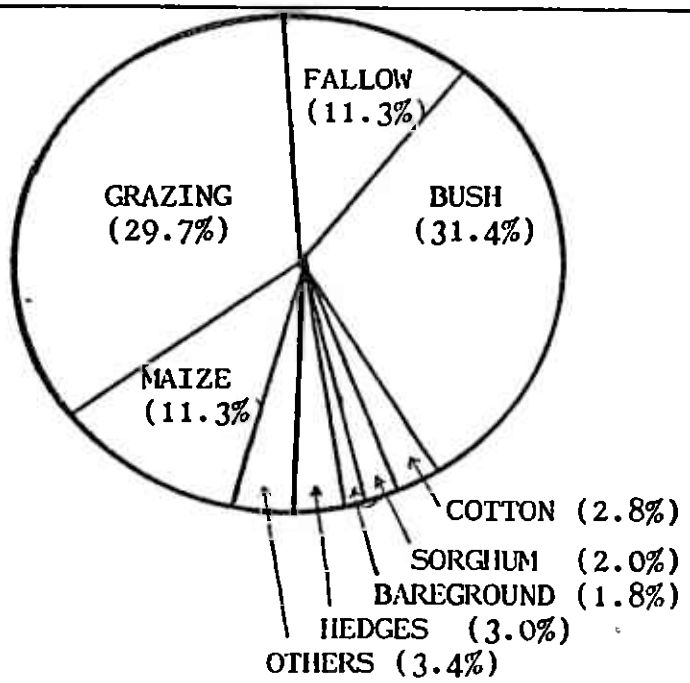
SILVER: In Bondo and even in Kenya as a whole, this mineral occurs naturally alloyed with gold as electrum.

DIAGRAM 2: LAND AVAILABLE FOR VARIOUS ACTIVITIES IN SOUTH SAKWA LOCATION



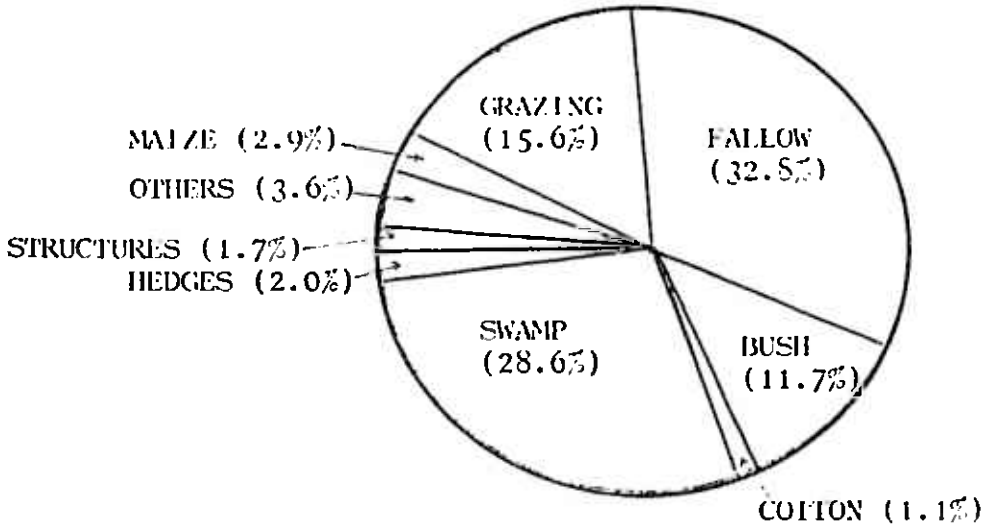
Source: Compiled from data acquired from Ministry of Agriculture Bondo.

DIAGRAM 3: LAND AVAILABLE FOR VARIOUS ACTIVITIES IN NORTH SAKWA LOCATION



Source: Compiled from data acquired from Ministry of Agriculture, Bondo.

DIAGRAM 4: LAND AVAILABLE FOR VARIOUS ACTIVITIES IN YIMBO LOCATION



Source: Compiled from data acquired from Ministry of Agriculture, Bondo Division.

INFRASTRUCTURE

Bondo Division exhibits unbalanced physical and social infrastructural facilities. The physical infrastucture includes facilities like roads, electricity, water post office and telephones while the social infrastructure includes facilities like schools, health institutions and social halls.

But in this context, we are mainly going to concern ourselves with the distribution of roads.

ROADS

Roads in the Division are deemed to be well distributed (except in a few areas such as Nyamonye, Got Agulu and parts of Maranda sub-locations) although some of them are in poor condition escpecially during the rainy season. The road network cuts across the division in all directions. Among the classified roads, the longest paved (tarmaced) road is C 27 which runs from Ndori to Usenge through Bondo rural centre. This road forms the trunk road in the divisionand all the other roads radiate from it as can be seen in figure 8. In addition there are a number of unclassified roads in the division again distributed evenly except in a few remote areas.

All these roads assist in linking the various government facilities like schools, health centres, administrative centres and even service centres which assist in production and marketing of both agricultural and industrial products. It is important to note that transportation network influences both population and primary schools distribution as we shall see later in the other Chapters.

CHAPTER 3

3.0 METHODOLOGY OF DATA COLLECTION AND ANALYSIS

3.1 INTRODUCTION

The foregoing chapter examines physical and human environments as they relate to economic activities carried out in the study area and these three spatial variables ultimately influence the distribution and variation in use of primary schools in the study area, as will be seen in Chapter 4.

In this chapter, various methods employed to achieve the stated objectives of the study are discussed. The methods used provide a means of analysing and presenting the data. To a large extent, the methodology used is determined by the factors being examined. Some of the aspects looked at in this chapter therefore include: the sources of data, nature of data collected, sample design (i.e. sampling technique), data collection techniques, techniques used in data analysis and presentation, and hypothesis testing and the major research limitations (problems) encountered by the researcher during the field study and the attempted solutions to the difficulties encountered in the field.

3.2 SOURCES OF DATA

Both primary and secondary data were collected, in order to achieve the stated objectives in Chapter 1, section 1.3.

3.2.1 PRIMARY DATA COLLECTION

This type of data was collected in two ways namely interviews and field observations. Where interviews were used to obtain data,

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sampling was necessary because of the large population to be studied. This decreased the cost of carrying out the research as well as minimizing time spent in the field, in dealing with the entire population. Those interviewed include: school pupils, parents, headmasters and other staff members. Personal observations noted by the researcher were also recorded as part of the primary data.

3.2.2. SECONDARY DATA COLLECTION

This study also relied a lot on data from secondary sources, some of which was not relevant to the author's study area. These included both published and unpublished literature. These supplemented the primary data, so as to show a clear and complete picture of the study. In particular, data from official government documents and statistics abstracts were made available. This included data on the number of educational facilities in the study area, their quality in terms of national examination performance as indicated by their respective average mark score, population served and distribution of these facilities. From the Ministry of Agriculture, data on climate and land use in the study area was collected. Transportation data and availability of other community facilities data was either in published or in unpublished form. Most of the secondary data was obtained from Headmaster's office in their respective primary schools, Bondo Education office, Siaya Education Office, Head offices of the Ministry of Agriculture (Bondo), Ministry of Education (Nairobi), Ministry of of Planning and National Development (Nairobi), Survey of Kenya (Nairobi), Ministry of Water

Library (Nairobi) and University of Nairobi Library.

3.3 NATURE OF DATA COLLECTED

The nature of data collected included the following among others: a brief historical background of the emergence of existing primary schools in the study area; spatial distribution of schools and variations in their use; examination results; income levels; distance (in km) from each school to the nearest neighbouring school, main road, water supply, market centre etc; transportation network; economic activities in the study area; climate; the number of school-age children (5-15) in each sub-location; population density by location and sub-location; distances covered and time taken by the pupils from their places of residence to school; sources of income; problems faced by the individual schools and pupils et-ce-tera.

3.4 POPULATION AND SAMPLE FRAME

All primary schools in the study area formed the universe population. It was not possible to cover a relatively complete survey of the universe population, due to the limiting factors stated in Chapter one, Section 1.7. Therefore, a random sample frame of 36 schools was sampled (on the basis of administrative units) as a representative of the universe population.

TABLE 15

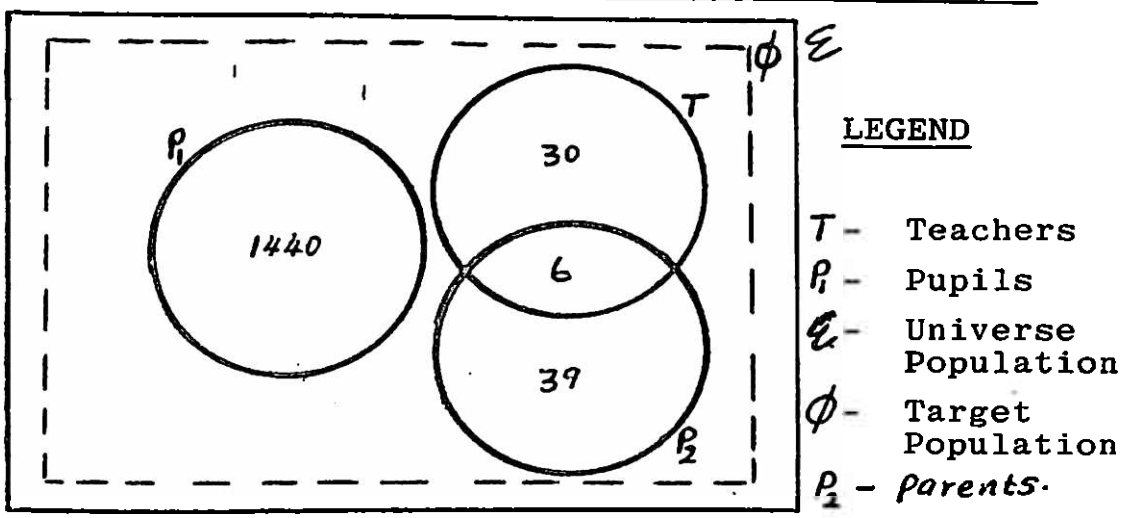
NUMBER OF PRIMARY SCHOOLS SAMPLED

LOCATIONS	NUMBER SAMPLED
South Sakwa	12
North Sakwa	12
Yimbo	12
Total	36

Source: Field Work, (1989)

DIAGRAM 5

VIEN DIAGRAM SHOWING STRUCTURE OF RESPONDENTS



Source: Fieldwork (1989).

3.4.1 SAMPLE DESIGN

After the selection of the research topic, a pilot survey (a reconnaissance trip) was conducted in the study area, by the researcher. Because most of the data needed was from pupils, they were assigned a larger proportion as compared to the other respondents, as indicated in diagram 5 above.

Sampling was done at three stages, first, educational facilities to be visited were selected using stratified random sampling. Secondly, 40 pupils were chosen by simple random sampling from each of the already selected educational facilities at stage one (1). Thirdly, the sample of 45 parents was also chosen randomly (i.e. using stratified random sampling). The 45 parents were chosen using line sampling method. In total, there were 124 primary schools in the study area to be selected from. Out of these, a sample of 36 schools was collected. Each primary school was assigned to a two digit number by the researcher, and with the use of a table of random sampling numbers, 36 out of the 124 were sampled and the pupils and teachers were interviewed.

In summary, these were the primary schools selected in each of the three locations of Bondo Division:

SOUTH SAKWA

1. LENYA
2. SERAWONGO
3. MBEKA
4. ONYINYORE
5. NYAN'GOMA 'M'
6. WAMBARRA
7. GOMBE

8. MINYA
9. GOT-ABIERO
10. MIGONO
11. KIPASI
12. BAR-KOWINO

480 - pupils interviewed.

NORTH SAKWA

1. ALARA
2. NYAMIRA
3. MARANDA
4. BONDO
5. SINAPANGA
6. PAR-OPUK
7. GOBEI
8. NYAWITA
9. ABOM
10. AJIGO
11. NDIRA
12. BAR-CHANDO

480 pupils interviewed.

YIMBO

1. BAR-KANYANGO
2. MAJENGO
3. NYAMONYE
4. NYANGEERA
5. NYABONDO
6. JUSA
7. PALA
8. USENGE
9. WAMBASA
10. ULOWA
11. KANYIBOK
12. OTHACH

480 pupils interviewed

In the process of interviewing the parents, three routes in each location were designed by the researcher from the starting point, diverging to different directions. Along each route, 5 parents were interviewed, giving a total of five households visited in each route. These five households were chosen approximately equidistant from each other along any given route (see fig.7).

TABLE 16

NUMBER OF PARENTS INTERVIEWED ALONG EACH ROUTE

LOCATION	ROUTE	NO. INTERVIEWED
SOUTH SAKWA	1	5
	2	5
	3	5
NORTH SAKWA	1	5
	2	5
	3	5
YIMBO	1	5
	2	5
	3	5
TOTAL	9	45

SOURCE: Field Work, (1989)

3.5 METHODS OF DATA COLLECTION

The research combined various social sciences techniques for data collection. The techniques included, among others, direct field observation, the use of questionnair, personal interviews as well as the various secondary sources of data.

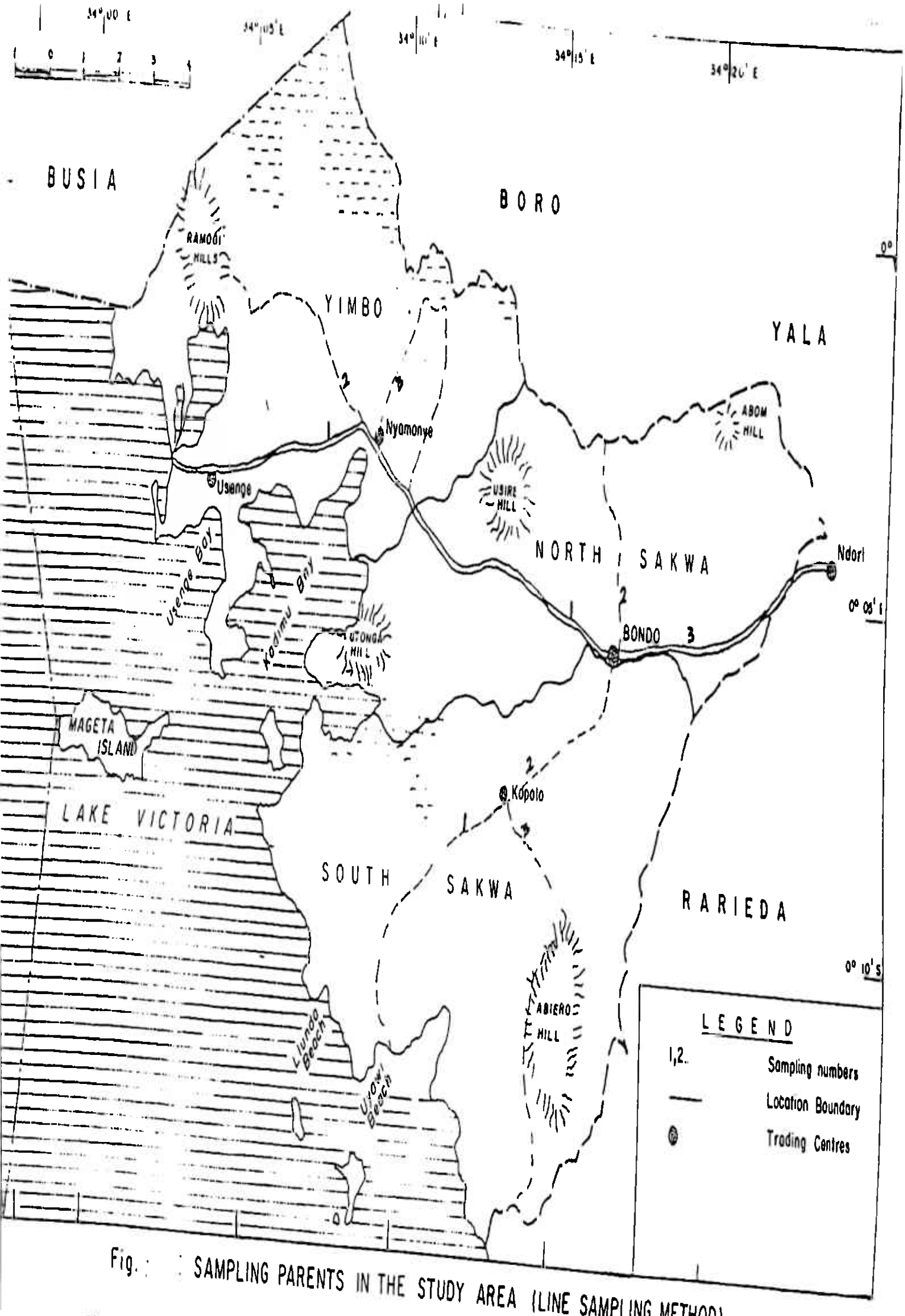


Fig. : SAMPLING PARENTS IN THE STUDY AREA (LINE SAMPLING METHOD)

3.5.1 DIRECT FIELD OBSERVATION

Since much of this research was field oriented, it relied heavily on direct field observation. This technique proved to be of great assistance in view of the fact that the area dealt with had not been widely studied and the secondary sources of data relating to the distribution and variation in use of educational facilities were either incomplete or non-existent at all. Consequently, the data on the actual availability of learning facilities were in the main derived from direct field observation. It is also important to note that direct field observation supplemented the data gathered through interviews. Observations were made regarding the pupils, learning facilities, staff and any other phenomenon relevant to the study. This also ensured accuracy and reliability of primary data collected. It also included assessing whatever information was given.

3.5.2 THE USE OF QUESTIONNAIRE (RESEARCH SCHEDULE)

The collection of data was done through well designed structured interview schedules (questionnaires). Before the actual field study questionnaires were laid out, with the assistance of the researcher's supervisors. The interviews were then carried out using questionnaires which were of three types: one for parents, another for pupils and the other for headmasters. In all, a total of 1440 pupils, 45 parents and 36 headmasters/ headmistress were interviewed.
From each educational facility, only one headmaster's questionnaire was required hence a total of thirty six. In case of

illiterate parents, a set of questions were formulated and read to them in vernacular language (Luo). Most of the questions asked were deliberately kept open-ended to enable the respondents to give answers that accurately represented their feelings. The questions were particularly made simple in view of the low levels of education of most respondents. At one stage, an attempt was made to make use of postal questionnaires to cut down on transport cost. This however, failed to function satisfactorily because most respondent considered personal preliminary introduction essential. Thus the questionnaires were in the main, self administered. An interview was also held with the head of each education institution visited, to gather information, on various aspects of education. These included manpower, equipment (i.e. learning facilities) and the general problems experienced by their respective primary schools. This enabled the researcher to have both the views of parents and staff, regarding the "quality" of the education institution in question.

3.5.3 PERSONAL INTERVIEW This method was widely used when interviewing individuals (or groups of individuals) for whom the structured questionnaires were not intended. They were mainly government officials whose functions were related to the development of education in the study area. This method enabled me to get valuable information from Inspector of schools, Assistant Education Officer, Ministry of Agriculture officials (Bondo) *etc.*

3.6 METHODOLOGY OF DATA ANALYSIS AND PRESENTATION

In order to embasize the variations in magnitude and/or association of the various parameters under observation, various techniques and methodshave been adopted in the

analysis and presentation of the collected data. They include descriptive, qualitative and quantitative techniques.

(a) DESCRIPTIVE ANALYSIS

In descriptive analysis, proportions and percentages have been used to arrive at a general picture, from which conclusions can be made. Proportions $P_1 + P_2 \ldots .Pn=1$ (i.e. addition of all proportions of a variable equal unity). This is equivalent to 100%. To convert any of the proportions into percentages, it is multiplied by 100.

$$\frac{P_1}{P_t} + \frac{100}{1}$$

Where:

P_1 = Proportion one of variable t.

P_t = Total proportions of variable t.

(b) QUALITATIVE ANALYSIS

Where data was inadequate or unsuitable for a statistical test(s) to be applied, some qualitative methods have been used. They represent the collected data in the form of line-graphs, bar-graphs, pie-charts, statistical tables and maps.

(c) QUANTITATIVE ANALYSIS

The choice of a particular test depends not only on the nature of the problem, but also on whether any assumptions can be made about the distribution of values in the population.

The scale of the variable measurements also needs to be considered. The kind of statistical test(s) used in analysing and presenting the collected data was therefore determined by the type of variables under test. In this respect, the following statistical tests have been used.

1. THE CHI SQUARE TEST STATISTIC

This test has been used to test whether there is any significant inter-location difference in the distribution of primary schools. The test is also used to determine the effect of transportation network on the distribution of schools in the study area.

Formula:

$$X^2 = \sum \frac{d^2}{e} \quad \ldots \quad (1)$$

Where:

X^2 = is the symbol for Chi square,
d = is the difference between the observed and the expected frequency for each category, and
e = is the expected frequency for each category

The Chi-square (X^2) test was used because of the following advantages:

(a) It did not make a series of rigid assumptions about the precise form of the sampled population.

(b) Its derivation did not require a high level of competence in mathematics.

(c) Given the small sample size, it was faster in application than other techniques.

(d) Since its assumptions about the nature of sampled poipulation were fewer and less elaborate, they were less susceptible to violation.

(e) It was the most suitable technique because the three sets of observations (the observations were independent) came from different populations, and the data dealt with were presented in form of frequencies.

Disadvantages. The disadvantages of the use of Chi square test lies in the following restrictions; the data must be frequencies, i.e. the number of discrete objects occurring in different categories. Also the categories must be mutually exclusive, so that one individual cannot possibly be counted in more than category.

A further important restriction on this form of Chi square test is that there should not be many categories for which the expected frequency is small:

(i) If the number of categories is greater than 2, no more than $\frac{1}{5}$ of the expected frequences should be less than 5, and certainly none should be less than 1.

(ii) If the number of categories is 2, both the expected frequencies should be 5 or larger. Total observed frequencies must equal at least 20. Finally, X^2 test will only give the extent of the probability in mathematical terms that a given distribution is due to chane. But the interpretation of the result of the test depends upon the skill and knowledge of the researcher.

2. LINEAR REGRESSION ANALYSIS

This test has been used to determine the degree of association between the following variables: distance and school attendance, and distance and time. The linear regression model is of the form:

$$y = a + bx; + E; \quad \ldots\ldots\ldots\ldots 2$$

Where:

Y = is the response variable.

a = is the y-intercept (or regression constant).

b = is the slope regression line

xi = is the explanatory variable.

Ei = is the random error

Regression line equation used is

$$Y = a + bx$$

Where:

Y = is the dependent variable

X = is the independent variable

a and b = are parameters.

$$a = Y - \bar{b}x, \text{ and}$$

$$b = \frac{x\,y - n\,x\,y}{x^2 - n\,x^2}$$

Where:

x = the values of the independent variable.

Y = the values of the dependent variable.

$\bar{X}$ and $\bar{Y}$ = are the respective means of the two sets of valuaes, and

n = the number of pairs of measurements

$$y = \frac{\Sigma y}{n}$$

$$x = \frac{\Sigma x}{n}$$

Where:

n - is the sample size.

In order to use the simple linear regression model, data on distance and frequency of school attendance will be transformed into natural logarithms because the distance decay relationship is non-linear (see figure 14) as illustrated. The simple linear Regression model therefore will be:

$$\text{Loge } Y = a + b\text{logeX}i + Ei$$

Simple linear regression will also be applied to find the relationship existing between distance travelled by pupils and the time taken to reach the educational facilities. This is of crucial importance because accessibility of such educational facilities can be determined and sound improvements made where possible.

To determine the degree of association between the two sets of paired values, correlation coefficient, r, has been derived. The formula used is:

$$r = \frac{\Sigma x\ y/n - x\ y}{S\ x\ Sy}$$

Where:

r = the product-moment correlation coefficient

x = the explanatory variable

y = the response variable.

$\bar{x}$ and $\bar{y}$ = the means of the two variables, and

Sx and Sy = the sample standard deviations of the two variables.

The 't' test statistic was then applied to test the null hypothesis whether the correlation between the two variables at the given degree of freedom and level of significance.

Formula:

$$t = r\sqrt{\frac{n-2}{1-r^2}} \quad \text{or} \quad t = \frac{|\bar{x} - \bar{y}|}{\frac{(\Sigma x^2/n_x) - x^2}{n_x - 1} + \frac{(\Sigma y^2/n_y) - y^2}{n_y - 1}}$$

Where:

t = the 't' - test statistic

r = is the coefficient of correlation

n = is the sample size

r^2 = is the coefficient of determination

$\bar{x}$ and $\bar{y}$ = are the means of the two samples,

$|\bar{x} - \bar{y}|$ = is the absolute value of the difference between the means and

nx and ny = are the sizes of the two samples.

3. SPEARMAN RANK CORRELATION TEST

The hypothesis that the distribution of primary schools, by sub-location, is in no way related to the distribution of the population of school age children will be tested using Spearman Rank Correlation statistic.

Spearman rank correlation coefficient is

$$r_s = 1 - \frac{6 \Sigma d^2}{n^3 - n}$$

Where:

r_s = is the Spearman rank correlation coeffient,

d = is the difference in ranking for each item

Σd^2 = means that the differences must be squared and then summed, and

n = is the number of items ranked, i.e. the number of pairs of rankings.

ANALYSIS OF VARIANCE

The hypothesis that there is no significant variation in use of educational facilities by location, will be tested using Analysis of Variance (the F ratio test). The first step in analysis of variance is to make two estimates of the variance of the hypothesized common population: the within samples variance estimate, and the between samples variance estimate. and the between samples variance estimate. :The within samples, variance estimate is calculated according to the following equation:

$$S_w^2 = \frac{\sum_{k}^{n} \Sigma (X - \bar{X})^2}{N - K}$$

Where :

$\hat{S}_w^2$ = is the within samples variance estimate

K = is the number of samples,

n = is the number of individuals in each sample,

N = is the total number of individuals in all the samples put together, and

$\bar{x}$ = is the mean of each sample

The expression $\sum^{n} (x - \bar{x})^2$ means that for each sample the deviations from the man are calculated, squared and summed. The summation sign $\sum^{k}$ means that all the sums of squares, one for each sample, are added together.

The between samples variance estimate can now be calculated as

$$\hat{S}^2_B = \frac{\sum^{K} n\ (\bar{x} - \bar{x}\ )^2}{k - 1}$$

Where

$\hat{S}^2_B$ = is the between samples variance estimate

n = is the number of individuals in a sample,

K = is the number of samples,

$\bar{x}$ = is the mean of a sample, and

$\bar{x}G$ = is the grand mean of all the data values.

The expression $n(\bar{x} - \bar{x}_G)^2$ means that for each sample the deviation of the sample mean from the grand mean is found, squared and then multiplied by the number of individuals in the sample. The summation $\sum^{k}$ means that these values are added together.

The F ratio is then calculated:

$$F = \frac{\text{between samples variance estimate}}{\text{Within samples variance estimate}}$$

$$F = \frac{\hat{S}^2_B}{\hat{S}^2_W}$$

5. THE KRUSKAL - WALLIS H TEST

The hypothesis that there is no significant difference in distances (range) travelled by the pupils to three selected primary schools in the study area will be tested using the Kruskal-Wallis test.

It can be calculated using the following formula.

$$H = \frac{12}{N(N+1)} \sum \frac{R^2}{n} - 3(N+1)$$

Where:

N = is the total number of individuals in all the samples.

R = is the sum of the ranks within a sample, and

n = is the number of individuals in that sample.

The summation $\sum R^2/_n$ means that the sum of all the values of $R^2/_n$ (one for each sample) must be found.

Last but not least, catchment areas (the range) for some of the chosen educational facilities in the study area will be determined. Nearest - neighbour analysis technique will be used to measure pattern in terms of the arrangement of primary schools. This technique involves calculating the mean of the distances between all primary schools and their nearest neighbours.

3.7 PROBLEMS ENCOUNTERED

The main research limitations experienced in this study were as follows:

(a) Data from secondary sources was missing in certain cases, and where it was available, it was very unreliable because certain headmasters/headmistress fail to send their monthly returns to district headquarters regularly.

(b) Financial constraints also limited the data collection because:

(i) those educational facilities located far from the researcher's centre of operation could not be visited more than once due to high transport costs.

(ii) there was not enough money to produce enough copies of questionnaires and therefore in certain cases the researcher ~~and~~ had to write questions on the blackboard and then provide the pupils with plain papers to use in writing their answers.

(c) The time allocated for this research was too short and therefore not all the data required could be collected. This meant cutting down on the sample size to 36 schools, that is only 12 schools could be physically visited from each of the three locations of Bondo Division. Also, only 45 parents could be interviewed, 15 from each location, due to shortage of time.

(d) There was also the problem of co-operation from heads of educational facilities, who made it difficult to hold interviews with

pupils, and the entire staff. Furthermore, some of the heads were not even willing to release the details concerning their performance in national examinations and therefore the researcher had to find other ways of getting such information, for instance, visiting Bondo Education Office where annual and/or monthly returns from all schools are kept. In certain cases, this at times necessitated visiting some educational facilities a number of times if the head of a certain school was not available to grant permission or comments.

(e) There was the problem of inadequate reading material because very little research has been carried out in this field of social geography. Where available, literature exists for larger areal units like a whole country and hence comparision becomes difficult due to the problem of scale.

(f) Finally, obtaining information on the level of income among parents was the most difficult task the researcher ever experienced as most parents were not willing to give such information.

CHAPTER 4

4.0 ANALYSIS OF EDUCATION FACILITY DISTRIBUTION AND VARIATION IN USE IN THE STUDY AREA

4.1 INTRODUCTION

In this chapter, the various factors that determine and explain the pattern of distribution of educational facilities in Bondo Division will be critically analysed. Some of the factors of distribution which are of crucial importance and which are discussed in this paper include:

(a) The role played by missionaries (i.e church influence) and community harambee 'self-help' facilities.
(b) Population distribution (i.e spatial distribution).
(c) Income distribution of the people.
(d) Transportation network.

The factors that explain variation in the use of educational facilities will also be analysed. Hypotheses formulated in Chapter One will be tested and the influence of demographic, social and physical factors on the use of educational facilities discussed. Finally the catchment areas for selected educational facilities will be indicated and the reasons for the differences (if there is any) in catchment areas among primary schools sought.

.2 THE SPATIAL DISTRIBUTION OF EDUCATIONAL FACILITIES

As mentioned earlier in Chapter Two, Bondo Division has a total of 124 government educational facilities (primary schools) These educational facilities serve a population of 32,000 schools-age children (5-15 years old) as per population projections from 1979/1969 population census giving the educational facility population ratio of 258. However, this figure hides alot of local inequalities as will be seen in Table 17 and figure 11 below and later on the chapter.

Figure 11 shows the patterns of population and educational facility distributions. It is important to note from the figure that population distribution is not uniform throughout the disivion Infact, the density of population varies considerably as indicated in the table below. Likewise, educational facility distribution on the other hand, is also not uniform in the division and the numbers vary significantly from one location to another. Table 17 shows population and educational facilities in each location.

TABLE 17: POPULATION DISTRIBUTION/DENSITY AND THE NUMBER OF GOVERNMENT EDUCATIONAL FACILITIES IN EACH LOCATION

Location	Population	Pop. Density	Pop. of Sch. age children	Pop. Density	Educational Facilities	Density of Schools (per 100 Km^2)
South Sakwa	25761	113	12819	57	53	23
North Sakwa	19501	120	9507	59	39	25
Yimbo	20073	107	9677	52	32	17
Total/Mean	65335	114	32001	56	124	22

Source: Bondo Education Office/1979 Population Census, Vol.I

From Table 17 and figure 11, it can be observed that the spatial distribution of educational facilities does follow that of population distribution. From the population densities indicated in the above table, North Sakwa location would be expected to have the largest density of educational facilities and Yimbo the least. Indeed this is the case with the two locations, for instance, North Sakwa has a density of 25 educational facilities per 100 Km^2 whereas Yimbo has a density of 17 educational facilities per 100 Km^2. South Sakwa has a moderate population density of school-age children (about 57 per Km^2) and also moderate density of educational facilities (about 23 per 100 Km^2).

NB: It is important to note that such inequalities in the distribution of educational facilities cannot be explained by the population factors alone but it is as a result of the interaction of many factors which can be grouped under the broad headings namely Demographic, Economic, Physical, Infrastructure etc as we will see later in the chapter.

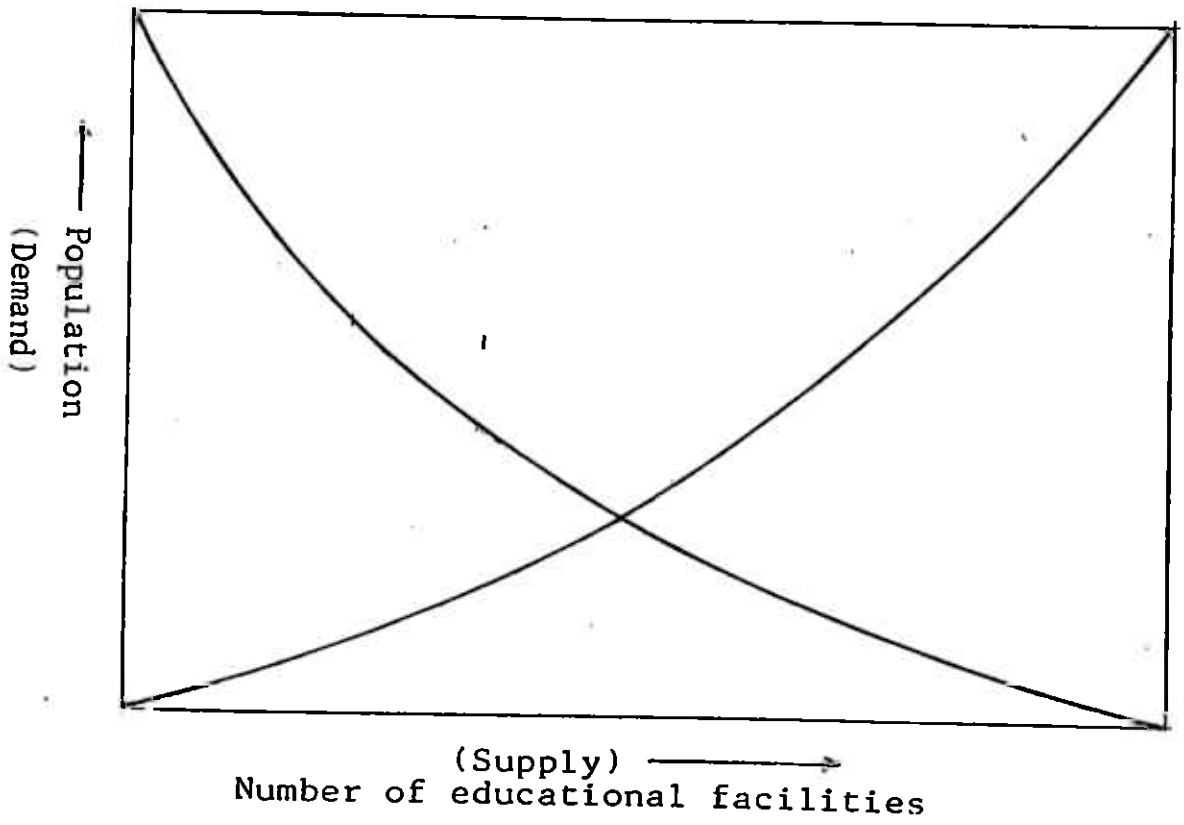
Exceptions to such pattern of the distribution of population and educational facilities can be observed at the super micro (sub-location) level where it is surprising to find a high density of population but with very few schools, examples of which include Got Agulu and Usenge sub-locations (of Yimbo location) with very high population density of 109 and 111 school-age children per Km^2 with only 3 and 6 educational facilities respectively. In such situations most school-age children have to seek education services from the neighbouring location/sub-location or from Mission or private educational facilities Lack of enough government educational facilities in a location and/or sub-location must be explained by other factors apart from the population distribution. Since it is clear that distribution of

government educational facilities do follow or correspond with population distribution, it is important to look first at the criteria used by the Ministry of Education (MEO) together with its shortcomings or repercussions before venturing into other factors of location and distribution of educational facilities, which is the partial theme of this paper.

CRITERIA USED BY MINISTRY OF EDUCATION (MOE)

One of the main objectives of rural education programme as stated by the MOE under the umbrella of District Focus for Rural Development is to formulate strategies for satisfying basic education needs in the rural areas offered by the government or non-governmental organizations. This policy is emphasized by the saying "..... it is the right of every child to receive at least some form of basic education....."[36] In line with this saying, the guiding principles have been population distribution and accessibility. In this process an attempt has been made to avoid writing-off already existing facilities even if they are under or over-utilized. This, therefore, implies that in some cases inequality is already a permanent feature unless efforts are made towards building new educational facilities in areas where they are most needed under the economic principle of supply and demand (see the figure below)

Figure 8: Demand and supply Curves for the use of primary schools



Source: Researcher's perception.

The selection of the types of facility and its location in an area will depend on: population density and distance of existing educational facilities, and in the selection of a site, such factors as topography, drainage, source of water supply, infrastructure and the general site formalities are considered. Finally, it is stated that choice of site should be done with a full understanding of existing and future patterns of development and human settlements, patterns which might affect educational functions.

4.4 ANALYSIS OF FACTORS INFLUENCING THE DISTRIBUTION OF EDUCATIONAL FACILITIES

It is important to note that most primary schools in this country and particularly in the area under discussion, were built in the pre-independence episode by various religious organizations. And those educational facilities that have emerged in the post-independence period have largely been built by the concerted efforts of the various local communities, with a little assistance from the government. This has led to the highly polarised nature of the distribution of primary schools, as only those areas with sizeable financial power have been able to establish such community schools.

The role of missionaries as a factor in the provision and distribution of rural educational facilities is of great importance. The distribution of mission educational facilities shows a definite religious or denominational polarity. It is the area of maximum influence of that particular denomination (e.g. Catholic) where the educational facility is located. An example of such influence is given by almost all schools in Nyang'oma sub-location, which were built under one denomination - Catholic.

But in the current years, the missionary influence has been minimal and therefore the decision has been left in the hands of the local community and in sone cases, it has been the influential politicians, wealthy business men, civic authorities etc in various communities that decide on the provision and "optimal" location of primary schools - possibly perpetuated under the umbrella of the recently introduced cost-sharing policy. Such a state of affairs, if left unchecked, will both in the short and long run give rise to and perpetuate spatial inequalities in the distribution of educational facilities.

The government's role, on the other hand has been that of supplying of teachers, training and supervision. Therefore, the final decision as to where schools were to be located was initially left to the religious organizations and later, to the community in question.

From figure 9, observations on the distribution of educational facilities can be made and conclusion drawn that Chisholm's method of describing and assessing factors operating to achieve a least cost settlement site, as suggested by Gould[37] was never adopted at all in the educational planning, since there were various religious organizations that had other motives and perhaps, the most important of all was to maximize the catchment area of their followers, in order to obtain a threshold population that would support the existence of a mission station. Therefore, various religious organizations set up primary schools on a competitive basis without considering the optimal location of the school. Similarly, a clan or community may set up a primary school, not because they have enough children for it to cater for, but simply because of prestige and prejudice and also to confirm their superior position in their particular region. Such schools may be located in areas which are inaccessible and with very low population density resulting in the underutilization of such educational facilities and therefore such schools are uneconomical to run. Of course, we must realize the fact that optimal location is difficult to achieve in the real world where we are always faced with various constraints (which include physical, economic, cultural, political etc). But a careful consideration of location factors could be taken into account whenever there is a need for a new primary school in any given region or locality.

The first geopgraphical hypothesis to be tested and analysed is that the primary schools are uniformly distributed throughout the study area. This hypothesis will be tested with a Chi-square test statistic to find out whether or not there are statistically significant differences between the observed and the expected distributions.

ASSUMPTIONS:

(i) The test is restricted to nominal (frequency) data.

(ii) It is a non-parametric test and therefore all the conditions of nonparametric tests must be met before it can be used.

(iii) That the sample data come from random samples.

The data collected during the interview were used as basis of investigation.

TABLE 18: COMPUTATION OF THE X^2 VALUE

LOCATION	OBSERVED NO. OF SCHOOLS (O)	EXPECTED NO. OF SCHOOLS (E)	(O-E)	$(O-E)^2$	$(O-E)^2$
South Sakwa	53	42	11	121	2.88
North Sakwa	39	42	-2	4	0.095
Yimbo	32	42	-10	100	2.381
Total	124				5.356

$\therefore \sum \frac{(O-E)^2}{E} = 5.356$

$\therefore$ The calculated $X^2 = 5.356$

The number of schools in the whole division was found to be 124 and the distribution of these schools per location was found to be: South Sakwa (53), North Sakwa (39) and Yimbo (32). The expected number of schools per location was also computed and found to be approximately 42.

During statistical testing of Null Hypothesis (Ho) at 90% significance level (i.e. $\alpha = 0.1$), the tabulated Chi-square value was found to be 4.60 and the degree of freedom (df) was 3 minus 1 = 2. The calculated Chi-square value was found to be 5.356. Since the calculated value of X^2 is greater than the tabulated critical value, the null hypothesis is rejected at the 0.1 significance level.

SUMMARY: The above finding implies that primary schools are not uniformly distributed throughout the study area.

Having done a simple test to determine the general distribution of primary schools in Bondo Division, we now turn our attention to quantitative factors influencing such distribution. The following hypothesis will be tested for that purpose. The factors considered are the transport network and the population of school-age children.

1 THE INFLUENCE OF TRANSPORT NETWORK ON THE DISTRIBUTION OF PRIMARY SCHOOLS

Ho: Accessibility does not significantly influence the distribution of primary schools in the study area.

Hi: Alternative.

Under the above Ho hypothesis, it is assumed that the distribution primary schools is in no way related to the differential trnsport network in the study area, and that the observed differences are mainly due to chance occurence.

COMPUTATION OF X^2 VALUE RELATING DISTANCE FROM THE MAIN ROAD AND THE NUMBER OF SCHOOLS

The primary data obtained from the field are first tabulated - the distance values obtained from different schools are first put in categories and the number of schools for each category determined (see table 19).

A significance level of 0.05 is decided upon.

TABLE 19: SHOWS THE RAW DATA AND THE COMPUTATION OF X^2 VALUE

DISTANCE CATEGORIES	OBSERVED NO. OF SCHOOLS (O)	EXPECTED NO. OF SCHOOLS (E)	(O-E)	$(O-E)^2$	$\frac{(O-E)^2}{E}$
0.00-1.99	22	7.75	+14.25	203.06	26.202
2.00-3.99	4	7.75	-3.75	14.06	1.815
4.00-5.99	3	7.75	-4.75	22.56	2.911
6.00+	2	7.75	-5.75	33.06	4.266
TOTAL	31	31			35.194

The Chi Square statistic is calculated as follows:-

$$X^2 = \Sigma \frac{d_i^2}{e}$$

Where:

X^2 = is the symbol for Chi square,

d = is the difference between the observed and the expected frequency for each category, and

e = is the expected frequency for each category.

In this case there are four categories: 0.00-1.99; 2.00-3.99; 4.00-5.99 and 6.00+. The observed frequencies are 22, 4, 3 and 2, and the expected frequencies are 7.75, 7.75 and 7.75. The value of X^2 is therefore

$$X^2 = \frac{(22-7.75)^2}{7.75} + \frac{(4-7.75)^2}{7.75} + \frac{(3-7.75)^2}{7.75} + \frac{(2-7.75)^2}{7.75}$$

$$= 26.202 + 1.815 + 2.911 + 4.266$$

$$= 35.19$$

The degrees of freedon (df) is 4 minus 1 = 3. The calculated X^2 is 35.19 and from the table, the critical value of X^2 at the 0.05 significance level with 3 degrees of freedom is 7.82. Since the calculated X^2 value is greater than the tabulated critical value, the null hypothesis is rejected at the 0.05 significance level

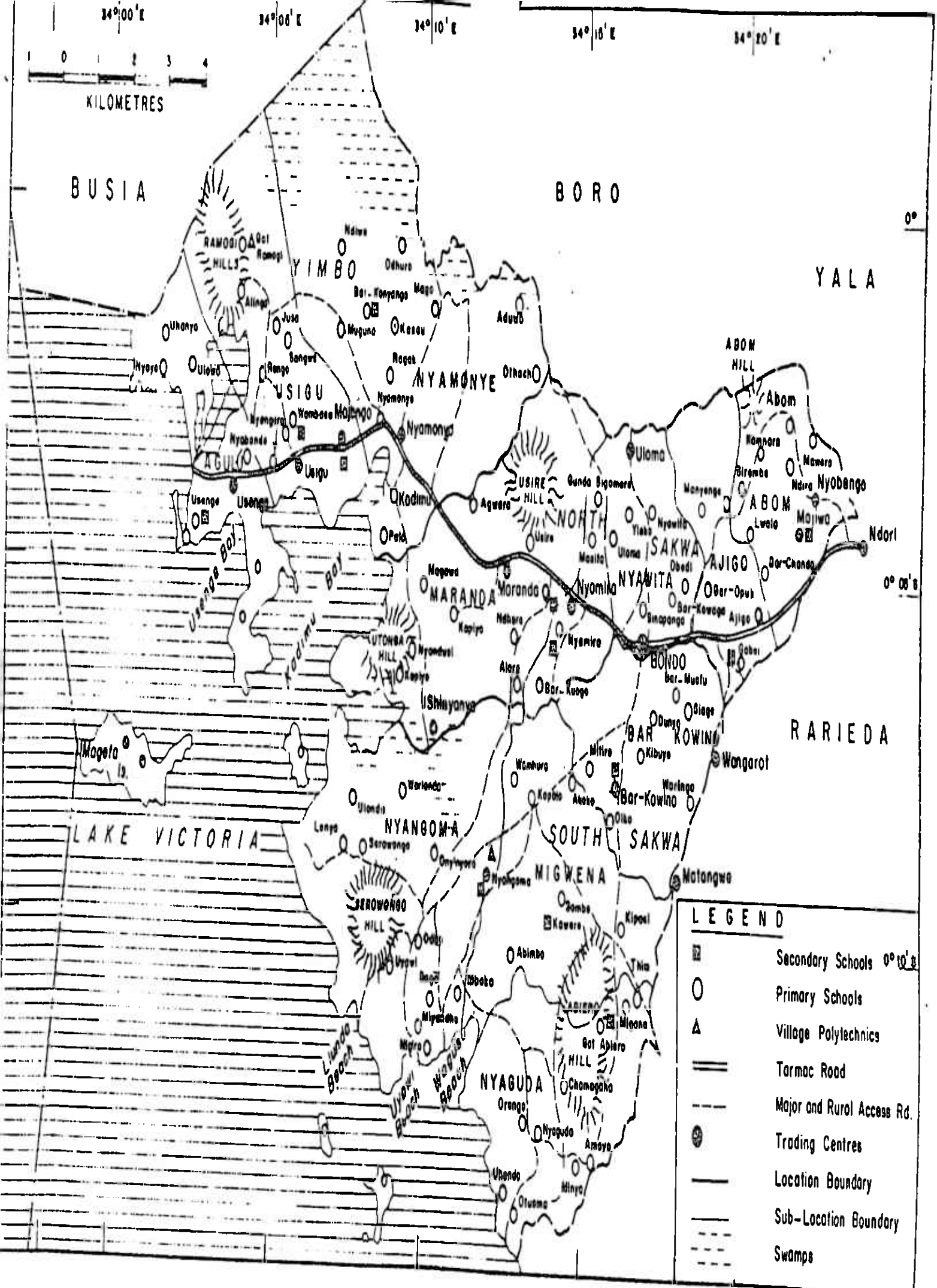


Fig. 1 : DISTRIBUTION OF SCHOOLS AND ROAD NETWORK IN BONDO DIVISION.

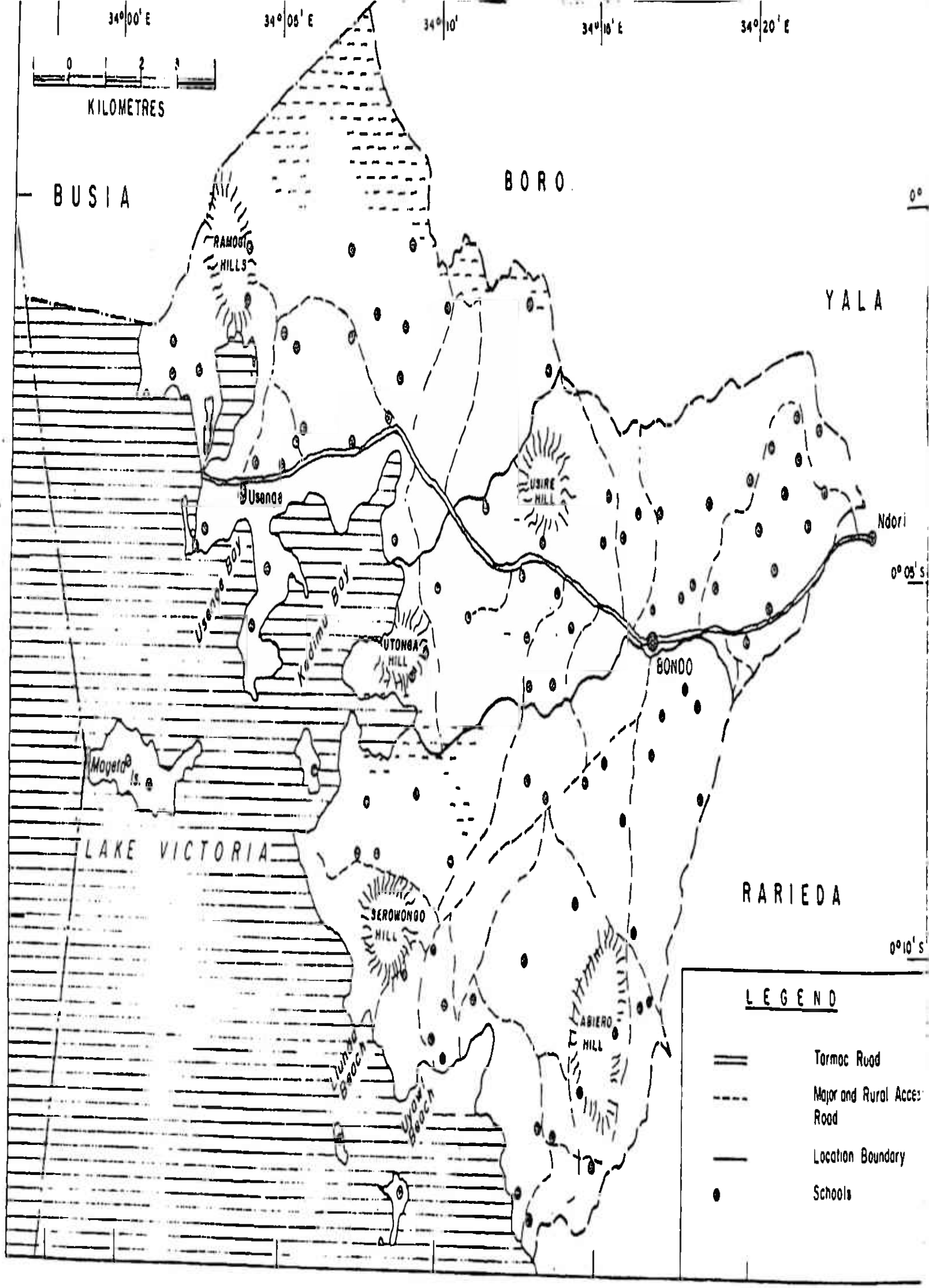


Fig. 1 : DISTRIBUTION OF SCHOOLS AND ROAD NETWORK

SUMMARY: From the above statistical test, it can be concluded (at 95% confidence limit) that accessibility does significantly influence the distribution of primary schools in the study area. This conclusion is further propounded by the fact that an examination of a map showing the distribution of primary schools which is superimposed on a map showing the transportation network clearly gives some kind of correlation, ~~with areas having some kind of correlation~~, with areas having very high density of transport network (e.g Abom, Ajigo, Maranda and Nyawita sub-locations) having more schools as compared to areas with low density of transportation network (e.g. Got Agulu and Nyamonye sub-locations) (see figure 9 (b). A closer examination of figure 9 (b) also reveals that most of the primary schools in the study area tend to be located near to the existing main roads. The importance of accessibility in terms of school supervision and distribution of other learning facilities will be discussed in the next chapter.

2 THE EFFECT OF THE DISTRIBUTION OF POPULATION OF SCHOOL-AGE CHILDREN ON THE DISTRIBUTION OF PRIMARY SCHOOLS

Having tested the influence of transportation network on the distribution of primary schools, we now turn our attention to the test of the influence of the distribution of school-age children on the distribution of primary schools in the study area.

In order to understand the influence of the distribution of population of school-age children on the distribution of primary schools, the following null hypothesis was formulated.

Ho: There is no rank correlation between the distribution of primary schools by sub-location and the distribution population of school-age children. In other words, the distribution of primary schools by sub-location is in no way related to the distribution of the population of school-age children. It is assumed that any observed relationships between the two variables is due to chance occurrence.

This hypothesis will be tested with Spearman Rank correlation test to find out whether or not there are statistically significant correlations between the observed and the expected distributions.

JUSTIFICATION OF THE CHOICE OF THE TEST STATISTIC

The Spearman Rank correlation co-effecient is a nonparametric measure of the relationship between two sets of ordinal (ranked) values. It is a technique which deserves to be more widely used by geographers as an alternative to product moment correlation ~~of two~~

with its restricting assumption of two normally distributed variables.

The spraman test can be applied to data which are inherently ordinal, such as preference data, of to interval data converted to ranked form (as ~~ab~~ in our case here).

COMPUTATION

The data collected during the interview were used as basis of investigation. The total number of school-age children (both those attending school and those at home of ages between 5 and 15 were obtained and tested against the actual number of shool facilities in each sub-location. These data are tabulated in the first two columns of Table 20. The third column contains the ranking of the number of school-age children by sub-location. They have been ranked from smallest to largest, i.e 1415 becomes i and

TABLE 20: ORIGINAL AND RANKED DATA FOR SPEARMAN RANK CORRELATION

SUB-LOCATION	POP. OF SCH. AGE (5-15(X)	NO. OF SCH. (Y)	RANKED VALUES r_x	r_y	RANK DIFFERENCE d	d^2
MIGWENA	2409	8	5	4	1	1
NYAGUDA	3649	12	11	8.5	2.5	6.25
NYANGOMA	4166	21	12	12	0	0
BAR-KOWINO	2595	11	7	7	0	0
ABOM	2819	10	8	6	-2	4
AJIGO	2030	5	2	2	0	0
MARANDA	2209	12	3	8.5	-5.5	30.25
NYAWITA	2447	13	6	10.5	-4.5	20.25
NYAMONYE	3073	13	10	10.5	-0.5	0.25
USIGU	2300	9	4	5	-1	1
USENGE	2889	7	9	3	6	36
GOT AGULU	1415	3	1	1	0	0
TOTAL	32003	124				99

$\Sigma x = 32003 \quad \Sigma Y = 124$

$X = 258 \quad Y = 10.3 \quad \Sigma d^2 = 99$

4166 ~~between~~ 12. The rankings of the second variable number of schools by sub-location, are given in the fourth column. The difference between

the ranked values for each sample point and the squares of these differences are also given in table 20.

The rank correlation co-efficient can now be calculated using the following equation:

$$r_s = 1 - \frac{6\Sigma d^2}{n^2 - n}$$

Where

r_s = is the Spearman rank correlation co-efficient,

d = is the difference in ranking for each item,

Σd^2 = means that the differences must be squared and then summed,

and n = is the number of items ranked, i.e the number of pairs of rankings.

$$r_s = 1 - \frac{6\Sigma d^2}{n^3 - n}$$

$$= 1 - \frac{6 \times 99}{12^3 - 12}$$

$$= 1 - 0.3461538 = 0.6538462$$

$$= 0.65$$

For comparision, the value of the product moment correlation co-efficient for the same data in interval form is 0.826 (see figure 10). It must be remembered that the process of converting from interval to ordinal measurements is bound to result in some loss of information. There is no reason to expect that rank correlation should produce the same result as product-moment correlation when the two techniques are applied to a common data set. Rank correlation may well be a more reliable measure in many instances, since it does not depend on any possibly unwarranted, assumptions about the frequency distributions of the variables.

SIGNIFICANCE/INTERPRETATION

Stating it again, the null hypothesis is that there is no rank cofrelation between the number of primary schools and the number of school-age children by sub-location, in the population. In other words the population rank correlation co-efficient (denoted by p_s) is zero. The fact that the sample rank correlation co-efficient (r_s) is not zero is due to chance in the sampling process.

A significance level of 0.05 is decided upon. The degrees of freedom for a significance test of r_s are the number of pairs of ranked values, n.

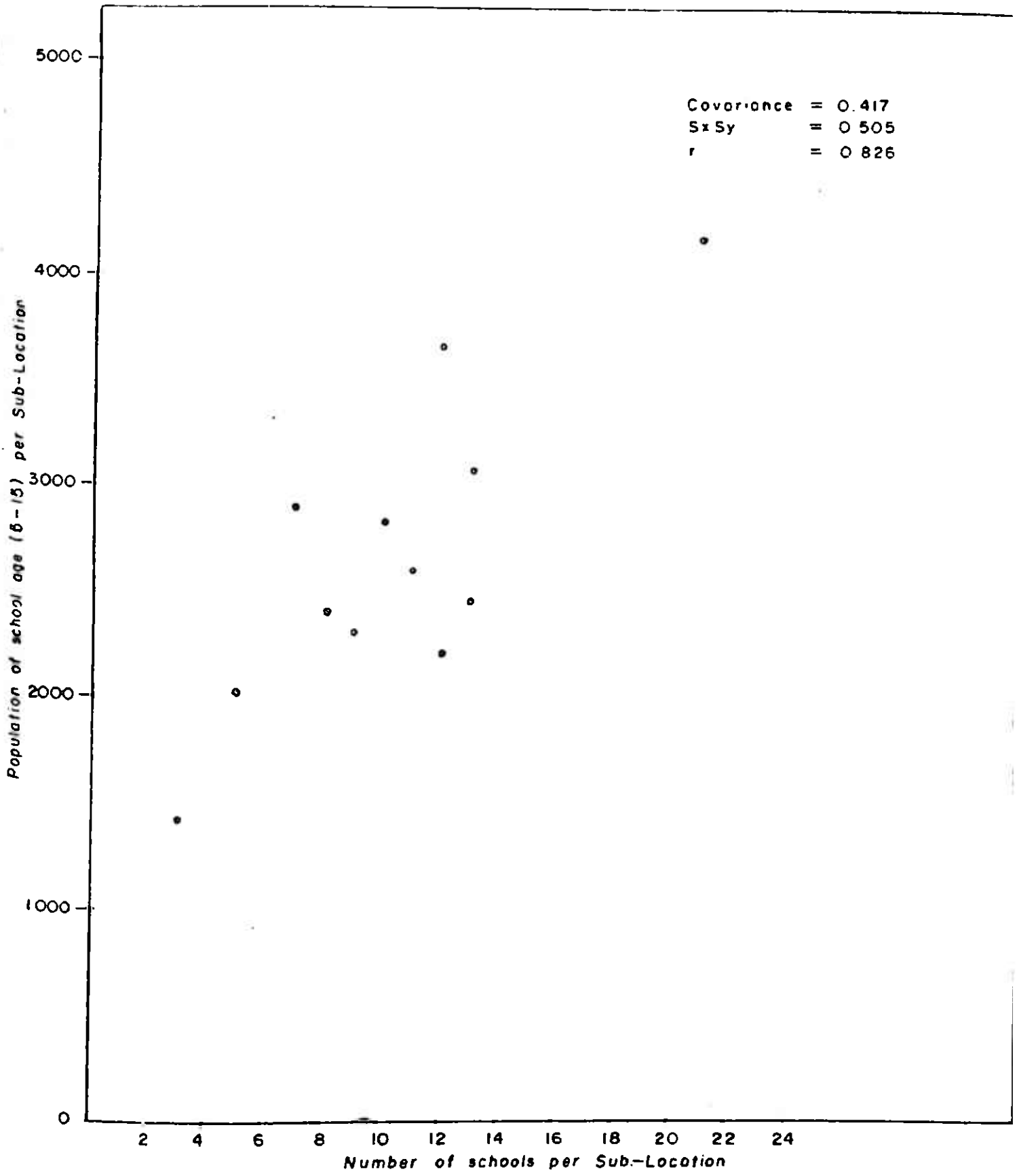


Fig. 10 : PRODUCT-MOMENT CORRELATION BETWEEN THE POPULATION OF SCHOOL AGE CHILDREN (5-15) AND THE NUMBER OF PRIMARY SCH SCHOOLS IN EACH SUB-LOCATION

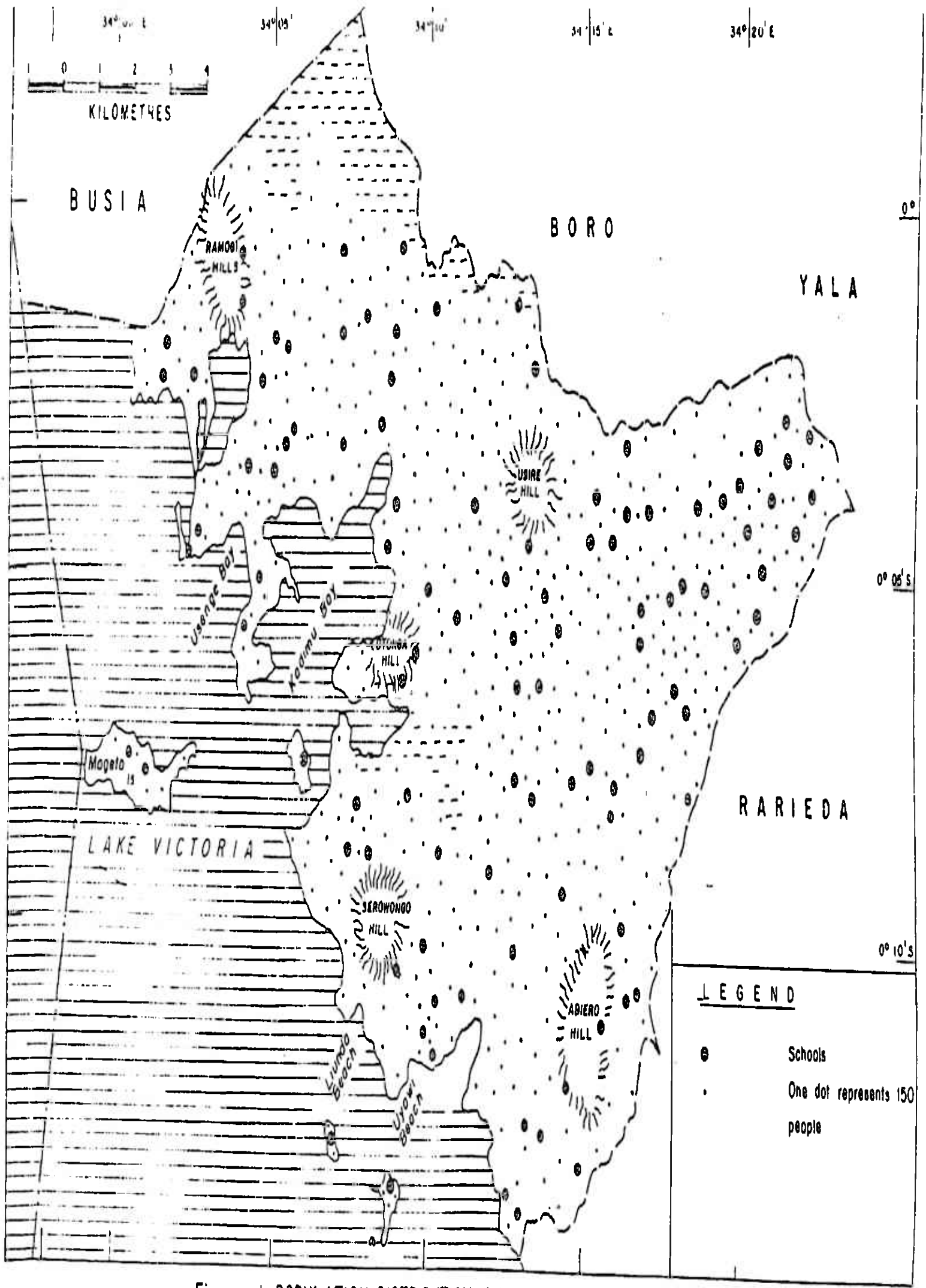


Fig. 11 : POPULATION DISTRIBUTION AND DISTRIBUTION OF SCHOOLS

The rank correlation between the number of primary schools and the number of school-age children, by sub-location, is 0.654, and the degrees of freedom are 12 (the number of pairs of rankings) Assuming a significance level of 0.05, the crifical value of rs for a one-failed test is found to be 0.497. For a two-failed test at the same significance level the crifical value is 0.591. This means that there is a probability of 0.05 of getting a sample rank correlation of 0.497 or more when the population correlation is zero. This is a one-failed test ($H_1: Ps > 0$). There is a probabilityof 0.05 of getting a sample rank correlation of 0.591 or more, or - 0.591 or less, when the population correlation is zero. This is a two-failed test ($Hi: Ps \neq 0$).

For the correlation between the number of primary schools and the number of school-age children, (by sub-location) the alternative bypothesis is likely to be directional: that there is a positive correlation between the two variables in the population. A one failed test is therefore appropriate. The calculated value of rs is greater than the crifical value for a one failed test at the chosen significance level of 0.05. The null hypothesis can therefore be rejected, and the conclusion can be drawn that there is a significant rank correlation between the numbers of primary schools and thenumbers of the population of school-age children (by sub-location) at the 0.05 level.

SUMMARY

The rejection of our null hypotherrs above implies that primary schools are distributed in aaccordance with what is expected on the basis of population of school-age children found in each sub-location This is apparently true for a number of cases as shown in the table. For instance, Nyangoma sublocation, with the highest number of the population of school-age children (4166) also has the highest observednumber of school facilities (21). This is followed by Nyamonye and Nyawita sub-locations with the same number of schools (13 each) but withdifferent numbers of the population of school-age children (3073 and 2447 respectively). Theoretically, Nyamonye is expected to have more primary schools than Nyawita but this is not thecase due to other factors militating or dictating against the expected theoretical framework. These factors possibly include

differential income distribution between the two sub-locations and the nature of the inherent transport network in the two sub-locations. Nyamonye is a sub-location in Yimbo location which is an area with very low per capital income/house hold income (see appendix 7).

Since most rural primary schools are built on harambee basis by the local communities, areas with very low income people are deprived of such opportunity and Nyamonye sub-location is no exception. Nyawita on the other hand is inhabited with people with a higher income as compared to Nyamonye. This differential distribution of income between the two regions is dictated by the differential climatic elements and educational attainment. Nyawita is well served with rainfall (which is of orographic origin) and other climatic elements and since the main economic activity in both sub-locations is peasant farming/small-holder, Nyawita stand a better chance of good harvest as compared to Nyamonye with very low and erratic rainfall of convectional origin. These defferences in climatic elements hence the state of economic activities is reflected in the distribution of primary schools in the two regions.

Another factor which should be considered is accessibility or transportation network. As we have seen, accessibility significantly influences the distribution of primary schools in the study area (see section 4.4.1). Transport network in Nyamonye sub-location is relatively poorly developed as compared to Nyawita sub-location and most of the areas in Nyamonye are inaccessible. Population is mainly concentrated along the lake shore and few scattered parts inland forming population islands (see figure 10). Nyawita on the other hand has good transport network and with even distribution of population. We can therefore conclude that Nyawita and Nyamonye sub-locations have the same number of primary schools but different numbers of the population of school-age children, mainly due to differential income distribution and accessibility. A region with a reasonable average per capital income and good transport network will possibly have a good number of primary schools even if the number of school-age children population is relatively low.

From table 20 it can be observed that Got Agulu sub-location has the lowest number of primary schools (3) and also the lowest number of schoold-age children population. The reasons for this include the rugged terrain of the region which militate against human settlement resulting in low density of population and therefore only few schools are needed to serve the relatively low number of school-age children. This observation obeys our alternative hypothesis that there is significant correlation between the number of population of school-age children and the number of primary schools by sub-location. But it is important to note that this situation should not always be taken as absolutely true, since other factors may dictate the distribution of schools in a given region other than population distribution as we have seen in the case of Nyawita and Nyamonye sub-locations. From our sample data we can draw a general conclusion that the distribution of primary schools in Bondo Division follows that of population of school-age children though there are local perturbations which can be observed by any critical reseacher.

PATTERN OF THE DISTRIBUTION OF PRIMARY SCHOOLS

It can be argued that the existence of pattern in the spatial arrangementof phenomena on the earth's surface provides a fundamental stimulus to much of the geographers work. Geographers talk of settlement patterns; land use patterns; drainage patterns etc. In each case 'pattern' implies some sort of spatial regularity, which in turn is taken as a sign of the working of a regular process.

The recognition and measurement of pattern is therefore of great importance to the researcher in his attempt to study the distribution of primary schools and the factors or processes which has resulted in such pattern to emerge.

The next geographical problem rather related to the previous ones is therefore that the primary schools are not only distributed in proportion to school-age children, they are also not evenly distributed. Since it had been demonstrated earlier in this chapter that the distribution of school-age population is not completely even, it would be proper that the spacing of schools should also not be completely even. The null hypothesis is that the observed arrangements is the result of primary schools being located at random within the study region. In other words, there is no significant difference between the observed mean spacing for the first order nearest-neighbour and that expected in a random of neighourhood, based on the first nearest-neighbour (see figure 12).

NEAREST-NEIGHBOUR ANALYSIS

Nearest-neighbour analysis is a technique developed by plant ecologists (Clark and Evans, 1954), which is specifically designed for measuring pattern in terms of the arrangement of a set of points in two or indeed three dimensions. In our case the technique involves calculating the mean of the distance between all primary schools and their first nearest neighbours (see figure 12).

Figure 12(a) shows the distribution of primary schools within Bondo Division. In figure 12(b) each primary school has been linked by an arrow to its nearest neighbour. In some cases, such as Lenya and Sarawongo primary schools and Mitundu and Mageta primary schools, nearest neighbours form a reflexive pair, i.e each one is the nearest neighbour of the other. Once the nearest neighbours have been identified the nearest neighbour distance for each primary school can be measured (or obtained during the interview with the headmasters), and the mean

nearest neighbour distance found. The numbers of nearest-neighbour distance is always the same as the number of points (primary schools). These calculations are given for figure 12 in table 21. It can be seen that the mean nearest-neighbour distance in this case is 2.055 Km.

TABLE 21: DISTANCES BETWEEN EACH SCHOOL AND ITS FIRST NEAREST-NEIGHBOUR

CODE NO.	NAME OF SCHOOL	DISTANCE (KM)	CODE NO.	NAME OF SCHOOL	DISTANCE (KM)
1.	BAR-KOWINO	2.0	29.	LENYA	1.2
2.	JUSA	2.4	30.	NYABONDO	1.0
3.	MAJENGO	2.0	31.	MARANDA	1.5
4.	WAMBASA	1.7	32.	ALING'A	3.2
5.	PALA	3.0	33.	ABIDHA	3.1
6.	NYAMONYE	1.0	34.	GOT-MATAR	3.2
7.	AKOKO	1.0	35.	GOT-RAMOGI	3.2
8.	ORENGO	2.0	36.	KANYIBOK	2.2
9.	WAMBARRA	2.3	37.	KASAU	1.2
10.	GOBEI	1.5	38.	MUGUNA	3.0
11.	BONDO	1.5	39.	MAGO	2.2
12.	BAR-OPUK	2.3	40.	MAHANGA	2.6
13.	GOT-ABIERO	1.5	41.	MITUNDU	2.0
14.	NYANGERA	4.0	42.	MAGETA	2.0
15.	MBEKA	2.0	43.	NDIWO	3.0
16.	NYAMIRA "M"	1.5	44.	NYAYO	2.5
17.	KIPASI	2.1	45.	OTHACH	2.8
18.	GOMBE	3.0	46.	ODHURO	3.2
19.	SINAPANGA	2.0	47.	RAPOGI	3.0
20.	NYAWITA	3.0	48.	RAGAK	2.5
21.	USENGE	0.3	49.	SANGWE	2.9
22.	BAR-KANYANGO	3.0	50.	SANDA	2.7
23.	NYANG'OMA "M"	0.4	51.	ULOWA	2.5
24.	MIGONO	1.0	52.	UHANYA	2.5
25.	MINYA	1.0	53.	BAR-AWENDO	2.0
26.	ALARA	1.0	54.	CHUNGA	2.7
27.	ONYINYORE	2.8	55.	MAGAK	3.0
28.	SERAWONGO	1.2	56.	DAGO	3.0

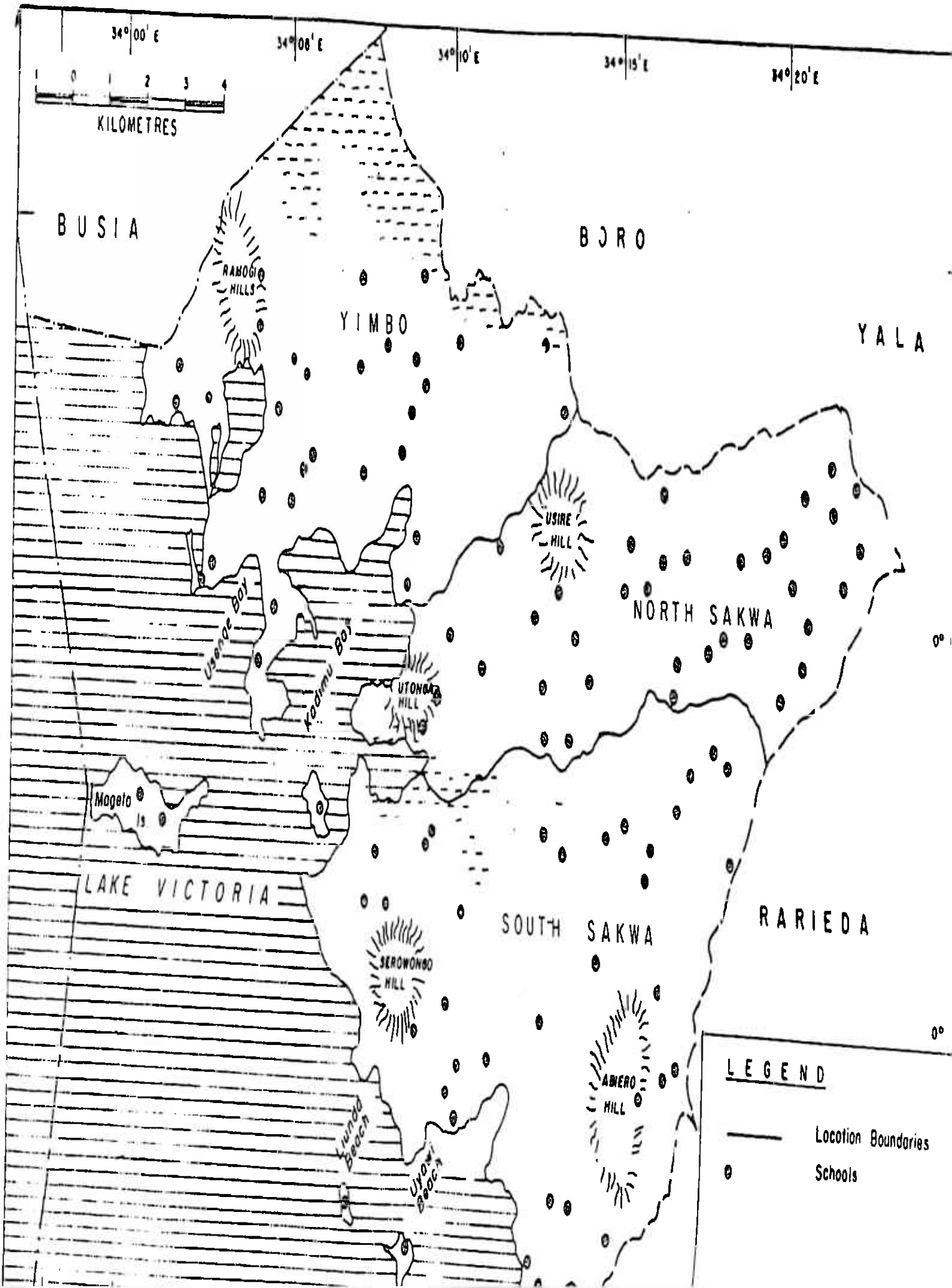
57.	MIGIRO	2.0	90.	RATIYA	3.0
58.	MIYANDHE	1.5	91.	BUR-LOWO	3.2
59.	NYANG'OMA "G"	0.4	92.	BAR-KWOGO	3.0
60.	NYANG'OMA "B"	0.4	93.	MITIRO	2.6
61.	NYANG'OMA "TP"	0.3	94.	ABOM	1.2
62.	OYAMO	9.0	95.	AJIGO	1.1
63.	ODAO	5.0	96.	AGWARA	1.5
64.	SIFU	4.0	97.	BAR-CHANDO	1.3
65.	ULANDA	2.0	98.	BAR-KAWAGA	0.9
66.	UYAWI	2.0	99.	KEYO-KODINDO	1.2
67.	WARUANDA	2.0	100.	KAYOGO	1.4
68.	NYAMWANGA	3.0	101.	KAPIYO	1.6
69.	OLAGO	2.5	102.	KAMNARA	1.1
70.	RABANGO	2.7	103.	LWALA	1.3
71.	NDEDA ISLAND	6.5	105.	MASITA	1.4
72.	WARINGA	3.0	106.	MANYONGE	1.7
73.	UHENDO	2.0	107.	MAJIWA	1.6
74.	LIGAWA	3.2	108.	MAWERE	1.2
75.	SIAGE	2.5	103.	MAGAWA	2.3
76.	OTUOMA	2.7	109.	NDHERE	1.0
77.	OIKO	2.1	110.	NDIRA	1.3
78.	NYAGUDA	2.0	111.	NYANDUSI	1.6
79.	MATANGWE	3.8	112.	SHINYANYA	2.5
80.	MARANYONA	3.1	113.	USIRE	2.1
81.	KIBUYE	3.0	114.	ULOMA	1.0
82.	DUNYA	2.7	115.	UGADHI	1.2
83.	CHAMAGAHA '	2.5	116.	YIEKE	1.5
84.	BAR-MUOFU	1.5	117.	KAMBAJO	1.3
85.	ATILILI	2.0	118.	OBEDI	1.0
86.	ABIMBO	2.2	119.	NYAKASUMBI	2.0
87.	GOT-KOCHIENG'	1.9	120.	MARANDA M. HANDIC.	0.7
88.	DIER-AORA	3.0	121.	OKOLA	1.2
89.	THIM	1.0	122.	SIREMBE	1.3
			123.	GUNDA SIGOMERE	2.0
			124.	MILENGA	2.3

$n = 124$ $\quad \Sigma d = 254.8$

Mean nearest-neighbour distance:

$$\bar{d} = \frac{\Sigma d}{n} \qquad \frac{254.8}{124} \qquad 2.0548387$$

$\therefore \quad \bar{d} = 2.055$


34° 00' E
34° 05' E
34° 10' E
34° 15' E
34° 20' E
0 1 2 3 4
KILOMETRES
BUSIA
BUNYORO
YIMBO
YALA
RANOGI HILLS
USIRE HILL
NORTH SAKWA
Usonde Bay
Kadimu Bay
UTONDA HILL
Mageta Is
LAKE VICTORIA
SOUTH SAKWA
RARIEDA
SERONGO HILL
ABERO HILL
Lunda Beach
Uyoma Beach
0°
LEGEND
Location Boundaries
Schools

The theoretical value of the mean nearest-neighbour distance for the spatial arrangement of primary schools was then calculated. This theoretical or expected mean nearest-neighbour distance for a random arrangement can be calculated from the following equation:

$$\bar{d}ran = \frac{1}{2\sqrt{p}} \qquad (10)$$

Where: dran = is the expected mean nearest-neighbour distance for a random arrangement of primary schools.

p = is the density of primary schools per unit area (the number of primary schools divided by the area)

In our case, the area is 574 Km^2 and there are 124 primary schools. The density of schools is therefore 124/574 = 0.216. Note that the area must be calculated in the same units, in this case kilometres, as the nearest-neighbour distances. Using equation 10 above, the expected mean nearest-neighbour distance for a random arrangement of 124 primary schools within an area of 574 Km^2 can now be calculated:

$$\bar{d}ran = \frac{1}{2\sqrt{0.216}}$$

$$= \frac{1}{2 \times 0.465} = \frac{1}{0.930} = 1.076$$

$$\therefore \quad \bar{d}ran = 1.076$$

If the primary schools in figure 12 had been arranged randomly the mean nearest-neighbour distance could be expected to be 1.076.

We can now calculate the expected mean nearest-neighbour distance for these primary schools if they had been arranged in the most dispersed way possible. Here it is assumed that the primary schools have the maximum possible distance separating them; they are as far apart as they can possibly be. This type of pattern is often referred to in description of nearest-neighbour analysis as 'regular or 'uniform'.

For a dispersed pattern it can be shown that the expected nearest-neighbour distance is given by:

$$\bar{d}\ dis = \frac{2\frac{1}{6}}{3\frac{1}{4}\sqrt{p}} \quad \text{or} \quad \frac{1.07453}{\sqrt{p}} \qquad (11)$$

For our case $\sqrt{p}$ has already been calculated as 0.465. The expected mean

nearest-neighbour distance for a dispersed pattern in this case is therefore 1.07453/0.465 = 2.311.

A third type of pattern can be considered in which the primary schools are as close as possible to their nearest-neighbours. In the most extreme case of such a 'clustered' pattern each primary school will be so close to its nearest-neighbour that the mean nearest-neighbour distance will be zero.

NOTE: Nearest-neighbour analysis therefore is concerned with finding the position of an observed spatial arrangement of primary schools (or any other phenomena) along a scale of pattern types. At the two extremes there are clustered and dispersed patterns, with a random arrangement falling somewhere in between.

In our case, with 124 primary schools in an area of 574 Km^2, the expected mean nearest-neoghbour distance is 0.0 Km for a clustered pattern and 2.311 Km for a dispersed pattern. The expected mean nearest-neighbour distance for a random arrangement is 1.076 Km. Since the observed mean nearest-neighbour distance is 2.055 Km. it can be said that the observed arrangement is close to being a dispersed pattern.

TABLE 22

PATTERN TYPES	EXPECTED MEAN NEAREST-NEIGHBOUR DISTANCE (IN KM)
Clustered	0.000
Dispersed	2.311
Random	1.076
Observed mean nearest-neighbour distance	2.055

THE NEAREST-NEIGHBOUR INDEX

The nearest-neighbour index provides a more concise measure of pattern in terms of asingle value. The nearest-neighbour index is simply the observed mean nearest-neighbour distance divided by the expected mean nearest-neighbour distance for a random arrangement :

$$R = \frac{\bar{d}\ obs}{\bar{d}\ ran}$$

Where:

R = is the nearest-neighbour index,

d obs = is the observed mean nearest-neighbour distance, and

d ran = is the expected mean nearest-nieghbour distance for a random arrangement of primary schools.

NOT: The nearest-neighbour index can have a value between 0.0 indicatin a completely clustered pattern, and 2.15, indicating a completely dispersed pattern. A random arrangement is indicated by a nearest-nieghbour index of 1.0

In our case here:

$$R = \frac{2.056}{1.076} = 1.910$$

$$R = 1.910$$

This suggests that the observed arrangement of primary schools is very 'dispersed'.

SIGNIFICANCE TEST

It is possible to apply a significance test to nearest-neighbour analysis to decide how probable it is that the observed arrangement of primary schools occurred by chance. The null hypothesis is that the observed arrangement is the result of primary schools being located at random within the study area. The test statistic used is based on the difference between $\bar{d}$ obs and $\bar{d}$ ran, and is very similar in form to student's t section 3.6:

$$C = \frac{\bar{d}\ \text{obs} - \bar{d}\ \text{ran}}{SE_{\bar{d}}} \qquad (3$$

Where:

C = is the test statistic

$\bar{d}$ obs = is the observed mean nearest-neighbour distance,

$\bar{d}$ ran = is the expected mean nearest-neighbour distance for a random arrangemdnt, and

$SE_{\bar{d}}$ = is the standard error of the mean nearest-neighbour distance.

The standard error of the mean nearest-neighbour distance is calculated as follows:-

$$SE_{\bar{d}} = \frac{0.26136}{\sqrt{np}}$$

Where:

n = is the number of primary schools, and

p = is the density of primary schools per unit area.

For the arrangement shown in figure 12 this gives:

$$SE_{\bar{d}} = \frac{0.26136}{\sqrt{124 \times 0.216}}$$

$$= \frac{0.26136}{\sqrt{26.784}}$$

$$= \frac{0.26136}{5.175}$$

$$SE_{\bar{d}} = 0.051$$

∴ The test statistic 'C' can now be calculated for figure 12:

$$C = \frac{\bar{d}\ obs - \bar{d}\ ran}{SE_{\bar{d}}}$$

$$= \frac{2.055 - 1.076}{0.051}$$

$$C = 19.196$$

NOTE: The sampling distribution of the test statistic 'C' is in fact the normal distribution. In other words, C is a standard normal deviate. Positive values denote a dispersed pattern and negative values a clustered one.

Assuming a significance level of 0.05, the appropriate critical value for a one-tailed test is 1.645, which is less than the observed value of C. The test therefore shows that the null hypothesis can be rejected at the 0.05 level i.e that the arrangement shown in figure 12 can be considered to be 'significantly dispersed' at the 0.05 level.

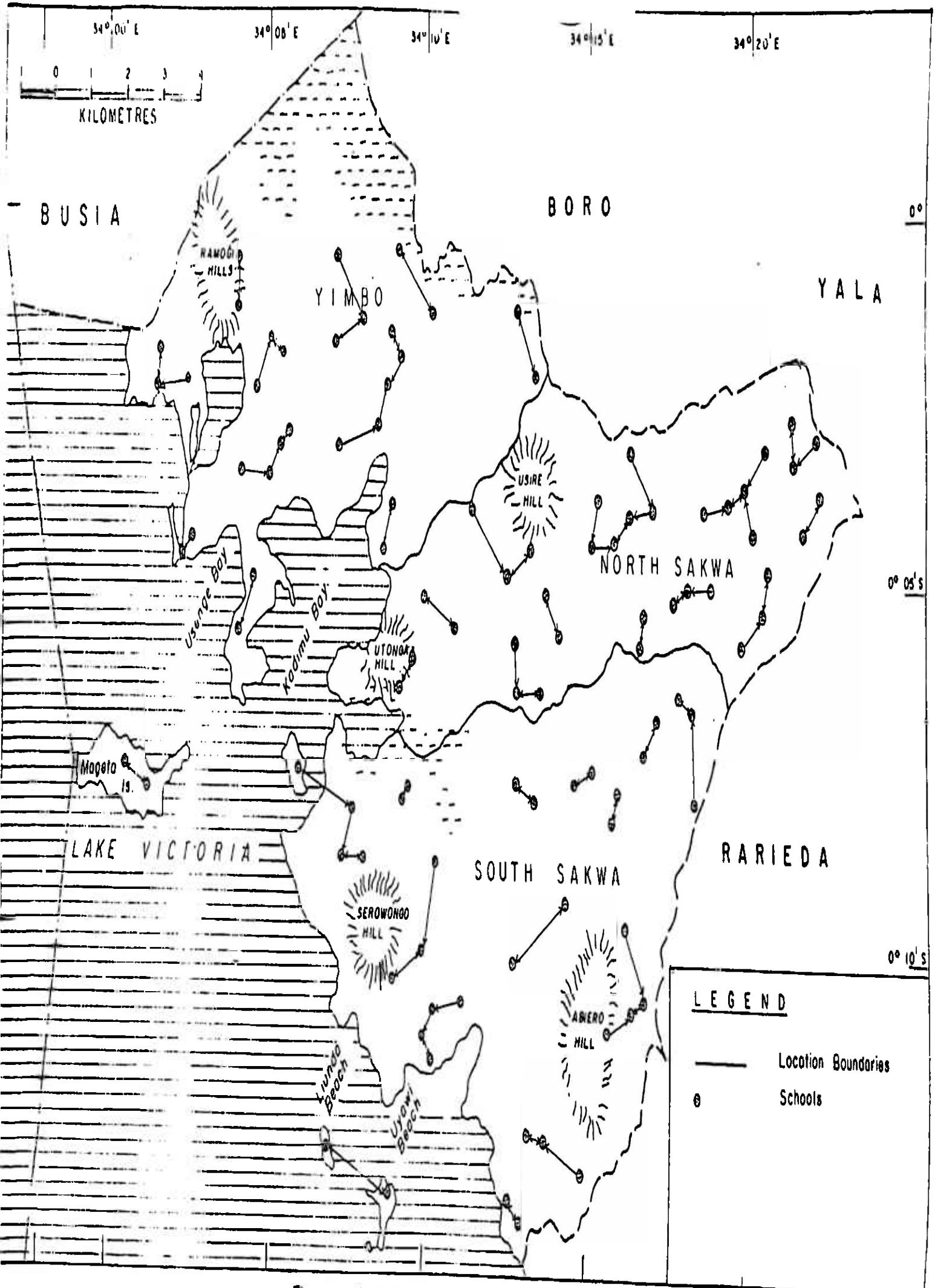


Fig. 12(b) : DISTRIBUTION OF SCHOOLS

SOME PROBLEMS IN THE APPLICATION OF NEAREST-NEIGHBOUR ANALYSIS

The various theoretical equations used in nearest-neighbour analysis, particularly $\bar{d}ran=\frac{1}{2\sqrt{p}}$ and $sed=\frac{0.26136}{\sqrt{np}}$, are based on two crucial assumptions. The first is that the points are located within an infinite area. The second is that the points are free to locate anywhere within that area. In most geographical situations these assumptions are manifestly unrealistic. In many cases where nearest-neighbour analysis is applied the delimitation of the study area is quite arbitrary. Since the size of the area influences the point density, P, it also seriously affects the outcome of the analysis. If a study area is enlarged, without bringing more points into it, the effect is to increase the expected value of $\bar{d}ran$, without of course changing the value of $\bar{d}obs$. Thenearest-neighbour index, R, will consequently be decreased in value, although the appearance of the observed arrangement of points and its degree of clustering or dispersion will not have changed at all.

There is also some evidence (Ebdon,1976) that the significance test described above is consistently biased towards finding significantly dispersed patterns. The existence of these problems does not mean that nearest-neighbour analysis should not be used by geographers. The technique provides a very useful descriptive measure of point patterns such as the distribution schools in a given area.

SUMMARY

Inspite of the above stated problems of the application of nearest-neighbour analysis, we can still draw some concrete conclusions from the results obtained during hypothesis testing. It is important to recall that ournull hypothesis tested statistically above is that the observed distributional pattern of schools does not differ significantly from that expected on a random of neighbourhood. The test for significance used is that of the Z-distribution. As stated above, because the calculated value of Z (19.196) is greater than the oritical value (1.645), our null hypothesis was thus rejected at 95% (0.05) significance level. This means that the distribution of schools differs significantly from random in a regular direction since $\bar{d}obs$ is 2.055. Theresults of the Z-distribution further validate the feeling that $\bar{d}obs$ was not obtained

by chance. In other words, there have been distinct processes that have caused the present pattern of schools to have a tendency towards regularity. These processes have alreadybeen mentiond in this chapter and can be grouped under broad headings as physical and human processes.

NOTE: These results may seem to contradict ourresults in the previous section where we talked of schools being distributed in accordance with the distribution of school-age children in the study area which implies a random distribution. It is important to note that nearest-neighbour analysis does not tell us that there is complete uniform (even) distribution of primary schools nor does it tell us that there is complete randomness in the destribution of schools in the study area. What it tells usis that the distribution of primary schools in the study area tends towards evenness meaning that there is some elements of random distribution as well as even distribution (see figure 12 for clarification), though the distribution is more of even than random. This kind of pattern as we have seen in section 4.5 is dictated by the pattern of population distribution which also tend to follow the same pattern ofdistribution as that of primary schools. The regular distribution of schools can be seen in the northern parts of South Sakwa, most parts of North Sakwa and north-eastern parts of Yimbo locations. The random distribution of schools is clearly evident in the south and south-western parts of South Sakwa (especially areas bordering the lake shore), most parts of Yimbo especially the western and the lakeshore regions. It will be recalled that most of the areas with uniform distribution of schools are located in the lower zone where the distribution of population has a high tendency towards evenness. Thefactors that have favoured this pattern of distribution have been discussed in detail in chapter 2.

On the other hand, areas which do not exhibit a clear uniform spacing of schools, mainly fall within the Higher Zone where the physical conditions tend to restrict population to certain places. Hence, more primary schools, like anyother social facilities, have been provided where population is dense. It must be realized that to attain a regular hexagonal form of the distribution of schools (which can be compared withCentral Place Theory as advanced by Walter Christaller) is not easy, in the real world where factors militating against this are numerous.

4.6 VARIATION IN USE OF EDUCATIONAL FACILITIES

4.6.1 INTRODUCTION

In this section, factors that explain variation in use of educational facilities will be critically analysed. Hypotheses from the objectives mentioned in section 1.3 will be tested and conclusions drawn from the resultant findings, with an aim of blending the twin problems of distribution and variation in use of such educational facilities in Bondo Division. The main important factors discussed include income, manpower and learning or service facilities. The influence of social status, mainlyincome will be discussed with an aim of finding regional income level differentials which in turn may influence the distribution and variation in use of educational facilities. The reasons for the choice of educational facilities will also bediscussed and the role of distance (in absolute terms) and time analysed. Catchment areas for the few selected primary schools will be determined. Finally, some factors influencing the location of primary schools will be summarised and the problems in the use of educational facilities in the study area discussed with an aim of improving the situation where possible.

4.6.2 ANALYSIS OF VARIATION IN USE BY DISTANCE AND TIME

Under this section we will deal with the effect of distance and time on the use of eductional facilities in thestudy area. It should be noted that thetwo variables are very important because they reflect the accessibilityof any educational facility. They also affect the choice of education institution and the frequency of attendance to such an educational institution.

One of the foremost enquiries on the question of attendance regards the choice of educational facilityby pupils. It is noted that out of a total of 1440 pupils interviewed, 867(60.2%) said that theypreferred particular primary schools (or educational facilities) because they were near their homes. Majority of the other 24.1% said their choice was influenced by the fact that their respective schools were famous for good performance in the national examination.

This finding ties with our results in section 4.10 where we found that there is some significant correlation between the 'quality' of the school (in terms of national examination performance) and its total enrolment. However, reasons for choice differed from one educational facility to another as shown in table 23 below.

TABLE 23: PROPORTIONS OF DIFFERENT REASONS FOR CHOICE OF EDUCATIONAL FACILITIES IN THIRTY SIX EDUCATIONAL FACILITIES IN BONDO

CODE NO.	NAME OF SCHOOL	A	B	C	D	E (OTHERS)
1.	SERAWANGO	4	79	13	0	4
2.	ONYINYORE	11	39	33	11	6
3.	BAR-KANYANGO	0	67	33	0	0
4.	MIGONO	0	44	39	11	6
5.	GOT-ABIERO	6	55	28	0	11
6.	BAR-OPUK	14	58	14	14	0
7.	BAR-KOWINO	18	35	18	24	5
8.	GOBEI	10	33	29	14	14
99.	NYAMONYE	0	65	30	0	5
10.	NYABONDO	0	77	23	0	0
11.	MINYA	0	57	29	14	0
12.	PALA	7	64	0	29	0
13.	KANYIBOK	19	50	0	31	0
14.	NYANGERA	0	57	29	0	14
15.	GOMBE	0	51	41	0	8
16.	ULOWA	18	58	12	6	6
17.	MAJENGO	3	50	35	3	9
18.	JUSA	9	70	21	0	0
19.	LENYA	0	87	13	0	0
20.	WAMBARRA	3	80	7	3	7
21.	BONDO	0	63	35	2	0
22.	MARANDA	0	84	13	3	0
23.	MBEKA	0	55	30	15	0
24.	NYAMIRA "M"	40	48	12	0	0
25.	NYAWITA	5	71	24	0	0
26.	NYANGOMA "M"	7	57	29	2	5
27.	USENGE	4	52	27	13	4
28.	KIPASI	0	29	67	0	4
29.	SINAPANGA	0	79	17	4	0
30.	ALARA	8	54	38	0	0

31.	WAMBASA	0	41	56	0	3
32	ABOM	10	75	15	0	0
33.	AJIGO	3	68	18	8	3
34.	NDIRA	0	83	10	7	0
35	BAR-CHANDO	11	54	23	6	6
36	OTHACH	8	78	6	3	5
	MEAN PERCENTAGE	6.1%	60.2	24.1	6.2	3.4

Source: Field data

WHERE:

'A' = isthe percentage of pupils who said that theyattended that educational institution because their parents belong to that denomination.

'B'= is the percentage of pupils whosaid that they decided to attend that educational institution because it was near their places of residence.

'C' = is those who chose because of better performance in national examination (such schools have better average mark score as compared to other schools (see Appendix 2).

'D' = is those who chose toattend their respective schools because of other reasons other than the ones given above, for instance, accessibilityto water supply.

Considering all the reasons given, it is noted that the overriding one was that of the distance (in absolute terms). However, in two schools namely kipasi and Wambasa, the question of distance was not important and therefore does not determine the choice of school. The other reason that comes into prominence in the choice of school is good performance in national examination. This is clearly evident

when we consider the percentage of pupils in each of the two schools who chose to attend because the school is famous for good performance in national examination. These percentages are 67 for Kipasi and 56 for Wambasa. In these two primary schools, total enrolment is mainly, determined by their good performance in national examinations. Migono and Gombe primaryschools also have comparativelyhigh percentages of pupils (39 and 41 respectively) who chose to attend because of good performance in national examination but in these two schools the distance factor slightly outweighs that of national examination performance. The next factors which follow the above two (in magnitude) are: good teachers "and" religion in that order (see table 23 for mean Percentages).

The other aspect of distance to be considered is how it relates to time taken to get to educational facilities. This is important because accessibility is not just the presence of roads (i.e. connectivity), but also the time taken to move from one place to another. It is the latter that makes the distribution of educational facilities such an important issue. In order to understand that aspect of distance, the following hypochesis will be tested to estabish if there is a relationship between distance and time using simple correlation analysis and simple Linear Regression Analysis:

Ho: There is no significant relationship between distance travelled by pupils to educational facilities and time taken.

Hi: There is significant relationship between distance travelled by pupils to educational facilities and time taken.

NOTE: The simple Linear Regression Analysis will only be done for those pupils who travel to school on foot since those who use other means of transport are almost negligible.

SIMPLE CORRELATION ANALYSIS FOR DISTANCE (Y) AND TRAVEL TIME (X) TO EDUCATIONAL FACILITIES IN BONDO DIVISION

TABLE 24: COMPUTATION OF THE PRODUCT-MOMENT CORRELATION COEFFICIENT, r.

DISTANCE (IN K.M) (X)	TIME (IN MIN.) (Y)	(X^2)	(Y^2)	(XY)
0.01	6	0.0001	36	0.06
0.015	3	0.000225	9	0.045
0.03	4	0.0009	16	0.12
0.04	5	0.0016	25	0.20
0.05	8	0.0029	64	0.40
0.10	11	0.01	121	1.10
0.20	7	0.04	49	1.40
0.25	17	0.0625	289	4.25
0.30	20	0.09	400	6.00
0.40	7	0.16	49	2.80
0.50	20	0.25	400	10.00
0.60	17	0.36	289	10.20
0.70	14	0.49	196	9.80
0.75	13	0.5625	169	9.75
0.80	18	0.64	324	14.40
0.90	20	0.81	400	18.00
1.00	24	1.00	576	24.00
1.20	21	1.44	441	25.20
1.25	30	1.5625	900	37.50
1.30	43	1.69	1849	55.90
1.40	30	1.96	900	42.00
1.50	23	2.25	529	34.50
1.60	25	2.26	625	40.00
1.70	60	2.89	3600	102.00
1.80	20	3.24	400	36.00
1.89	40	3.5721	1600	75.60
1.90	25	3.61	625	47.50
1.95	25	3.8025	625	48.75
2.00	36	4.00	1296	72.00
2.30	35	5.29	1225	80.50
2.50	50	6.25	2500	125.00
3.00	59	9.00	348	177.00
3.10	73	9.61	5329	226.30
3.20	30	10.24	900	96.00

3.50	49	12.25	2401	171.50
3.80	105	14.44	11025	399.00
4.00	70	16.00	4900	280.00

$\Sigma X = 51.535$ $\Sigma Y = 1063$ $\Sigma X^2 = 120.13743$ $\Sigma Y^2 = 48563$

$n = 37$ $n = 37$ $\Sigma XY = 2284.78$

$X = 1.39$ $Y = 28.73$ $Sx = 1.15$ $Sy = 22.07$

ASSUMPTIONS: The variables must be measerred on an interval scale, and the technique also assumes that both variables have come from normally distributed populations.

CALCULATION AND INTERPRETATION

The formula commonly used for the computation of the product moment correlation coefficient, r is given by:

$$r = \frac{\Sigma(x.y)n - XY}{Sx \cdot Sy}$$

WHERE:

r = is the product-moment correlation coefficient,

x and y = refer to the values of the two variables (i.e. x for distance and y for time).

X and Y = are the means of the two variables, and

x and Sy = are the sample standard deviation of the two variables

$$x^2 = \frac{\Sigma x^2}{n} - x^2 = \frac{120.14}{37} - (1.39)^2 = 1.32$$

$x^2 = 1.32$

$x = 1.15$

$$y = \frac{Sy^2}{n} - y^2 = \frac{48563}{37} - (28.73)^2 = 587.10$$

3.50	49	12.25	2401	171.50
3.80	105	14.44	11025	399.00
4.00	70	16.00	4900	280.00

$\Sigma X = 51.535$ $\Sigma Y = 1063$ $\Sigma X^2 = 120.13743$ $\Sigma Y^2 = 48563$

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CALCULATION AND INTERPRETATION

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$$r = \frac{\Sigma(x.y)n - XY}{Sx \cdot Sy}$$

WHERE:

r = is the product-moment correlation coefficient,

x and y = refer to the values of the two variables (i.e. x for distance and y for time).

X and Y = are the means of the two variables, and

Sx and Sy = are the sample standard deviation of the two variables

$$Sx^2 = \frac{\Sigma x^2}{n} - x^2 = \frac{120.14}{37} - (1.39)^2 = 1.32$$

$Sx^2 = 1.32$

$Sx = 1.15$

$$Sy^2 = \frac{Sy^2}{n} - y^2 = \frac{48563}{37} - (28.73)^2 = 587.10$$

$\therefore$ Sy $= 487.10$

Sy $= 22.07$

$\therefore$ We can now calculate the product-moment correlation coefficient, r, as follows:

$$r = \frac{\Sigma xy/n - XY}{Sx\ Sy}$$

where:

$\Sigma xy = 2284.78$

$\Sigma xy/n = 61.75$

$Sx.\ Sy = 25.38$

$$\therefore \quad r = \frac{61.75 - 39.93}{25.38} = 0.859732$$

$$= 0.86$$

$\therefore$ r = + 0.86

CORRELATION SIGNIFICANCE TEST

This can be done by the use of the student's t distribution, using the formula:

$$t = r.\sqrt{\frac{n-2}{1-r^2}}$$

where:

r = product moment correlation coefficient.

n = the size of the sample.

r = 0.86 and n=37

$$\therefore \quad t = 0.86\sqrt{\frac{37-2}{1-(0.86)^2}}$$

r = 9.97

Assuming a significance level of 0.05, the degrees of freedom for the t test are (nx-1)+(ny-1), which in this case gives 72. From tables of the student's t sampling distribution, the critical value of t with 72 degrees of freedom for a two-tailed test at the 0.05 significance level is 2.00. Since the calculated value of t is greater than the critical value, the null hypothesis must be rejected at the 0.05 significance level.

COEFFICIENT OF DETERMINATION, R^2

$$R^2 = r^2 = 0.86^2 = 0.7396$$

$$\therefore R^2 = 0.74$$

The R^2 value (0.74) measures the amount of travel time explained by distance. R^2 = 74%, means that 74% of the variations in travel time can be explained by the differential distance, and this value(74%) indicates a very high degree of positive correlation between travel time and distance.

SUMMARY

It is important to recall that correlation analysis is a measure of the strength and the direction of association or relationship. Therefore, the coefficient of +0.86 clearly implies that there is a high degree of positive correlation between these two variables (distance and travel time) in terms of fluctuations in time. Travel time increases with increasing distance, though this tendency is neither absolute nor of uniform magnitude.

This conclusion was further confirmed by the use of student's t test, where it was seenthat the percentage probability that this coefficient could have occurred by chance is only 5%. In other words this coefficient is highlysignificant. This conclusion was again further confirmed bythe use of coefficient of determination test, R^2 (see section 4.6.2 above).

SIMPLE LINEAR REGRESSION ANALYSIS FOR DISTANCE (Y) AND TRAVEL TIME(X) EDUCATIONAL FACILITIES IN BONDO DIVISION

COMPUTATIONS

The simple linear regression equation is of the form:

$\hat{Y} = a + bx$ based on the regression model $Y = a+bx + E$

Where:

Y = Distance to educational facilities.

X = Time taken to reacheducational facilities.

a = The Y-intercept (~~or~~ regression constant).

b = Partial regression coefficient (which gives the slope line).

NOTE: The assumption embodied in a regression equation is that the values of the dependent variable (for instance, travel time) depend on the values of the independent variable (distance). There is a suggestion of cause and effect.

The essential part of regressionanalysis is the calculation of the regression coefficients a and b, using the following equations:

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma X^2 - n\bar{x}^2} \quad 15$$

$$a = \bar{y} - b\bar{x} \quad 16$$

Where:

X = refers to the values of travel time (dependent variable).

Y = refers to the values of distance (independent variable).

$\bar{X}$ = refers to the mean of X values.

$\bar{y}$ = refers to the mean of y values, and

n = is the number of pairs of measurements.

The basic data are given in ~~table~~ table 24 together with the calculation of some of the elements of equations 15 and 16. The regression coefficients can now be calculated:

$$b = \frac{\Sigma xy - n\bar{x}\bar{y}}{\Sigma x^2 - n\bar{x}^2} = \frac{2284.785 - 37 \times 1.39 \times 28.73}{120.14 - 37 \times 1.39^2}$$

$$= \frac{2284.785 - 1477.58}{120.14 - 71.49}$$

$$b = 16.59$$

$$a = \bar{y} - b\bar{x} = 28.73 - 16.59 \times 1.39$$

$$a = 5.67$$

These coefficients can beinserted into a regression equation (equation 3). In this case:

$$\bar{Y} = 5.67 + 16.59x$$

From this equation it is possible to predict the values of $\bar{y}$ from the observed values of x.

For example:

$$\bar{y} = 5.67 + 16.59 \times 0.01 = 5.84$$

$$\bar{y} = 5.67 + 16.59 \times 4.00 = 72.03$$

The least-squares regression line must, therefore, pass through the points on the graph where X = 0.01 and Y = 5.84, and where X = 4.00 and Y = 72.03. Figure 13 shows this regression line drawn through the graph of distance against travel time to educational facilities in Bondo Division.

NTERPRETATION OF THE COMBINED CORRELATION AND REGRESSION ANALYSIS

rom figure 13 it can be observed that there is general linear attern of the two variables. This pattern shows that there is significant relationship or association between the given ependent and independent variables i.e. there is association between ravel time and distance covered by pupils to educational facilities.

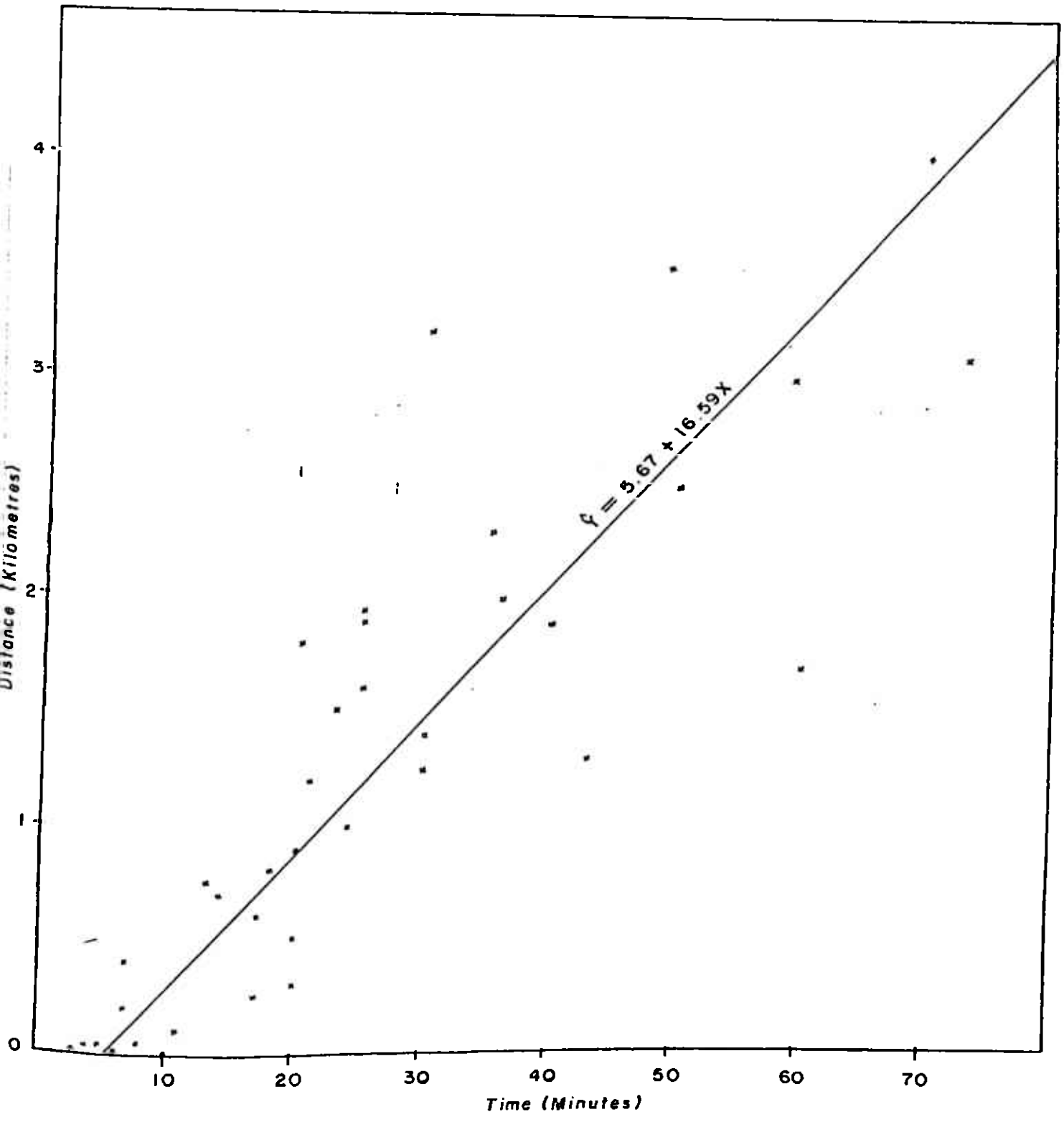


Fig. 13 : REGRESSION LINE FOR DISTANCE AND TIME TAKEN BY PUPILS TRAVELLING ON FOOT TO TWELVE EDUCATIONAL FACILITIES IN BONDO DIVISION

Going back to the results of correlation analysis. it should be noted that the coefficient of dertmination of pupils travelling on foot (the number of those using other means of transport are almost negligible) to the thirty seven educational facilities in Bondo (0.74) shows that 74% of the total variation is accounted for by the regression, and the remaining 36% of the variation (i.e. the residual variation) cannot be explained by the regression. The residuals canbe explained bythe fact that pupils may take different travelling time to schools evenif distance is the same mainly because of their differences in ability to cognitive mapping. For example, a pupil who takes a longer route, knowingly or unknowingly is bound to take longer than another pupil who takes a short foute to school. Also, residuals can be explained by the errors made in estimation of time taken to travel by the pupils from their places residence to school, since most of them, if not all, did not have watches. There was the tendency, therefore, to underestimate or overestimate the time. It is also possible that poor accessibility (as in the case of western parts of Yimbo location) may slow down the pace at which pupils travel to schocl.

Generally, however, it can be concluded that the distance travelled to educational facilities is closely related to the time taken.

SIMPLE LINEAR REGRESSION ANALYSIS (BASED ON DISTANCE DECAY MODEL) RELATING PRIMARY SCHOOL ATTENDANCE (TO THIRTY ONE EDUCATIONAL FACILITIES IN BONDO DIVISION) TO DISTANCE TRAVELLED.

It is important to note that the relationship between school attendance and distance travelled falls under nonlinear Regression. Figure 14 represents a set of data obtained from a sample survey of pupils attending some thirtyone primary schools in Bondo Divisior The number of pupils from eachof the thirtyone areas of influence (on the vertical axis) isplotted against distance (one the horizonta axis). It can be seen that there is some kind of relationship between number of pupils and distance from the school. With increasing distance there is a decline in the number of pupils attending each particular school. However, this decline is not uniform; it could not be represented by a straight line on a graph. This is an example ofthe sort of nonlinear relationship that is quite common in human geography.

Figure 15 is based on the same set of data. This time, instead of plotting the number of pupils against distance, the logarithm of the number of pupils is plotted against the logarithm of the distance. By transforming the two variables, number of pupils and distance, from an arithmeticto a logarithmic scale, a nonlinear relationship has been changed into a linear relationship. In the present case there is a linear relationship between the log of the number of pupils and thelog of distance. To be of practical use to us, this needs tc be translated into some form of relationship between the number of pupils and distance travelled to school.

NOTE: In order tounderstand the influence of distance travelled by pupils to educational facilities on frequencyof attendance to such educational facilities, the following null hypothesis was formulated.

Ho: There is no significant relationship between the primary school attendance by the pupils and distance travelled from their places of residence.

Hi: Alternative.

As we have noted, this type of relationship conforms to the distance decay function (model), which is a non-linear relationship (figure 14

Applying to the techniqueoflinear regression the transformed data will yield a regression equation of the form:

$$\log_{10}\bar{y} = a + b\log_{10}x \quad \text{.....} \quad (4.$$

By taking the antilogarithm of bothsides of this equation, it is possible to rewrite it in terms of x and y instead of $\log_{10}x$ and $\log_{10}y$:

$$\bar{Y} = \text{antilog}_{10}ax^{b} \quad (5$$

Where:

$\log_{10}y$ = predicted natural logarithm for frequency ofattendance bypupils.

$\log_{10}x$ = natural logarithm for distance travelled by pupils to educational facilities.

TABLE 25 REGRESSION OF NUMBER OF PUPILS ON DISTANCE TRAVELLED TO FIFTEEN PRIMARY SCHOOLS

ORIGINAL VALUES		TRANSFORMED VALUES			
DESTANCE X	PUPILS Y	X'	Y'	X'²	X'Y'
4.00	2	0.602	0.229	0.362	0.138
4.00	2	0.602	0.367	0.362	0.221
1.33	3	0.125	0.523	0.016	0.065
1.00	6	0.000	0.770	0.000	0.000
1.50	10	0.176	1.000	0.031	0.176
8.00	2	0.903	0.187	0.815	0.169
4.00	2	0.602	0276	0362	0.166
1.25	7	0.097	0.824	0.009	0.080
3.50	9	0.544	0.959	0.296	0.522
3.50	10	0.544	1.000	0.296	0.544
2.50	7	0.398	0.854	0.158	0.340
0.06	7	0.243	0.824	0.059	0.200
1.33	4	0.125	0.602	0.016	0.075
1.33	5	0.125	0.699	0.016	0.087
		5.387	9.57	2.889	2.92

$\Sigma X' = 5.39 \quad \Sigma Y' = 9.57 \quad \Sigma X'^2 = 2.889 \quad \Sigma X'Y' = 2.92$

$$Z' = \frac{\Sigma X'}{n} = \frac{5.39}{15} = 0.359 \qquad Y' = \frac{\Sigma Y'}{n} = \frac{9.57}{15} = 0.638$$

NOTE: $X' = \log_{10} x, \quad Y' = \log_{10} Y.$

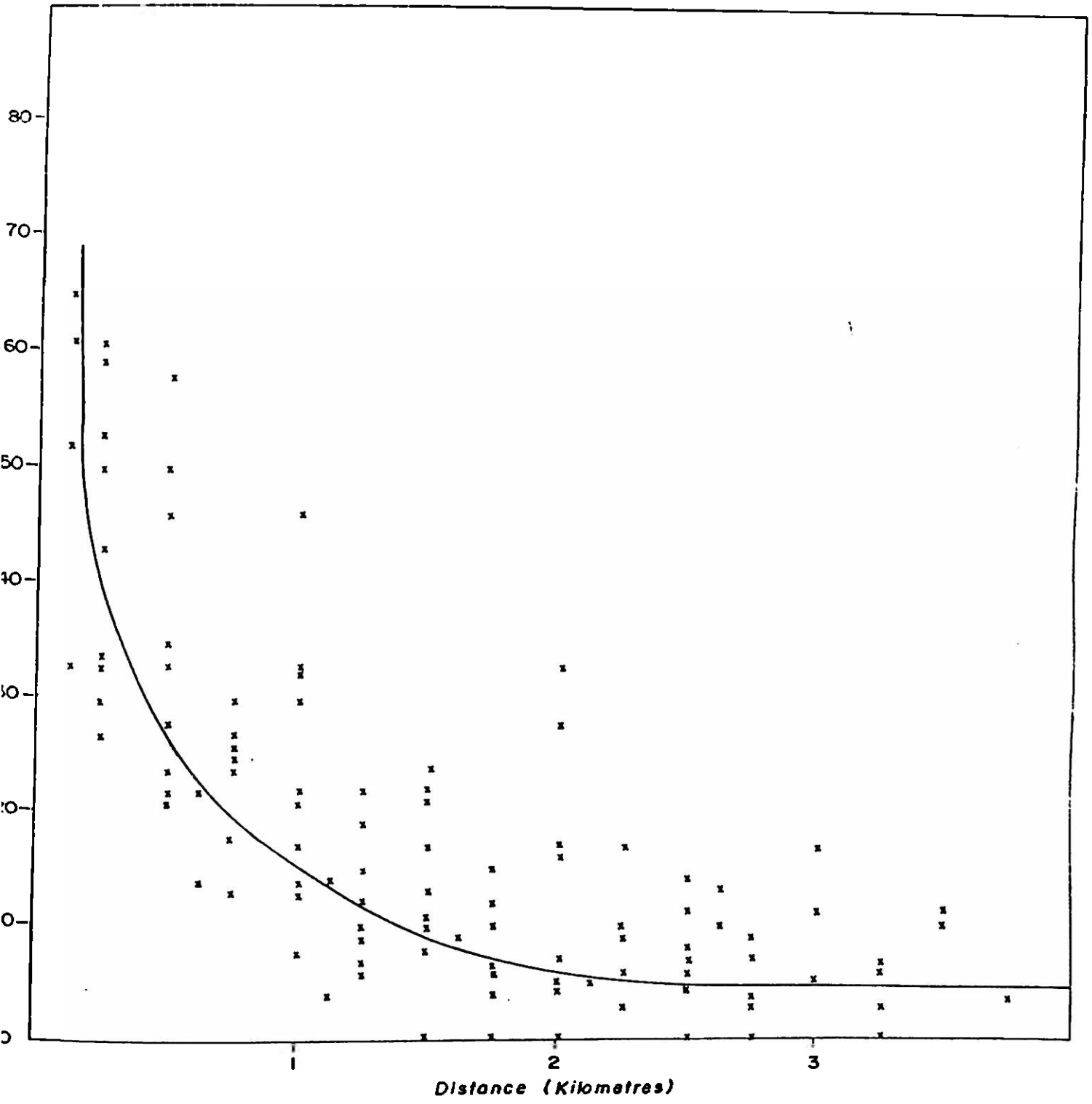


Fig. 14 : SCATTERGRAPH SHOWING THE PERCENTAGE DISTRIBUTION OF SCHOOL ATTENDANCE BY DISTANCE IN THIRTY-SIX SCHOOLS (SIMPLIFIED-^{1}IN-X_b)

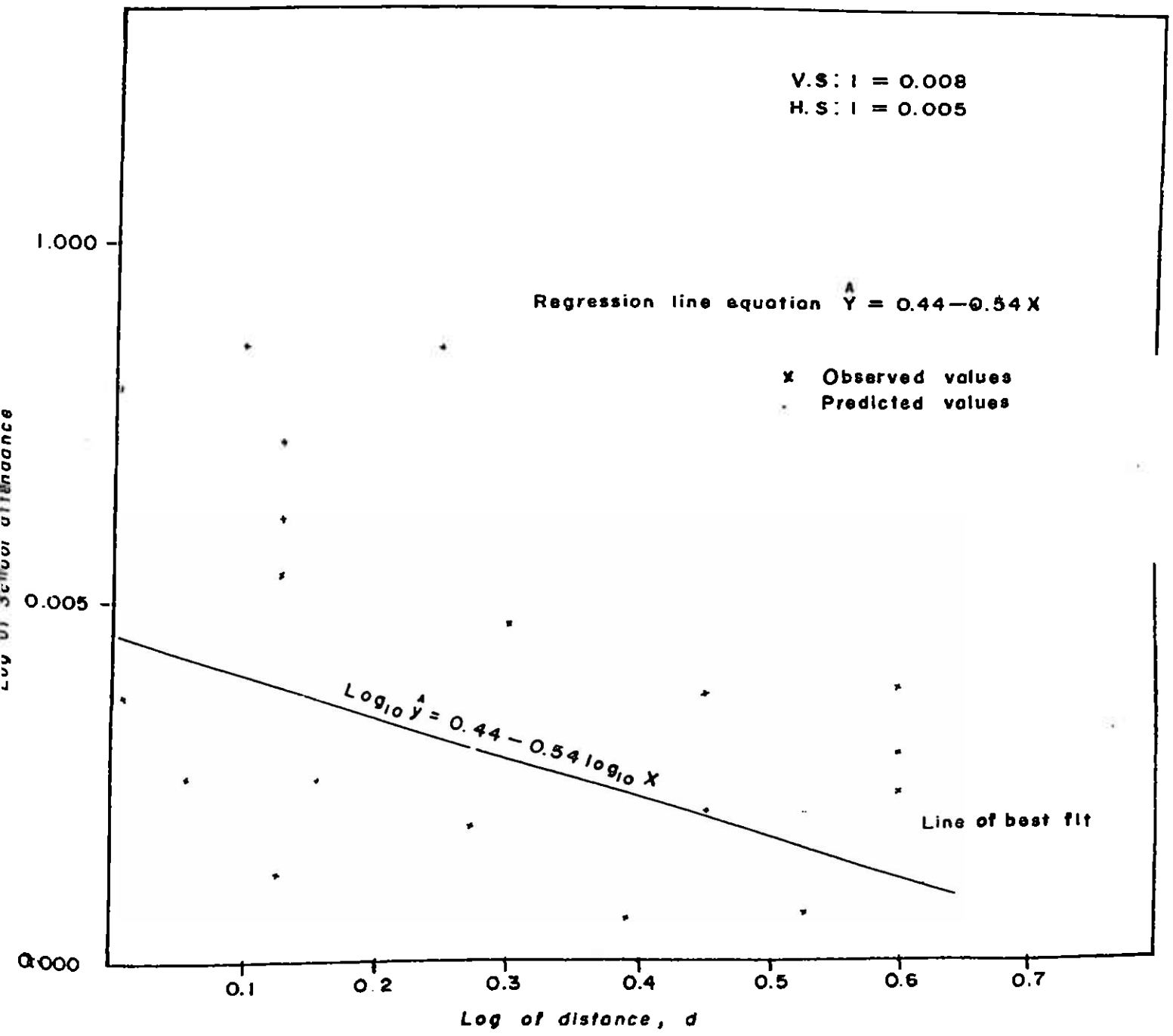


Fig. 15 : SCATTERGRAM AND REGRESSION LINE ON LOGARITHMIC SCALE TO SHOW RELATIONSHIP BETWEEN SCHOOL ATTENDANCE AND DISTANCE

NOTE: Equation 18a couldbe used to predict the valueof the logarithm of the number of pupils, given the logarithm of the distance. Equation 18b is rather more useful, as it enables distance to beused to predict number of pupils directly.

Table 25 contains the data from which figure 15 was drawn. It also gives the logarithms of all the values of the two variables. It is these logarithms to which the linear regression technique is to be applied. Effectively this means fitting a least squares regression line as shown in figure 15. The regression coefficients can be calculated using the equations given previously:

$$b = \frac{\Sigma x'y' - n\bar{x}'\bar{y}'}{\Sigma x'^2 - n\bar{x}'^2}$$

$$a = \bar{y}' - b\bar{x}'$$

The prime (1) has been added to x and y to denote that these are variables which have been transformed, in this case by taking logarithms. In other words, X' (pronounced X prime) means $\log_{10} X$ and y' means $\log_{10} Y$.

The various elements of the two equations given above have been calculated in table 25. These can be substituted into the equations in order to give the regression coefficients:

$$b = \frac{2.92 - 15 \times 0.359 \times 0.638}{2.889 - 15 \times 0.359^2}$$

$$\therefore b = 0.54$$

$$a = 0.638 - (-0.54 \times 0.359)$$

$$\therefore a = 0.44$$

The regression equation can now be written out:

$$\hat{Y}' = 0.44 - 0.54X'$$

or since x' and y' are $\log_{10} X'$ and $\log_{10} y$ respectively:

$$\log_{10} \hat{y} = 0.44 - 0.54 \log_{10} X'$$

Equation 20 could now be used to predict the expected value of $\log_{10} y$ for any given value of $\log_{10} X$. By taking the antilogarithms of both sides of the equation, however, it is possible to obtain an equation for predicting y from x:

$$y = \text{antilog}_{10} ax^{6}$$

which in this case means:

$$y = \text{antilog}_{10} 0.44 \, x^{-0.54} \quad \ldots\ldots\ldots\ldots 21$$

From standard mathematical tables $\text{antilog}_{10} 0.44$ is found to be 2.75 so that Equation 21 can be further simplified to:

$$y = 2.75 \, x^{-0.54} \quad \text{or} \quad y = \frac{2.75}{x^{0.54}} \quad \ldots\ldots\ldots 22$$

This relationship can be put into words as follows: the expected number of pupils is equal to 2.75 divided by the distance to the power of 0.54. For example, approximately 2 pupils could be expected to come from a distance of 2 kilometres:

$$y = \frac{2.750}{x^{0.54}} = \frac{2.750}{z^{0.54}} = \frac{2.750}{1.716} = 1.60$$

$$y = 2$$

This compares with the actual number of pupils coming from the 2 kilometre zone, which is 3.

INFERENTIAL ASPECTS

It is important to note that when linear regression is used in conjunction with transformed variables to describe what is originally a nonlinear relationship, the five major assumptions of the technique (discussed in section 4.7) still apply. However, it is the transformed data, not the raw values which must satisfy these assumptions. The assumptions can therefore, be rewritten to fit the present situation:

1. The independent variable consists of a set of fixed values not a set of sample measurements, or, alternatively, the values of the independent variable have been measured without error.

2. The values of the transformed dependent variable y' are normally distributed.

3. The variance of the transformed values of the dependent variable is constant for all values of the independent variable.

4. The values of the residuals from the regression between the transformed variables have a normal distribution.

5. The values of the residuals from the regression between the transformed variables are independent of each other.

As far as the primary school attendance by distance is concerned, the first assumption is satisfied, since the distance zones were fixed values. All the other assumptions are also satisfied.

SIMPLE CORRELATION ANALYSIS OF THE NUMBER OF PUPILS AND DISTANCE TRAVELLED TO SOME FIFTEEN PRIMARY SCHOOLS (ON A LOGARITHMIC SCALE) IN BONDO DIVISION

Product moment correlation coefficient, r, is given by the following equation:

$$r = \frac{\Sigma x'y'/n - \bar{x}'\bar{y}'}{Sx'Sy'}$$

Where:

Sx' = Standard deviation of x'

Sy' = Standard deviation of y'

$\bar{x}'$ = The mean of the variable x'

$\bar{y}'$ = The mean of the variable y'

$\Sigma x'y'/n = 0.195$

$\bar{x}'\bar{y}' = 0.229$

$Sx' = 0.25$

$Sy' = 0.25$

$Sx'.Sy' = 0.0625$

$$r = \frac{0.195 - 0.229}{0.0625} = -0.549$$

Product-moment correlation coefficient, $r = -0.549$

The coefficient of Determination, R^2, $= r^2 = (-0.549)^2 = 0.301$

CORRELATION SIGNIFICANCE TEST

This can be done by the use of the student's t test

From the data given in Table 25 the value of the test statistic, t can be calculated using the following equation:

$$t = \frac{|\bar{x} - \bar{y}|}{\frac{(\Sigma x^2/nx) - x^2}{n_x - 1} + \frac{(\Sigma y^2/ny) - y^2}{n_y - 1}}$$

Where:

x and y = are the means of the two samples,

$|x - y|$ = is the absolute value of the difference between the means, and

n_x and n_y = are the sizes of the two samples.

The calculation of the various elements of Equation 23 above is shown in Table 25. The elements can then be substituted into the equation to give:

$$t = \frac{0.359 - 0.638}{\frac{(2.889/15) - 0.359^2}{15-1} + \frac{(7.23/15) - 0.538^2}{15-1}}$$

$$= \frac{0.279}{0.0995} = 2.804$$

$\therefore$ t = 2.80

The calculated value of t is 2.80

The degrees of freedom for the t test are $(n_x-1) + (n_y-1)$, which in this case gives 28. From tables of the student's t sampling distribution the critical value of t with 28 degrees of freedom for a two-tailed test at the 0.05 significance level is 2.05. Since the calculated value of t is greater than the critical value, the null hypothesis that there is no significant relationship between the primary school attendance by the pupils and distance travelled from their places of residence must be rejected at the 0.05 significance level.

INTERPRETATION/CONCLUSION

The product-moment correlation coefficient of -0.549 cleaily implies that there is a relatively high degree of negative correlation between school attendance and
distance travelled by the pupils from their places of residence. In other words, primary school attendance by the pupils decreases with increasing distance from the school and vice-versa.

The coefficient of determination (r^2) calculated above shows that 30.1% of the variation is explained by the regressionm and the other 69.9% of the variation is not explained by the regression. The residual variation is due to the fact that there are a number of cases where distance does not influence the frequency of school attendance. In some cases as discussed in section 4.10, school attendance by the pupils is dictated more by the performance in national examinations (i.e. C.P.E./K.C.P.E.). This is especially true for the respondents in the two schools namely Kipasi and Wambasa Primary Schools where it was found that 67% and 56% of their pupils (respectively) chose to attend because the two schools usually do well national examinations.

But generally, distance seems to have ~~to~~ a bigger share in influencing school attendance by the pupils as it is human nature to try and minimize transport cost in terms of energy, time, money etc.

On the question of how far from schools the pupils' places of residence were, the researcher intended to test one major determinant of school attendnace, and through our field data, it was possible to delimit zones of influence of various schools, one from each location and some of the rural centre schools. The criterion used for establishing the spheres of influence was that of distance which children travelled to

their respective schools. It is important to note that distances given here were approximations and they should therefore, be treated as such in this context.

The data, which is expressed here as percentage of the total number of pupils in each school, were collected under four categories, namely, those who lived within a distance of 1 Km; between 1 Km and 2 Km; Between 2 Km and 3 Km and finally those who lived at distances greater than 3 Km. as shown in the Table below.

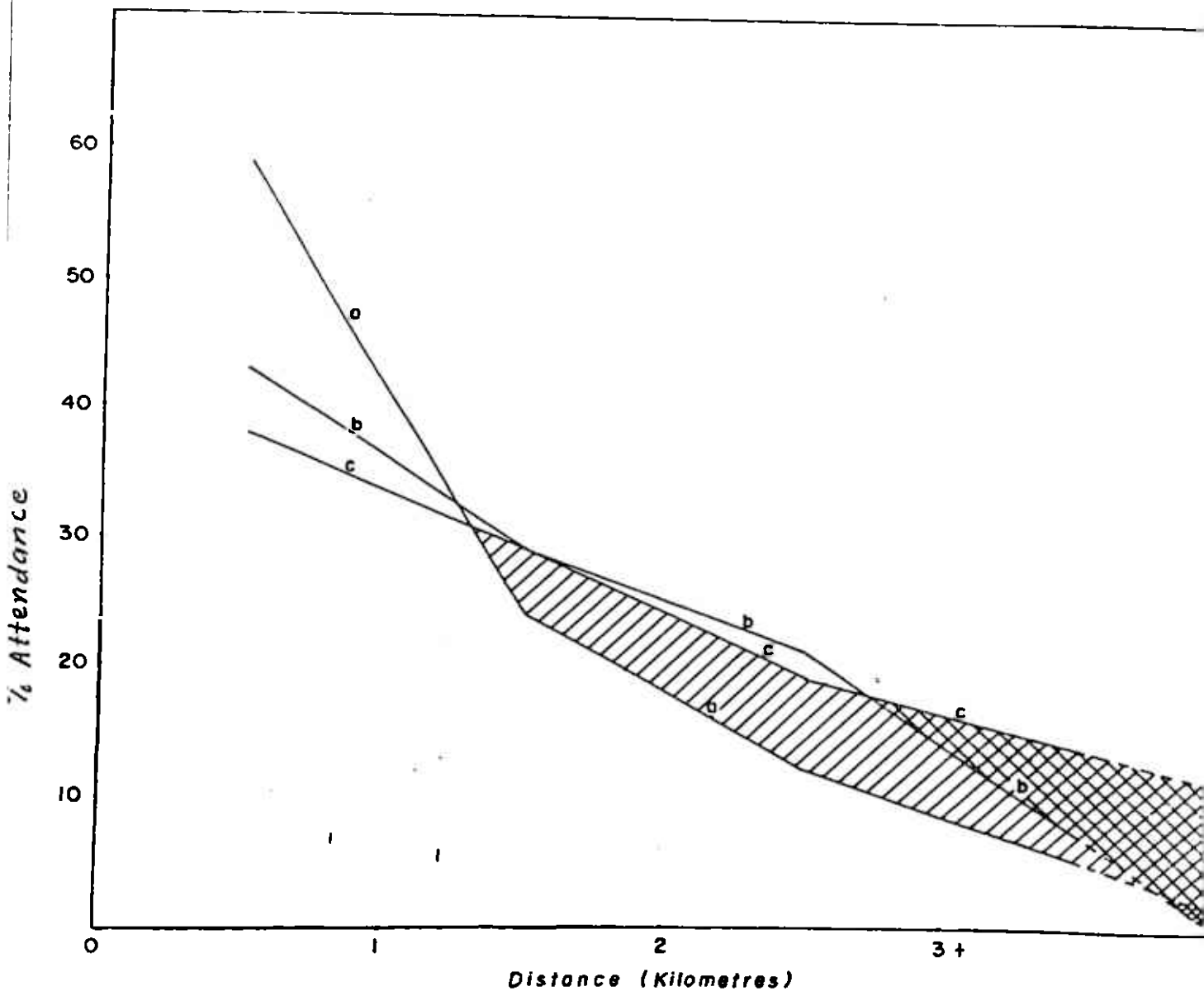
During the final analysis of the data collected, it was noted that an average 53% of the children in the selected schools lived within a distance of 1 Km. from their respective schools. It was also discovered that the schools with greater percentage than the mean, particularly above 60% are those primary schools which are located either near trading centres/rural centres, for example, Usenge, Mbeka and Ajigo (see figure 17) or those located in very densely populated areas, for instance, Ndira, Bar-Chando, Gombe and so on. In general, the greatest number of pupils in the study area lived within a distance of 1 Km. from their respective schools, as it is shown in figure 16 and table 26.

Furthermore, the mean percentage of those pupils who lived between 1 Km. and 2 Km. was found to be 27%; between 2 Km. and 3 Km. was 13% and finally a distance greater than 3 Km. was 7%. The schools with greater than 7% of pupils living at a distance greater than 3 Km. are mainly the ones that are ranked the best in terms of the national examination results, for instance Nyawita School (see Appendix 2#). In general, those schools whose performance is relatively poor and whose enrolment is relatively low, drew less than 7% of their pupils from a distance greater than 3 km. The schools which are located in areas with very low density of population drew more than 7% of their pupils from a distance greater than 3 Km. for instance, Nyangera Primary school.

From the above analysis, we can conclude that distance-decay effect is quite strong upon primary school attendance. The strength of this function upon enrolment in the thirty-six selected schools is shown in figure 16.

TABLE 26 : RELATIONSHIP BETWEEN DISTANCE AND THE PROPORTION OF PUPILS ATTENDING EACH SCHOOL

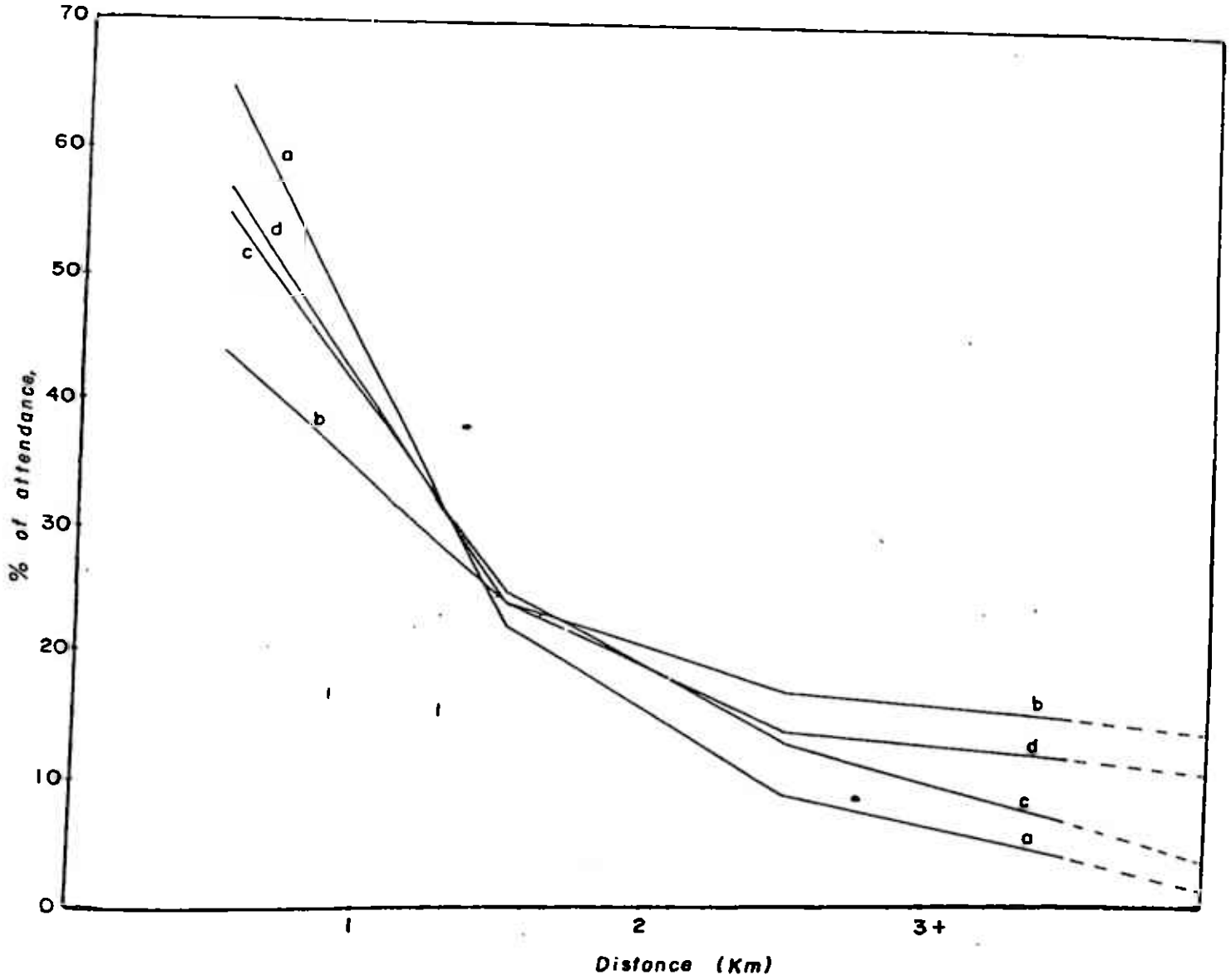
CODE NO.	NAME OF SCHOOL	0-0.99 Km	1-1.99 Km	2-2.99 Km	3 + 3+n Km
1.	SERAWONGO	58	25	17	0
2.	ONYINYORE	45	33	11	11
3.	BAR-KANYANGO	41	25	17	17
4.	MIGONO	39	27	17	17
5.	GOT-ABIERO	44	28	28	0
6.	BAR-OPUK	43	29	21	7
7.	BAR-KOWINO	59	23	12	6
8.	GOBEI	47	33	10	10
9.	NYAMONYE	55	30	10	5
10.	NYABONDO	69	23	8	0
11.	MINYA	57	29	14	0
12.	PALA	43	21	21	15
13.	KANYIBOK	56	25	13	6
14.	NYANGERA	38	29	19	14
15.	GOMBE	62	27	8	3
16.	ULOWA	65	29	6	0
17.	MAJENGO	44	38	15	3
18.	JUSA	52	30	9	9
19.	LENYA	66	20	7	7
20.	WAMBARRA	37	30	20	13
21.	BONDO	55	25	15	5
22.	MARANDA	40	30	20	10
23.	MBEKA	67	24	9	0
24.	NYAMIRA "M"	49	27	12	12
25.	NYAWITA	38	29	19	14
26.	NYANGO'OMA "M"	44	24	17	15
27.	USENGE	65	22	9	4
28.	KIPASI	52	24	14	10
29.	SINAPANGA	45	35	17	3
30.	ALARA	62	31	7	0
31.	WAMBASA	37	33	15	15
32.	ABOM	60	25	10	5
33.	AJIGO	71	18	8	3
34.	NDIRA	75	21	4	0
35.	BAR-CHANDO	66	26	6	2
36.	OTHACH	65	22	8	5
	MEAN % =	53	27	13	7



LEGEND

a. % attendance at Bar—Kowino School (Moderate range)
b. % attendance at Bar—Opuk School (Shortest range)
c. % attendance at Nyongera School (Longest range)

Fig. 16 : THE DISTRIBUTION OF SCHOOL ATTENDANCE, BY DISTANCE IN THR
SELECTED SCHOOLS



a. % attendance at Usenge School — a rural centre school
b. % attendance at Nyang'oma 'M'-School — a rural inland school
c. % attendance at Bondo School — a rural centre school
d % attendance at Gombe School — a rural inland school

Fig. 17 : THE DISTRIBUTION OF SCHOOL ATTENDANCE BY DISTANCE, IN FOUR SELECTED SCHOOLS : TWO ARE LOCATED IN RURAL CENTRES AND THE OTHER TWO IN RURAL INLAND

In summary, we can say that schools which are located in areas with low population density have greater range than their opposite members, and the schools which are located in or near trading centres/rural centres have smaller range than their opposite members. Also, the schools with better performance in national examination have greater range than the ones which perform poorly.

NB: By range of a school is meant the maximum distance travelled by pupils from their places of residence to school.

The range of any given school is influenced by a number of factors which include: population density of school-age children, topography, accessibility, quality of the school, the density of schools in a given area, etc. These factors may work either singly or in combination to determine the range of any given school (see figure 16).

VARIATION IN USE OF PRIMARY SCHOOLS BY LOCATION

Under this section we shall examine the variation in use of primary schools by location. That is, whether there is more variation in use between the three locations other than within them.

To understand fully the variation in use of primary schools between locations and within them, the following null hypothesis will be tested:

Ho: The sample of school children have come from a common, normally distributed population of school children.

Hi: Alternative.

The test statistic to be applied here is Analysis of Variance (the F ratio test).

JUSTIFICATION OF THE USE OF ANALYSIS OF VARIANCE AND THE EMBODIED ASSUMPTIONS

Analysis of Variance is the standard parametric test of difference between three or more samples. Like other parametric tests, however, it is often used in situations where the rather rigid assumptions of scuch tests cannot be justified. Analysis of variance can only be applied to data measured on an interval scale.

The null hypothesis of analysis of variance is that the samples are taken from a common, normally distributed population (or from identical populations). The alternative hypothesis is that the samples come from populations with different distributions.

The rationale of analysis of variance is to find out whether there is mor

variation between the samples than within them. If the samples are taken at random from a common population (the null hypothesis), it is reasonable to expect the variation within the samples to be about the same as the variation between the samples, since both are reflections of the overall variation in the population. Any difference in these two measures of variation is merely due to chance in the sampling process. If the samples are taken from different populations (the alternative hypothesis), this is not a reasonable expectation, since the variation within each sample is a reflection of the variation within the particular population from which it has come. Variation between samples in this case is a reflection of the difference between the populations.

A researcher is interested in differences in use of educational facilities in three locations of Bondo Division. As a preliminary exercise a random sample of 12 primary schools are selected from each location, and the total number of pupils in each school recorded. The total enrolment in each school and by location are listed in Table 27.

The null hypothesis is that the sample of pupils have come from a common normally distributed population of school children (pupils). The alternative hypothesis is that the sample of pupils come from different but still normally distributed, populations of school pupils.

A significance level of 0.05 is decided upon.

COMPUTATION

The first step in analysis of variance is to make two estimates of the variance of the hypothesized common population (that is, the population of school children): the within samples variance estimate, and the between samples variance estimate.

The within samples variance estimate is calculated according to the following equation:

$$\hat{S}_w^2 = \frac{\Sigma\Sigma(x-\bar{x})^2}{N-K} \qquad (24)$$

Where:

$\hat{S}_w^2$ = is the within samples variance estimate,
K = is the number of samples
n = is the number of individuals in each sample,
N = is the total number of individuals in all the samples put together, and
$\bar{x}$ = is the mean of each sample

The expression $\sum^{n}(x-\bar{x})^2$ means that for each sample the deviations from the mean are calculated, squared and summed. The summations Sign $\sum$ means that all the sums of squares, one for each sample, are added together. Table 28(a) shows the calculation of $\hat{S}^2_w$ for our data, giving a value of 11938.5

The Between Samples Variance Estimate can now be calculated as:

$$\hat{S}^2_B = \frac{\sum^{k} n(x - x_G)^2}{K - 1}$$

Where:

$\hat{S}^2_B$ = is the between samples variance estimate

n = is the number of individuals in a sample

K = is the number of samples,

x = is the mean of a sample, and

x_G = is the grand mean of all the date values.

The expression $n(x - x_G)$ means that for each sample the deviation of the sample mean from the grand mean is found, squared and then multiplied by the number of individuals in the sample. The summation $\sum^{k}$ means that these values are added together (there will be one for each sample).

Table 28.6 shows the calculation of $\hat{S}^2_B$ for our data giving a value of 1772882.9. What happens in the calculation is that the variation within each sample is eliminated in order to measure the variation between the samples. This is done by effectively replacing each sample value bythe mean of the sample, and measuring the deviation of the sample mean from the grand mean. In Table 28b the calculationof $n(x - \bar{x}_G)$ for location A (South Sakwa) for example, involves finding the square of the deviation of the mean of that sample (314) from the grand mean (28.4) and multiplying by the number of individuals in the sample. This is equivalent to replacing each sample value by the sample mean.

TABLE 27: TOTAL ENROLMENT FOR SAMPLE PRIMARY SCHOOLS

AREA A (X)	AREA B (X)	AREA C (X)
SOUTH SAKWA	NORTH SAKWA	YIMBO
224	249	230
238	266	403
478	496	279
264	684	336
462	457	248
373	369	370
437	388	494
319	252	399
163	199	430
251	400	356
309	303	219
249	400	289
$\Sigma x = 3767$	$\Sigma x = 4463$	$\Sigma x = 4053$
$n = 12$	$n = 12$	$n = 12$
$\bar{x} = 314$	$\bar{x} = 372$	$\bar{x} = 338$

K (number of samples) = 3

N (total number of individuals) = 12 + 12 + 12 = 36

x_G (grand mean) = (314 + 372 + 338)/36 = 28.4

TABLE 28: ANALYSIS OF VARIANCE APPLIED TO TOTAL ENROLMENT SAMPLE PRIMARY SCHOOLS, BY LOCATION

(a) CALCULATION OF WITHIN SAMPLES VARIANCE ESTIMATE

AREA A		AREA B		AREA C	
$(x-x)$	$(x-x)^2$	$(x-x)$	$(x-x)^2$	$(x-x)$	$(x-x)^2$
-90	8100	-123	15129	-108	11664
-76	5776	-106	11236	65	4225
+164	26896	124	15376	-59	3481
-50	2500	312	97344	18	324
148	21904	85	7225	-2	4
59	3481	-3	9	-90	8100
123	15129	16	256	32	1024
5	25	-120	14400	156	24336
-151	22801	-173	29929	61	3721
-63	3969	28	784	92	8464
-5	25	-69	4761	119	14161
-65	4225	28	784	-49	2401

$\Sigma(x-\bar{x})^2 = 114831$ $\Sigma(x-x)^2 = 197233$ $\Sigma(x-x)^2 = 81905$

$$\hat{S}_w^2 = \frac{kn \sum\sum (x - \bar{x})^2}{N - K} = \frac{114831 + 197233 + 81905}{36 - 3}$$

$$= \frac{393969}{33} = 11938.5$$

CALCULATION OF BETWEEN SAMPLES VAIANCE ESTIMATE

AREA A $\bar{x}$ 314 n = 12 $n(\bar{x}-\bar{x}_G)^2$ = $12(314-28.4)^2$ = 978808.32

AREA B $\bar{x}$ = 372 n = 12 $n(\bar{x}-\bar{x}_G)^2$ = $12(372-28.4)^2$ = 1416731.5

AREA C $\bar{x}$ = 338 n = 12 $n(\bar{x}-\bar{x}_G)^2$ = $12(338-28.4)^2$ = 1150225.9

$$S = \frac{\Sigma n(\bar{x}-\bar{x}_G)^2}{K-1} = \frac{978808.32 + 1416731.5 + 1150225.9}{3 - 1}$$

$$= \frac{3545765.7}{2} = 1772882.9$$

ANALYSIS OF VARIANCE TABLE

	Variance estimate	Degrees of freedom
Between Samples	S_B^2 = 1772882.9	2 (K- 1)
Within Samples	$\hat{S}_W^2$ = 11938.5	33 (n - K)

F ration = $\frac{\text{between Samples Variance estimate}}{\text{Within Samples Variance estimate}}$

$$= \frac{1772882.9}{11938.5} = 148.5$$

Degrees of freedon for between samples variance estimate = 2

Degrees of freedom for within samples variance estimate = 33

Having calculated two estimates of the population variance, the question now is: how probable is it that these two values are estimates of the same population variance? In order to answer this question a statistic known as the F ratio is calculated.

$$F = \frac{\text{between Samples Variance estimate}}{\text{Within samples variance estimate}} \quad \text{---------- 2}$$

Substituting the two variance estimate, we have:

$$F = \frac{\hat{S}^2_B}{\hat{S}^2_W} = \frac{1772882.9}{11938.5} = 148.5$$

SIGNIFICANCE

The degrees of freedom for analysis of variance are calculated as follows:

1. For the between samples variance estimate ($\hat{S}^2_B$) they are the number of samples minus one (K - 1).

2. For the within samples variance estimates ($\hat{S}^2_W$) they are the total number of individuals in the data minus the numbers of samples (N - K).

The critical value of F at the 0.05 significance level with 2 and 33 degrees of freddom is 3.32. Since the calculated value of F is greater than the critical value, the null hypothesis must be rejected at the 0.05 probability level.

SUMMARY

It is concluded that the sample of pupils have not come from a common population (or identical population). On the basis of the F test there is therefore the support for the contention that the differences in total school enrolment between the three sample sets of school children are representative of real differences in the primary school populations of those areas (locations).

NOTE: This conclusion is in line with the conclusion drawn in section 4.5 where it was found that the number of primary schools in each sub-location is determined by the number of population of school-age children also in each sub-location.

COMPARISON OF DISTANCES TRAVELLED BY A SAMPLE OF PUPILS FROM THREE PRIMARY SCHOOLS IN BONDO DIVISION

Under this section, an attempt willl be made to investigate the comparative influence of primary schools to their surrounding areas (Umlands). That is, whether there is any significant differences in the range among the three selected primary schools, and the reaso for that variation in the range, if there is any. The statistical test to be used here is the Kruskal-Wallis H Test.

JUSTIFICATION FOR THE USE OF THE KRUSKAL-WALLIS H TEST

The Kruskal-Wallis H Test is a test for deciding whether there is a significant difference between three or more samples. It is a nonparametric test and therefore does not rely on possibly unrealisti assumptions about the distribution of the variable. It can be applied to ordinal (ranked) data.

The null hypothesis of the H test is that the samples have been taken from populations with identical distributions. Any differences between the samples are due to chance variation inherent in the proce of random sampling. The alternative hypothesis is that the samples have come from populations with different distributions, so that differences between the samples reflect real differences between the populations.

In order to study and understand the above mentioned objective, the following null hypothesis will be tested:

o: There is no significant difference in distances travelled by the pupils to three selected primary schools in Bondo Division.

i: Alternative:

OMPUTATION

able 29 contains data obtained from a sample of pupils to three rimary schools namely Bar-Kowino, Bar-Opuk and Nyangera. The values columns a, c and c are the distance in kilometres travelled by ch pupil on his/her journey to school. The null hypothesis assumes at the three samples have come from identical populations. A gnificance level of 0.1 is decided upon.

TABLE 29: DISTANCES TRAVELLED TO THREE SELECTED PRIMARY SCHOOLS BY SAMPLE PUPILS

BAR KOWINO (A)		BAR OPUK (B)		NYANGERA (C)	
a Distance	b Rank	c Distance	d Rank	e Distance	f Rank
0.5	10	1.5	23	2.5	37
1.5	23	0.8	17	2.5	37
0.5	10	0.5	10	2.0	32
3.0	39.5	2.0	32	1.7	26
0.5	10	1.0	20.5	0.5	10
0.3	4.5	0.5	10	2.0	32
2.5	37	0.75	16	3.5	41
0.05	3	0.5	10	1.5	23
1.0	20.5	2.0	32	0.7	15
0.5	10	2.2	35	3.0	39.5
2.0	32	0.9	18.5	0.9	18.5
0.3	4.5	1.95	29	3.8	4.2
0.5	10	1.6	25	1.8	27
0.03	1	0.04	2	1.89	28
$R_A = 215$		$R_B = 280$		$R_C = 398$	
$n_a = 14$		$n_B = 14$		$n_c = 14$	

In order to apply the H test, the data must first be ranked, from lowest to highest. These rankings are given in columns b, d and f of Table 29.

The sums of the ranks are then found for each sample. In this case these are the three values of R in Table 29. This information can now be used to calculate H from the following equation:

$$H = \frac{12}{N(N+1)} \sum \frac{R^2}{n} - 3(N+1)$$

Where:

N = is the total number of individuals in all the samples,

R = is the sum of the ranks within a sample, and

n = is the number of individuals in that sample.

The summation $\sum R^2/n$ means that the sum of all the values of R^2/n (one for each sample) must be found. For the data given in Table 29:

$$H = \frac{12}{42 \times 43} \left(\frac{215^2}{14} + \frac{280^2}{14} + \frac{398^2}{14} \right) - 3 \times 43$$

$$H = 5.24$$

The appropriate degrees of freedom are given by the number of samples minus one; in this case 3 samples give 2 degrees of freedom.

At the 0.1 significance level the critical value of H is 4.60. Since the calculated value of H is larger than this, critical value, the null hypothesis can be rejected.

SUMMARY

At the 0.1 significance level it is therefore safe to assume that the difference between the samples reflects a real difference between the populations of pupils to the three primary schools. That is there is a significant difference in distance travelled by the pupils to three selected primary schools.

4.9 COMPARATIVE ANALYSIS OF THE QUALITY OF SCHOOL AND ITS ENROLMENT

Another hypothesis is that school enrolment is a function of the results of the C.P.E./K.C.P.E. Examination. In connection with this hypothesis, 1985 average (mean) mark score in C.P.E. Examination for each school can be correlated with the total enrolment, based on the data of the thirty six selected schools. The statistical test technique that is to be applied is that of Spearman's rank correlation (see table 30).

JUSTIFICATION OF THE USE OF SPEARMAN RANK CORRELATION

The Spearman rank correlation coefficient is a nonparametric measure of the relationship between two sets of ordinal (ranked) values. It is a technique which deserves to be more widely used by researchers as an alternative to product moment correlatio with its restricting assumptions of two normally distributed variables.

The Spearman test can be applied to data which are inherently ordinal, such as preference data, or to interval data converted to ranked form as in our case here.

COMPUTATION

Almost all computation of the Spearman rank correlation coefficient are shown in table 30. The first two columns of the table contain raw data on school attendance and performace in national examination. The third column contains the rankings of school enrolment. They have been ranked from largest to smallest i.e 684 becomes 1 and 163 becomes 36. The rankings of the second variable, performance in national examination given by the average mark score, are given in the fourth column. The differences between the ranked values for each sample point and the squares of these differences are also given in table 30.

The rank correlation coefficient can now be calculated using equation:

$$r_s = 1 - \frac{6\Sigma d^2}{n^3 - n}$$

TABLE 30: ORIGINAL AND RANKED DATA FOR SPEARMAN RANK CORRELATION

	1	2	3	4	5	6
SCHOOL	X ATTENDANCE	Y PERFORMANCE	RANK(X)	RANK(Y)	(X-Y) (d)	$(X-Y)^2$ (d)
SERAWONGO	238	303.86	31	7	24	576
ONYINYORE	264	189.11	25	36	-11	121
BAR-KANYANGO	230	262.50	32	23	9	81
MIGONO	251	312.14	27	4	23	529
GOT-ABIERO	163	229.81	36	32	4	16
BAR-OPUK	369	263.78	16	21	-5	25
BAR-KOWINO	249	263.70	28.5	22	65	42.25
GOBEI	388	298.51	13	10	3	9
NYAMONYE	279	266.61	23	19	4	16
NYABONDO	336	213.71	18	33	-15	225
MINYA	319	194.58	19	35	-16	256
PALA	370	213.25	15	34	-19	361
KANYIBOK	356	298.52	17	9	-8	64
NYANGERA	219	314.23	34	3	-31	961
GOMBE	437	238.29	7	30	-23	529
ULOWA	430	243.72	8	28	-20	400
MAJENGO	403	285.29	9	15	-6	36
JUSA	248	242.18	30	29	1	1
LENYA	224	297.12	33	11	22	484
WAMBARRA	373	237.73	14	31	-17	289
BONDO	684	290.07	1	13	-12	144
MARANDA	496	270.59	2	18	-16	256
MBEKA	478	277.05	4	17	-13	159
NYAMIRA	266	256.34	24	25	-1	1
NYAWITA	252	347.96	26	1	25	625
NYANG'OMA"M"	462	247.39	5	27	-22	484
USENGE	494	309.69	3	5	-2	4
KIPASI	309	287.54	20	14	-6	36
SINAPANGA	457	301.27	6	8	-2	4
ALARA	249	266.15	28.5	20	8.5	72.25
WAMBASA	399	325.16	12	2	10	100
ABOM	199	257.14	25	24	11	121
AJIGO	400	305.63	10.5	6	4.5	20.25
NDIRA	303	296.76	21	12	9	81
BAR-CHANDO	400	277.23	10.5	16	-5.5	30.25
OTHACH	289	253.68	22	26	-4	16

Where:

r_s = is the Spearman rank correlation coefficient

d = is the difference in ranking for each item,

Σd^2 = means that the differences must be squared and then summed, and

n = is the number of items ranked, i.e the number of pairs of rankings.

$$\therefore \quad r_s = 1 - \frac{6 \times 7185}{36^3 - 36} = 0.0753$$

SIGNIFICANCE

The degrees of freedom are 36 (the number of pairs of rankings). Assuming a significance level of 0.05, the critical value of r_s for a one-tailed test is found to be 0.282. This means that there is a probability of 0.05 of getting a sample rank correlation of 0.282 or more when the population correlation is zero.

The calculated value of r_s is less than the critical value for a one tailed test at the chosen significance level of 0.05. We therefore fail to reject our null hypothesis. In other words, our null hypothesis may be accepted at the chosen significance level since there is not enough evidence to disapprove it.

SUMMARY

The conclusion can be drawn that there is a significant rank correlation between the "quality" of the school (in terms of pupils performance in National Examination) and its total enrolment.

We can therefore draw another conclusion that our calculated value of r_s (0.0753) shows or indicates that the correlation between the above two variables in positive, that is, the higher the quality of school the larger the number of pupils enrolled. But it is important to note that this relationship is not strong as evidenced by the magnitude of our calculated r_s value (0.0753), which, though positive, tends towards zero. this means that there are other dominant factors which determine school enrolment other than the quality of the school. Such dominant factors include population of school-age children, accessibility, etc (see section 4.4).

Though not dominant, the above results suggest that one of the factors

influencing primary school enrolment is the performance of the school in the C.P.E./K.C.P.E. examination. From the table 30, one observes that schools uch as Wambasa, Ajigo, Sinapanga and Bondo have relatively good results and, at the same time, are the ones with high enrolment figures. But schools such as Got-Abiero, Onyinyore and Alara are the schools with very poor performance in the C.P.E./C.C.P.E. examination and very low enrolment. It is important to note that these geographical variations in schools performance and attendance cause both short and long-term disparities in the production of current and future high-level manpower which is most needed for a sound national/regional development hence the current disparities in the regional development of Bondo Division.

Teachers, parents, pupils and the rest of Society tend to judge the quality of primary education at each shool by how well the pupils perform on the Certificate of Primary Education/Kenya Certificate of Primary Education, and by how many are given places in Government-maintained secondary schools. This examination has a strong influence on the curriculum and the attitudes of teachers and pupils at the primary school level. Parents, especially the well-to-do are going to great pains to ensure that their children attend the so-called "high quality schools".

TABLE 31: Bondo Division K.C.P.E. Brief 1988 and the total enrolment in each school

	TOP TEN SCHOOL	ENROLMENT	LOCATIONS
1.	Mageta	178	Yimbo
2.	Ndira	303	North Sakwa
3.	Kipasi	309	South Sakwa
4.	Nyang'oma "G"	363	South Sakwa
5.	Lenya	224	South Sakwa
6.	Migono	251	South Sakwa
7.	Magiwa	414	North Sakwa
8.	Gobei	388	North Sakwa
9.	Mbeka	478	South Sakwa
10.	Wambasa	399	Yimbo
	AVERAGE ENROLMENT	331	
	BOTTOM TEN SCHOOLS	ENROLMENT	LOCATION
1.	Mahanga	176	Yimbo
2.	Kasau	166	Yimbo
3.	Abom	199	North Sakwa
4.	Oyamo	90	South Sakwa
5.	Nyang'oma "B"	181	South Sakwa
6.	Ndiwo	132	Yimbo
7.	Mitundu	108	Yimbo
8.	Nyabondo	336	Yimbo
9.	Nyaguda	226	South Sakwa
10.	Got Ramogi	301	Yimbo
	AVERAGE ENROLMENT	192	

4.10 MANPOWER, SERVICE AND OTHER LEARNING FACILITIES IN PRIMARY SCHOOLS - COMPARATIVE ANALYSIS

It is important to note that the question of manpower, equipment and other learning facilities is important in analysing the variation in use of educational facilities. This is mainly because most educational facilities are under utilized either because they lack staff, equipment or there is not enough learning facilities (see plate 5). Others are overutilized because of various factors ranging from the population density of school-age children to the existing number of existing educational facilities, that is the fewer the facilities (primary schools), the more they are overutilized.

In the study area staffing levels and the qualifications of the staff vary from one school to another. The following Appendix 5 shows the nature of staffing and the variations within the study area.

Appendix 5 shows that there exists disparities in the distribution of staffing in the existing primary schools on one level (that is, full primary schools having classes from I - VII) as well as at different levels. In the first case, it is obvious that even though the full primary schools are of equal levels, this is not reflected in the staffing. This is surprising since it defies the current government policy that all schools should be equally staffed depending on the category in question. In absolute terms, Bondo Primary school is better staffed with 23 staff members as compared to Usenge Primary School with only 9 staff members. There are also variations of staff of various grades among primary schools (see Appendix 5).

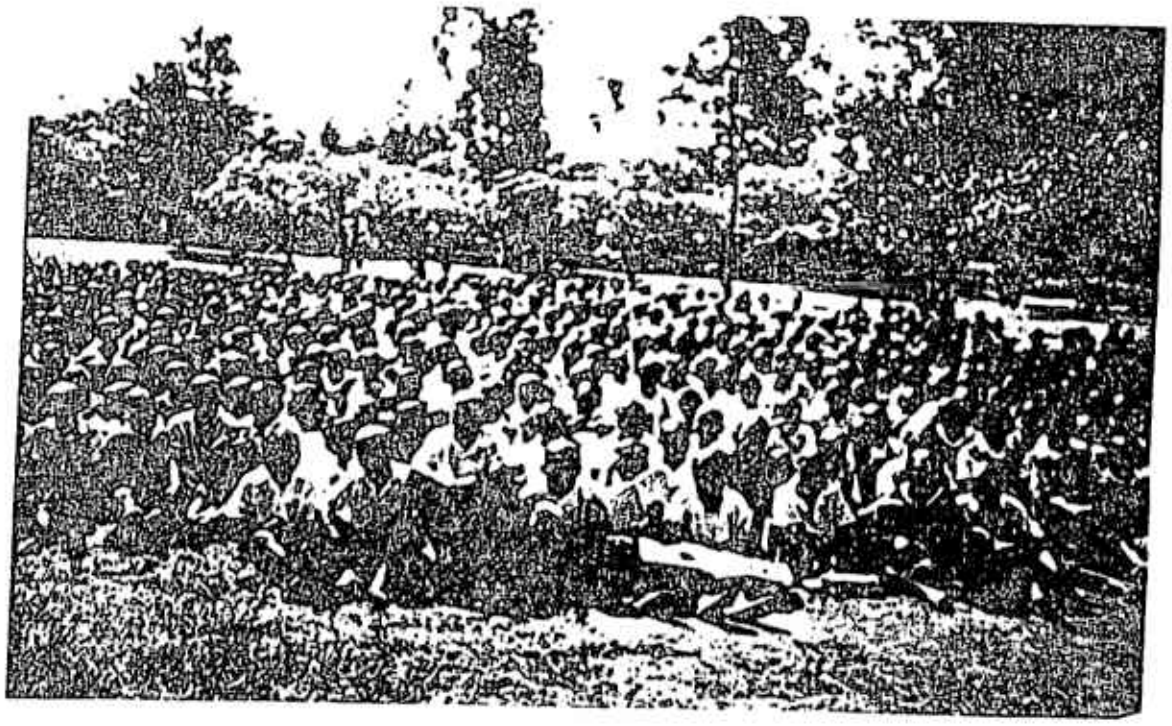
The Kenya Government recommends that teacher:pupils ratio should be 1:40 maximum but due to disparities in staffing position among the primary schools, this ratio highly fluctuates in different schools. For example, in Bondo primary school, this ratio is almost double (about 1:75) (see plate 2). Other schools such as Migono and Nyabondo, the ratio is very low, about 1:20. This means that in some schools, the teachers are overworked while in others teachers are underworked.

Service/learning facilities in education centres are basic and includes such things as laboratories, workshops, classrooms and desks etc. In Bondo Division, there is high disparities in the

availability of these facilities among the schools. Some schools totally lack laboratories and workshops, and the available classrooms and desks are insufficient to serve their respective number of pupils. Other schools have such facilities but in very bad conditions - classrooms are almost falling down, the roofs are leaking, the desks are broken or totally not there (see plate 3).

In some schools with very large numbers of pupils and with insufficient number of such learning facilities, the pupils are forced to learn under trees and worse still some of them sit on the ground (see plates 4, 5, 7 and 8). But it is important to note that such disparities in the availability of learning facilities reflects the level of socio-economic development of the community in which the schools are located as it has become the responsibility of the parents to develop their respecti schools under the recently introduced cost-sharing policy (see section 4.12).

PLATE 1

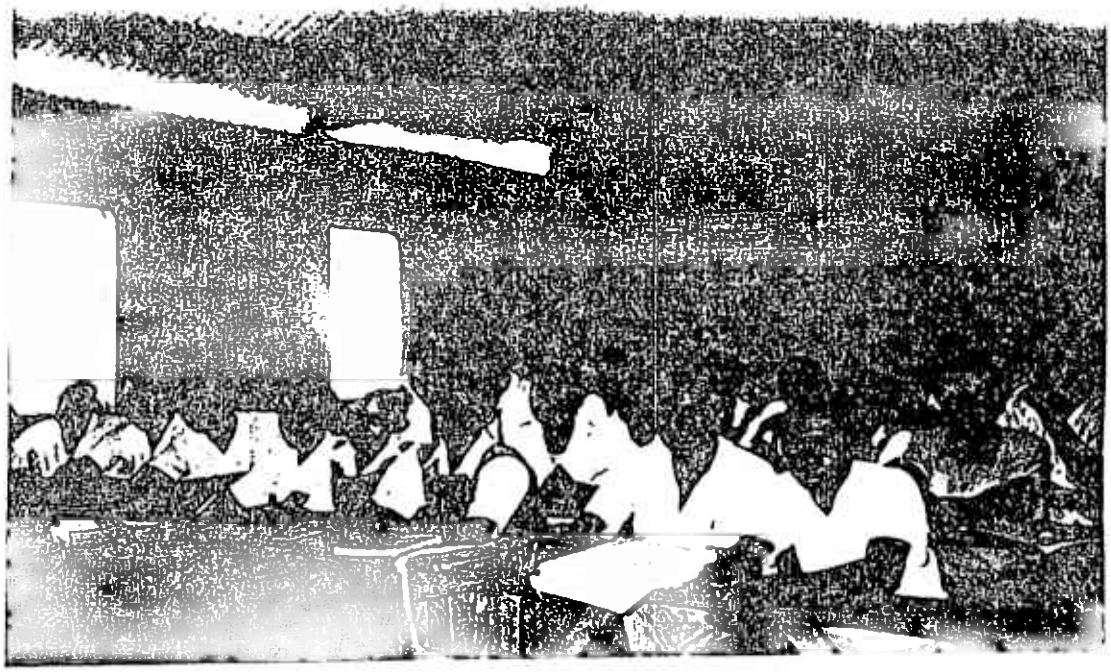


CONGESTION IN BONDO PRIMARY SCHOOL: A case of overutilization of Educational Facilities due to the huge population of School-age children in the area.

NOTE: Bondo is a rural centre school.

SOURCE: Field Survey.

PLATE 2



A STANDARD 8 CLASS of 75 pupils - in Bondo Primary School. The Class is congested with some pupils having no desks.

SOURCE: Field Survey.

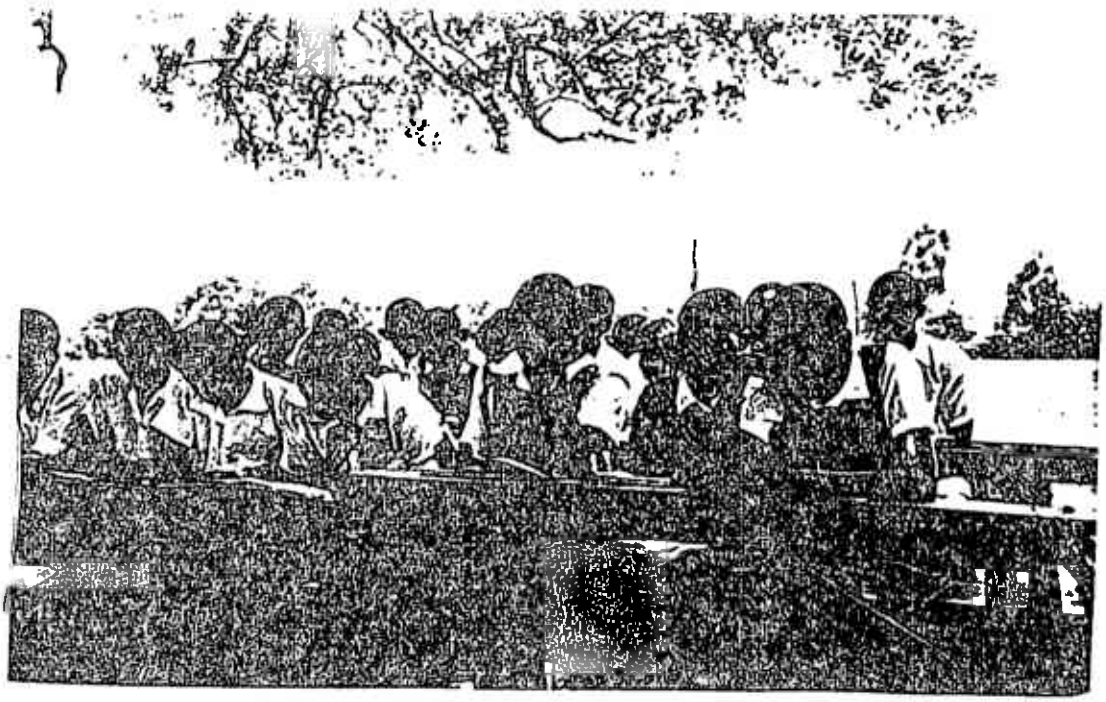
PLATE: 3

ONE OF THE TWO BUILDING IN ONYINYORE PRIMARY SCHOOL: The existing classrooms are in very bad condition.

NOTE: The school is located in South Sakwa Location where the parents' income level is rather poor and therefore, the parents find it extremely difficult to raise funds for the construction and maintenance of their respective schools.

SOURCE: Field Survey

PLATE 4:



INSUFFICIENCY OF LEARNING FACILITIES IN KIPASI PRIMARY SCHOOL: The pupils learn under a tree because there is no classroom for them, even though there are enough desks.

SOURCE: Field Survey.

4.11 ANALYSIS OF DISTRIBUTION AND VARIATION IN USE BY SOCIO-ECONOMIC STATUS

> "In proportion as the capacities of some are sterilized or stunted by their social environment while those of others are favoured or pampered by it, equality of opportunity becomes a graceful, but attenuated, figment. It recedes from the world of reality to that of perorations".
>
> R.H. Tawney, Equality. 1952

In this section, our attention will now be focused on the implications of differential regional development and social differentiation and its relationship to the regional development and use of educational facilities. It is of crucial importance to note that the predominant issue revolved around the distribution of educational resources and opportunities between regions and social groups. The issues of inequality in education in this period fits closely with the increasing concern for income distribution and spatial spread of development in the study area.

The social status of individuals influences the use of various educational facilities significantly. Especially important is the income received because this dictates whether or not a primary school can be built, maintained and attended.

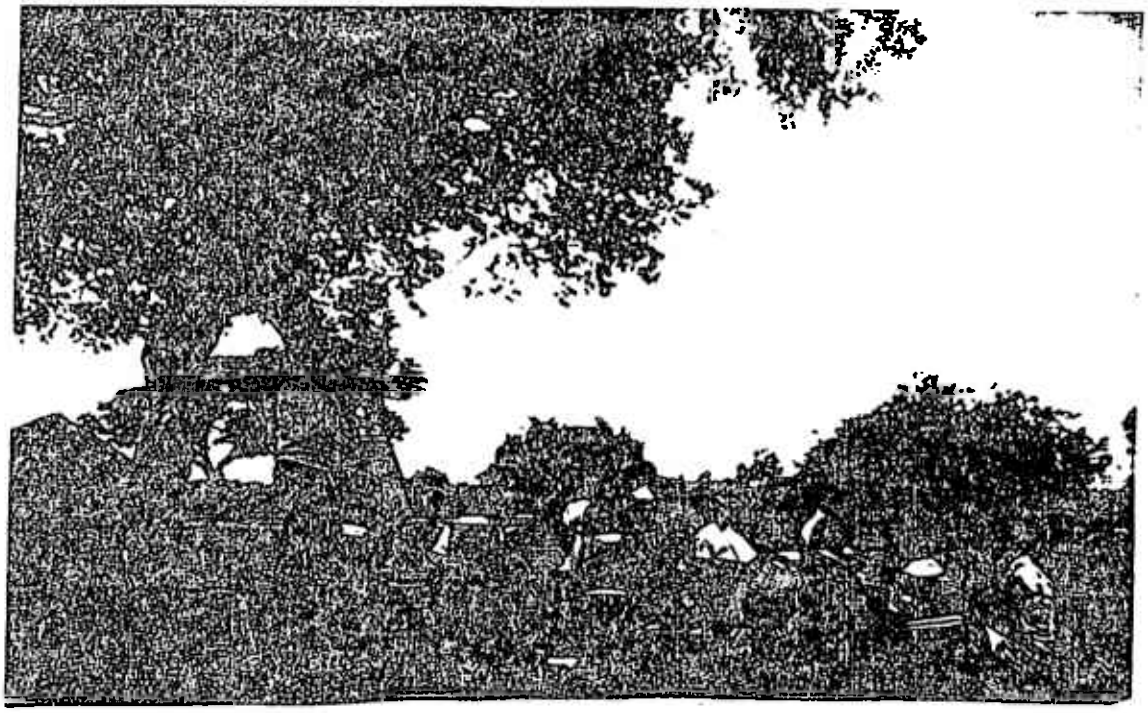
A consideration of the distribution of expenditures on education by individuals is an important complement to the discussion of the distribution of public expenditure. Before primary school education was made "free", poor peasants had to spend a large sum of money a year per pupil. But the burden still remains, although the expenditure is no longer termed school fees. In addition to expenditures on miscellaneous things (such as buying text-books, exercise books etc), the peasantry is further required to pay for the building of staff houses, classrooms, maintenance of the school buildings and the cost of other facilities which are needed in primary schools. The rural communities meet those expenses with little help from outside, so that a school-building committee exists for every such rural primary school.

It is not surprising that some rural families in Bondo Division do not send all their children to school, even when facilities are available. (See Appendix 7). Sometimes parents are also forced to withdraw their children from school due to lack of fees. When a family has to make a decision on who is to be educated, girls are

the first to be left out and they are the first to be withdrawn from school when funds are short. Education in the study area also occasionally suffers from natural disasters such as droughts or crop failures since the income level of smallholders is controlled by the vagaries of nature.

PLATE: 5

INSUFFICIENCY OF LEARNING FACILITIES (i.e desks, classrooms etc) IN LENYA PRIMARY SCHOOL.



NOTE: The school is located in Nyang'oma sub-location, South Sakwa Location, which is a poverty striken area where most parents cannot even afford to buy uniforms for their children. Notice the headmasters' office in the background.

SOURCE: Field Survey.

4.11.1 CLASS DIFFERENTIATION OF SCHOOLS

"There are three classes of people.
Few who make things happen.
Scores who watch things happen.
Milliards who have no idea of what is happening."

Wall posters in Government Offices,
Nairobi, 1989.

Intra-division differences in the distribution of educational facilities take two main dimensions. First, there are differences between regions within the division. Regional disparities are well defined between South Sakwa, North Sakwa and Yimbo locations.

The second dimension of intra-division differences are those between social groups. There are differences between the rich peasants on the one hand and poor peasants and labourers on the other. This process is observable in both backward locations such as Yimbo and in relatively developed location such as North Sakwa. As pointed out, inequalities among rural households can be traced to inequalities in natural resources ~~and~~ endowments, access to land, credit facilities and cash crop production and the overall nature of the main economic activities carried out. Such inequalities are reflected in the regional distribution and variation in use of primary schools. North Sakwa with a better average income level per household, has a relatively better average density of primary schools, about 24 per 100 square kilometres. South Sakwa with an average income level of Kshs.727 (as compared to Kshs.1080 for North Sakwa) has primary school density of 23 schools per 100 square kilometres and finally, Yimbo with an average income level of Kshs.603, has a density of 17 schools per 100 square kilometres (see table 17).

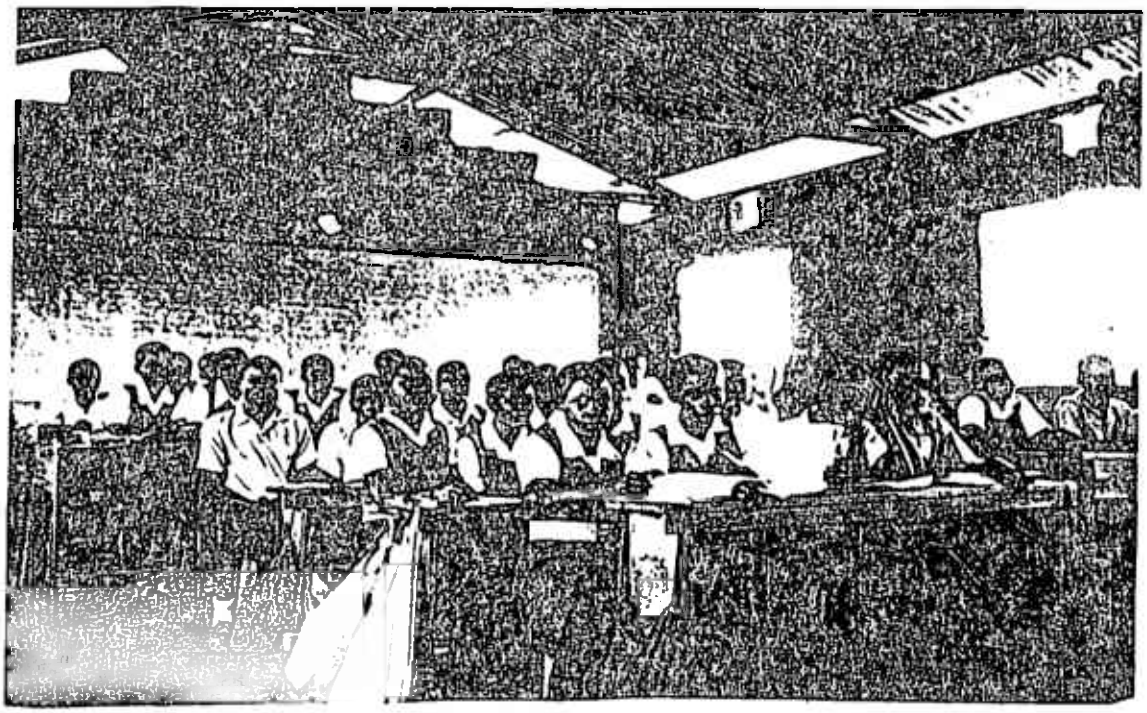
Since primary schools are built and maintained on harambee basis, it is therefore logical to conclude that locations or areas with very low average income levels will continue having fewer number of schools which in some cases are underutilized, whereas areas with a relatively high level of income will continue having more schools which in some cases are overutilized because parents are capable of building and maintaining schools for their children and are also able to send all their children to school.

NOTE: Some primary schools along the lakeshore (such as Kanyibok, Ulanda, etc) are underutilized not because of the poverty of parents but because parents would like their children to help them in their fishing activities rather than go to

school. An interview with each of the headmasters of such schools revealed this to be the main problem which has resulted in the low school enrolment hence the underutilization of those schools.

PLATE 6

STANDARD 8 CLASS IN SINAPANGA PRIMARY SCHOOL:
The School has adequate number of learning facilities.



NOTE: This School is in North Sakwa location, where as we have seen, the per capita income level is relatively higher as compared to other locations. The parents are able to raise funds on harambee basis for the building and maintenance of their schools.

SOURCE: Field Survey.

PLATE 7:

STANDARD V CLASS IN ULANDA PRIMARY SCHOOL: There is lack of adequate number of classrooms.

NOTE: There is poor pupil enrolment in this school mainly because most children take to fishing instead of going to school.

SOURCE: Field Survey

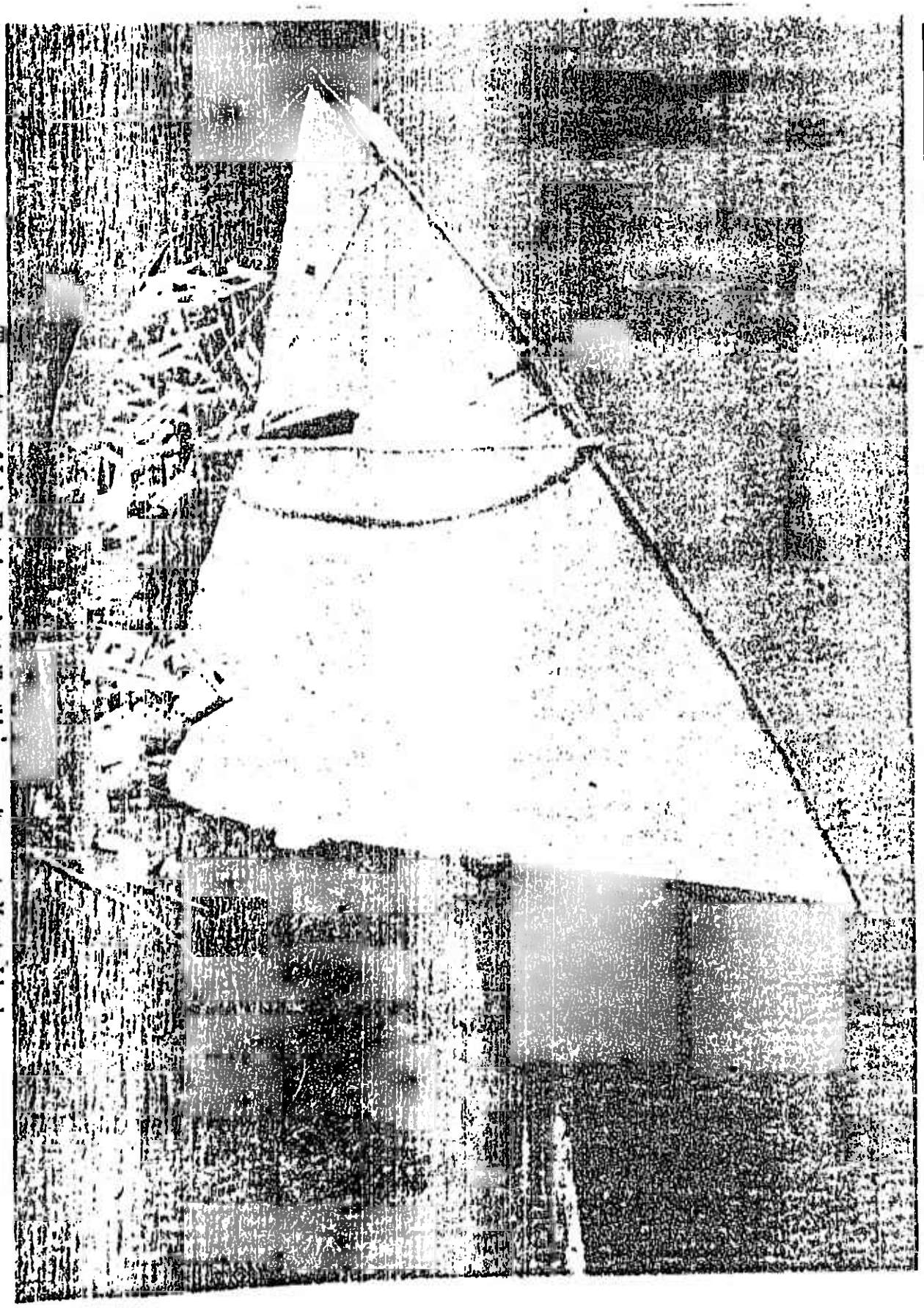
To sum up, we have indicated that the structure of primary schools in Bondo Division is closely related to income structure which is essentially a class structure.

PLATE 8:

LACK OF LEARNING FACILITIES IN KIPASI PRIMARY SCHOOL: There are no desks, no classrooms and therefore the pupils have to learn under a tree.

SOURCE: Field Survey.

PLATE 9:



Time has brought change to Kenya's 'Robben Island'

The mataus of Lake Victoria are boats like this one on its way to Mageta Island

A good transport system is of crucial importance in the distribution and provision of learning facilities to primary schools. The above boat carries desks from the main land to Mageta Primary School in the Island.

CHAPTER 5

5.0 CONCLUSIONS AND RECOMMENDATIONS.

5.1 INTRODUCTION.

In this chapter, the author aims at bringing together the basic conclusions of the study. Recommendations will also be made on how certain problems or difficulties identified in the study can be solved. It is hoped that both the conclusions and recommendations will provide a reasonable basis for the current and future education planners as well as other professional investigations in the issue of improvement of rural educational facilities in Kenya.

5.2 CONCLUSION

The purpose of this paper has been first, to outline the physical, demographic and socio-economic background to the emergence of regional and class inequalities in provision of primary education in Bondo. Secondly, the paper has analysed the existing regional and class inequalities in education focusing mainly on the period between 1970 and 1989. In essence, the paper has attempted to show the relationship between the development of "capitalism" in Bondo and the unequal development of education between regions and among social classes.

It is important to note that the overiding theme in this paper is that of distribution and variation in use of rural educational facilities. It is again noted that to achieve efficiency in the dispensation of education services, appropriate spatial distribution of such facilities should be done with due regard to certain basic factors. It has been found that the chief among these factors is the demographic aspect that is concerned with spatial population distribution and density. This is followed by the twin factor of the physical environment which as we have seen, determines the population distribution and the resultant density, which is turn influences the distribution and variation in use of educational facilities.

Thirdly, there is the factor of socio-economic background of the area and last but not least, there is the factor of Missionary or religious contribution.

It has been observed that the distribution of educational facilities corresponds with that of population which is uneven. Infact, it is apparent that not much attention has been paid to the spatial distribution of educational facilities and the population and accessibility criteria alone which are advocated by the Ministry of Education do not seem to have worked. The factor of the physical environment which has limited the number of schools in certain areas (such as the swampy lands of Western parts of Yimbo, the hilly areas of Got-Agulu sub-location, and Utonga Highlands) has also a profounding effect on the distribution of schools. The factor of regional differential income levels has also made inequalities in the distribution of primary schools worse, with locations such as North Sakwa with better monthly household income levels, having more schools as compared to the disadvantaged locations such as Yimbo. This is because the building and maintenance of schools is the responsibility of the local communities concerned, which they do on harambee basis. Poverty striken areas cannot afford to spare money for such projects hence fewer schools exist in such areas or localities.

Availability of other related community facilities such as water, transportation, trading centres, etc are very important on the question of educational facility distribution. Without some of these, it may be impossible to locate educational facilities in certain areas.

On the use of educational facilities, it may be concluded that attendance (and therefore use) differs accordingly from one region to another, depending on such factors as regional monthly household income levels, population density of school-age children, human perception of the concept of education and the prevailing economic activities in the area, to mention a few. The social status in terms of monthly household income determines whether a parent will take his/her

children to school or not. This factor has been pinpointed and aggravated by the recently introduced "cost sharing" policy in education. For example, most schools in Yimbo location and some schools in South Sakwa location have very poor pupil enrolment partly because of the low population density and partly because of the prevailing low income situation in those areas. In such circumstances, the researcher found that some parents have either not sent their children to school or have removed them from school mainly because of the high cost of living.

It has come to the researcher's notice that physical factors of distance and time significantly affect the use of educational facilities. Most pupils attend their nearest educational facilities and most parents also prefer taking their children to schools which are nearby. However, in the case of some "high-quality" schools, most pupils attend because such schools do well in National Examination and such schools have a wider range as compared to the so-called poor-quality schools. It is important to note that distance (in absolute terms) is related to the time taken to travel to educational facilities. This implies that the further the educational facilities from the pupils places of residence, the more expensive it is to get there in terms of time used to travel, and money used where public means of transport is used.

Owen, W (1968), - Claims that "further advantages result from the changes in village life that follow construction of an all-weather road, such as improvement of school and better school attendance .....". The above quotation which was experienced by W. Owen in his research on the "Impact of transportation network in development in India", also applies to some extent in Bondo Division. It has been found in this paper that improved transport system and transport facilities in an area influences the growth and the quality of some schools.

In the study area, there are a total of 124 primary schools, observing figure9, it can be seen that some schools are located next to good transport routes while others (very few) are relatively located next to poor transport network.

Several factors have therefore been found to explain the nature and the distribution of primary schools in the study area. These include among others: population distribution, income distribution of the people, church influence, and transportation network.

An area with a dense population distribution will definitely influence the establishment of a school in that particular area. The people of the area will decide to build a school for their children whether there is a nearby good transport network or not. Usually in such areas, a school is first established then a feeder road is constructed that connects the school with the main road as in the case of Kapiyo Primary school and many others.

Similarly, if in an area, the population has good income distribution obtained from economic activities such as fishing, farming, commerce, and some other activities, the location of schools would also be random regardless of the type of transport system that occurs in that particular area. Almost all schools in North Sakwa and especially in Nyawita and Marand sub-locations have grown because of good income distribution in those areas.

The location of some schools have also been influenced by the establishment of missions (churches) in some areas, as in the case of Nyan'goma sub-location where the Catholic Mission has established schools such as Nyan'goma mixed, Nyan'goma girls, etc.

Although the above factors affect the location and distribution of schools, good transport system together with efficient transport facilities would definitely have agreat influence on the nature of growth and the quality of schools quite effectively. For example, there are some schools in the division which were established in the 1940s, but up to date, have not grown beyond std. VIII classes, whereas some schools which were opened later have grown tremendously, and have therefore acquired status of secondary schools. The question is: to what extent is the nature of growth and quality of schools influenced by efficient transport network and facilities.

5.3 RECOMMENDATIONS

So far, the researcher has identified the pattern of distribution of educational facilities (i.e. partly random and partly even), and the factors associated with such a distribution. Possible anomalies which are likely to be associated with such a distribution have also been highlighted. The main reasons for the variation in use of educational facilities in the study area have also been identified.

In view of the above summarized findings, the following recommendations should be made, which in future will contribute ^ the improvement of education services in rural areas.

5.3.1 RECOMMENDATIONS TO THE GOVERNMENT

In the provision of education services by the government and other agencies, an integrated approach should be adopted in order to eliminate the currently existing anomalies in the distribution. This is of particular importance in future because more and more educational facilities are bound to spring up in rural areas. The government should pay particular attention to the less advantaged areas (or regions) in terms of the provision of education services. The implementation of the recently ^ cost-sharing policy should be revised so that the people in poverty striken areas are given much more assistance in the field of education than is currently done.

If this is not done then the gap between the rich and the poor will continue to widen which will again be relected in the inequalities in the provision, distribution and variation in use of educational facilities and unless immediate action is taken, things will grow from bad to worse.

It should also be noted that the distribution of teachers should be done equally for all schools without discrimination whatsoever. The current situation in the researchers study area is that some primary schools are overstaffed while others are understaffed. This unequal distribution of teachers should be stopped fourthwith.

Transportation and the quality of educational facilities should be improved to enable equal use of such facilities without under-and over-utilization of some of them. This can be done by providing (equally) some subsidies in terms of learning facilities and also by making sure that there is equal distribution of teachers in terms of their qualifications. Transportation network should be improved so that inaccessible areas are brought within easy reach. This will help in the construction of more schools in ares with very few schools, assist in population redistribution, and assist in school supervision.

Piped water should be given to areas with no water supply to curb the problem of severe water shortage which if not solved could lead to the closure of some schools in such areas.

RECOMMENDATIONS TO SCHOLLARS

Like in other social Services, Planning for educational facilities is an interdisciplinary process which requires the efforts and expertise of different disciplines. The expertise whose skills are most needed include human ecologists, sociologists environmentalists, geologists and planners from other disciplines. It should be noted that the geopgrapher's skill especially is required in the understanding and explaining the spatial distribution of phenomena. The interaction of different expertise from different disciplines should solve not only the problem of distribution but alos that of variation in use of these services.

Lack of adequate and up-to-date data is one of the serious economic drawbacks in the study area. Very little research has so been conducted in this area. Since no government can adequately plan, remain responsive to the needs of its citizens, or innovate without steady input of up-to-date information regarding the needs of the citizens, it is strongly recommended that a more extensive and intensive research need to be conducted in this area.

At present, the research on the distribution and variation in use of primary schools has mainly been carried out at the macro level (i.e. country or district), with this one being the first of its kind to be done at the micro level (i.e. Division, location and sub-location). It is, therefore, recommended that similar research should be done at the micro level and if possible in other areas with different physical, human and/or socio-economic back-ground so that comparisons may be made and concrete conclusions drawn.

Last but not least, it is recommended that such research should be more inter-disciplinary in approach so as to avoid unnecessary biases. But scholars from the discipline of Geography should conveniently apply their trans-disciplinary approach in this area of study.

5.4 SUGGESTIONS FOR FURTHER RESEARCH.

Since progress in any given field depends primarily on research, it is unrealistic to expect that rapid progress could take place in this field as long as little or no research is undertaken. Those who wish to undertake further research in this field should try to improve on the limitations of this paper:

(i) The sample size should be enlarged to make such sample more representative.

(ii) Much attention should be given to the impact of missionaries on the distribution and variation in use of educational facilities.

(iii) The impact of socio-economic factors in the distribution and variation in use of such facilities should be more critically analysed. The data on income levels seemed very difficult to obtain and so other researchers should take note of that if they are to come out with more correct and representative data.

NB: This study does not pretend to include final solutions to the problems discussed in this paper. All it does is only to indicate the direction in which such solutions will have to be sought. It will, however, have very little or no practical impact unless the recommendations put forward in it are acted upon by relevant authorities. Such authorities should try to cristallize the research findings and hence come out with their practical applications.

FOOTNOTES

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APPENDIX I

PRIMARY SCHOOLS IN BONDO DIVISION

NORTH SAKWA	SOUTH SAKWA	YIMBO
Kamnara	Orengo	Othach
Nyabenge	Serawango	Pala
Majiwa	Wambarra	Majengo
Gobei	Mitiro	Bar Kanyango
Lwala	Akoko	Jusa
Waringa	Uyawi	Wambasa
Bondo	Barkowino	Nyangera
Agwara	Kipasi	Nyamonye
Nyamira Girls	Gombe	Kanyibok
Nyamira Mixed	Got Abiero	Sanda
Maranda	Nyaguda	Usenge
Kapiyo	Mbeka	Ulowa
Uloma	Nyangoma Girls	Mageta
Nyawita	Nyangoma Mixed	Got Ramogi
Ndira	Ulanda	Uhanya
Ahinyanya	Warianda	Nyayo
Alara	Lenya	Got Agulu
Nyandusi	Odao	Nyabondo
Magawa	Dago	Rapogi
Ndhere	Miyandhe	Alinga
Bar-Kuogo	Migiro	Sangwe
Usire	Onyinyore	Muguna
Masita	Abimbo	Ndiwo
Nyakasumbi	Uhendo	Odhuro
Sinapanga	Otuoma	Ragak
Gunda Sigomere	Minya	Aduwa
Yieko	Chamagaha	Mago
Bar-Kawaga	Migono	Barawendo
Obedi	Thim	Chunga
Bar Opuk	Matangwe	
Manyonge	Waringa	

APPENDIX I Countinued

NORTH SAKWA	SOUTH SAKWA	YIMBO
Bar Chando	Oiko	
Ajigo	Kibuye	
Sirembe	Dunya	
Abom	Bar-Muotu	
Mawere	Siage	
Ober	Olago	
Okola	Rabango	
	Ligawa	
	Ndeda Island	
	Bur-lowo	
	Ratiya	

SOURCE: DIVISIONAL EDUCATION OFFICE BONDO, 1989 STATISTICS.

APPENDIX 2

SCHOOL	TOTAL ENROLMENT	AVERAGE SCORE IN 1985 K.C.P.E. NATIONAL EXAMINATION
Akoko	186	252.78
Magak	236	
Gombe	437	238.29
Dago	282	
Migiro	184	
Mbeka	478	277.05
Miyandhe	160	249.13
Nyango'ma "M"	462	247.39
Nyango'ma "G"	363	311.22
Nyango'ma "D"	181	
Nyango'ma "TP"		
Oyamo	90	
Onyinyore	264	
Odao	222	
Serawongo	238	303.86
Sifu	114	
Ulanda	136	
Uyawi	458	303.37
Lenya	224	
Warianda	93	
Nyamwanga	49	
Wambarra	373	237.73
Olago	35	
Rabango	25	
Ligawa	25	
Ndeda Island	66	
Waringa	137	228.96
Uhendo		
Siage	204	248.88
Orengo	322	256.39
Otuoma	286	236.54
Oiko	124	216.81
Nyaguda	226	202.45

APPENDIX 2 COUNTINUED

Matangwe	318	249.83
Migono	251	
Maranyona	192	
Minya	319	194.58
Kibuye	159	
Kipasi	309	287.54
Got-Abiero	163	229.81
Dunya	248	
Chamagaha	186	183.33
Bar-Muofu	342	266.43
Bar-kowino	249	263.70
Atilili	218	
Abimbo	169	
Got-Kochieng	105	
Dier-Aora	61	
Thim	105	
Ratiya	28	
Bur-lowo		
Bar-Kuoyo	277	
Mitiro	247	235.64
Abom	199	
Ajigo	400	
Agwara	203	232.69
Bar-chando	400	277.23
Bar-Opuk	369	263.78
Bar-Kawaga	290	291.76
Bondo	684	290.07
Gobei	388	298.51
Keyo Kodindo	240	
Kayogo	183	
Kapiyo	307	292.22
Kamnara	326	310.17
Lwala	303	219.63

Appendix 2 Continuation

Mawere	241	
Masita	153	
Manyonge	156	
Majiwa	414	312.22
Maranda	496	270.59
Magawa	201	
Ndhere	72	
Nyabonge	336	274.41
Ndira	303	296.76
Nyandusi	267	290.31
Nyamira "M"	266	256.34
Nyawita	252	347.96
Sinapanga	457	
Shinyanya	206	271.85
Usire	274	
Uloma	353	277.06
Ugadhi	180	
Yieke	248	
Kambojo	40	
Obedi	73	
Nyakasumbi	56	
Maranda M. Handio		
Okola	59	
Sirembe	35	
Gunda Sigomere	30	
Milenga'	54	
Alara	236	
Alinga'	348	
Abidha	316	
Bar-Kanyango	230	262.50
Got-Matar	237	236.73
Got-Ramogi	301	299.96
Kanyibok	356	298.52

Appendix 2 Continuation

Kasau	166	
Muguna	229	
Mago	258	290.55
Mahanga	176	
Mitundua	108	
Majengo	403	285.29
Mageta	178	288.00
Nyamonye	279	266.61
Ndiwo	132	
Nyangera	219	214.23
Nyabondo	336	
Nyayo	295	
Jusa	248	242.18
Othach	289	253.68
Odhuro	436	262.56
Pala	370	213.25
Rapogi	354	
Ragok	215	
Sanwe	130	
Sanda	222	237.37
Usenge	494	309.69
Ulowa	430	243.72
Uhanya	182	
Wambasa	399	325.16
Bar-Awendo	25	
Chunga	21	

APPENDIX 3

NAME OF SCHOOL	DISTANCE (IN KM) OF THE SCHOOL FROM THE NEAREST:			
	MAIN ROAD	DISPENSARY	WATER SUPPLY	LOCAL MKT/TRADING CEN
BAR-KOWINI	5.0	4.0	1.0	4.0
JUSA	4.5	3.5	1.5	1.0
MAJENGO	0.1	3.0	2.0	2.5
WAMBASA	1.5	1.5	2.0	1.5
PALA	0.75	6.0	1.0	2.0
NYAMONYE	0.2	4.0	0.4	0.5
AKOKO	1.0	6.0	1.5	1.0
ORENGO	0.5	6.0	0.5	3.0
WAMBARRA	2.0	4.0	3.0	2.0
GOBEI	0.1	0.1	1.0	2.0
BONDO	0.5	0.5	0.5	0.5
BAR-OPUK	2.5	3.0	1.0	4.5
GOT-ABIERO	1.5	10.0	2.5	4.0
NYANGERA	0.1	1.0	1.5	1.0
MBEKA	10.0	5.0	4.0	3.0
NYAMIRA "M"	4.0	7.0	7.0	7.0
KIPASI	0.4	11.0	0.4	3.0
GOMBE	3.0	8.0	8.0	5.0
SINAPANGA	0.5	2.0	0.1	2.0
NYAWITA	0.5	2.5	1.0	2.5
USENGE	0.3	3.0	0.3	0.3
BAR_KANYANGO	8.0	10.0	6.0	8.0
NYANGOMA"M"	0.5	3.0	5.0	2.0
MIGONO	1.5	10.0	10.0	2.0
MINYA	0.1	5.0	2.0	0.2
ALARA	3.0	5.0	5.0	2.0
ONYINYORE	0.9	1.2	6.0	1.2
SERAWONGO	0.5	3.0	2.5	0.6
NYABONDO	0.5	2.0	1.2	1.0
MARANDA	0.4	3.2	3.2	3.2
LENYA	0.01	2.8	2.3	1.2
TOTAL	54.36	136.3	83.4	73.7
AVERAGE/MEAN	1.75	4.40	2.69	2.38

APPENDIX 4

S C H O O L	DISTANCE(INKM) OF THE SCHOOL FROM THE NEAREST: NEIGHBOURING SCHOOL	MAIN ROAD	DESPENSARY	WATER SUPPLY	LOCAL MKT/ TRADING CENTR
BAR-KOWINO	2.0	5.0	4.0	1.0	4.0
JUSA	3.0	4.5	3.5	1.5	1.0
MAJENGO	2.0	0.1	3.0	2.0	2.5
WAMBASA	2.0	1.5	1.5	2.0	1.5
PALA	3.0	0.8	6.0	1.0	2.0
NYAMONGE	1.0	0.2	4.0	0.4	0.5
AKOKO	1.0	1.0	6.0	1.5	1.0
ORENGO	2.0	0.5	6.0	0.5	3.0
WAMBARRA	2.5	2.0	4.0	3.0	2.0
GQBEI	2.0	0.1	0.1	1.0	2.0
BONDO	2.0	0.5	0.5	0.5	0.5
BAR-OPUK	3.0	2.5	3.0	1.0	4.5
GOT-ABIERO	2.5	1.5	10.0	2.5	4.0
NYANGERA	5.0	0.1	1.0	1.5	1.0
MBEKA	3.0	10.0	5.0	4.0	3.0
NYAMIRA"M"	1.5	4.0	7.0	7.0	7.0
KIPASI	3.0	0.4	11.0	0.4	3.0
GOMBE	3.0	3.0	8.0	8.0	5.0
SINAPANGA	2.0	0.5	2.0	0.o	2.0
NYAWITA	3.0	0.5	2.5	1.0	2.5
USENGE	0.3	0.3	3.0	0.3	0.3
BAR-KANYANGO	3.0	8.0	10.0	6.0	8.0
NYANGOMA "M"	1.0	0.5	3.0	5.0	2.0
MIGONO	2.0	1.5	10.0	10.0	2.0
MINYA	2.0	0.1	5.0	2.0	0.2
ALARA	1.0	3.0	5.0	5.0	2.0
ONYINYORE	2.8	0.9	1.2	6.0	1.2
SERAWANGO	1.5	0.5	3.0	2.5	0.6
NYABONDO	1.0	0.5	2.0	1.2	10
MARANDA	1.5	0.4	3.2	3.2	3.2
LENYA	1.5	0.01	2.8	2.3	1.2
MEAN	2.13	1.75	4.40	2.69	2.38

APPENDIX 5

TEACHERS PER GRADE: MARCH 1989

SCHOOL	TOTAL ENROL	ATS M	ATS F	S1 M	S1 F	P1 M	P1 F	P2 M	P2 F	P3 M	P3 F	A* M	A* F	O* M	O* F	KJS M	KJS F	M	F	TOTAL
1. AKOKO	185					3		1						1	1			5	1	9
2. ALARA	251					5		1		1				1		1		9		9
3. DAGO	280					4		2						1		1		8		8
4. GOMBE	437					1	2	2		2	1			3	1			7	4	11
5. LENYA	222					3				1				2		1	1	7	1	8
6. LIGAWA	24					1												1		1
7. MAGAK	256					4		1		1			1	1				7	1	8
8. MBEKA	478					2	1	1	1	2		1	1	2	1			8	4	12
9. MIGIRO	188					5								2	1			7	1	8
10. MIYANDHE	156					4				2				1		1		8		8
11. NDEDA	78							1										1		1
12. NYAMWANGA	49							1			1							1	1	2
13. NYANGOMA"M"	364					2	1	1	1					2	3	1		6	5	11
14. NYANGOM"G"	363				1	2	3	2			2							5	6	11
15. NYANGOMA SFD	177			4	3	7	1	1	1					1				13	5	18
16. OLAGO	30					1												1		1
17. ODAO	233					1		3		1				3				8		8
18. ONYINYORE	280					3		2	1		1				1	1		7	2	9
19. OYAMO	88					5								2	1			7	1	8
20. RABANGO	25					1												1		1
21. SERAWANGO	238					2		3		1				2				8		8
22. SIFU	109					4		1						2				7		7
23. ULANDA	140					4								3		1		8		8
24. UYAWI	458					3	1	1	1	1		1		1				7	2	9
25. WAMBARRA	373					2	1	2						1	1	1		6	2	8
26. WARIANDA	93					1	1	1				1		1				4	1	5
27. KAPIYO	303					3	1	1	1					1				5	2	7
28. NYANDUSI	264					5		1		1				2			1	7	1	8
29. SINYANYA	186					4	1		1			1			1			5	3	8
30. AGWARA	199					1		3						4		1		9		9
31. MARANDA	496			1	1	3				2				1				5	3	8
32. NYAMIRA	266			1		2	2	1				1		1	2			6	4	10
33. ULOMA	360			1		2			2					3	3			6	5	11
34. BONDO	578			1		3	4	3	4	1	2	2		1	2			11	12	23
35. NYAWITA	252			1		4	1				1			1	1			7	2	9

APPENDIX 5 CONTINUATION

SCHOOL	ENROL	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	10
36. BAR OPUK	359					2	1	2		2				2	1			8	2	10				
37. LWALA	305					2		2	1	1			1					3	2					
38. KAMNARA	325					3			1		1			3				6						
39. GOBEI	388					1		3	2	1				3	2			8	1	9				
40. MAJIWA	414			1		3			2		1			2	2			6	3	11				
41. BAR_CHANDO	400					2	2	1	1		1	2	1		1	1		7	5	12				
42. NDIRA	274					4	1					1		2	1			7	2	9				
43. NYABENGE	318					4	3	1				1		2				8	3	11				
44. MANYONGE	156			1		3		1						2				7		7				
45. USIRE	274					2	1	3		1		1	1					7	2	9				
46. MASITA	141					3				2				6				11		11				
47. SINAPANGA	457			2		3	2	1	2		2		2	3				6	11	17				
48. MAGAWA	251					1	2	2						5				6	2	8				
49. YIEKE	209					6	1		1	1				2				9	2	11				
50. MAWERE	219					1		2		1				4				8		8				
51. NDHERE	94					5	1			1				1	1			8	2	10				
52. ABOM	55					1		2		1				3				7		7				
53. UGADHI	116					2		2			1	1	1		1			6	3	9				
54. AJIGO	307			1		2	3	3							1			5	5	10				
55. KEYO KODINGO	240					1	1	1				1			1	2		5	2	7				
56. KAYOGO	186					1	1			1				4				6	1	7				
57. MILENGA	52							1		1					1			2	1	3				
58. NYAKASUMBI	64						1			1	1				2			1	4	5				
59. OBEDI	73					1												1		1				
60. KAMBAJO	35					1	1								1			1	2	3				
61. BAR-KAWAGA	59			1		1	3	1	2	1	1			2	2			5	9	14				
62. OKOLA						1												1		1				
63. MARANDA S.P.	268			2		3	1											5	1	6				
64. GUNDA SIGOMERE	25					1												1		1				
65. SIREMBE	25					1												1		1				
66. ABIMBO	136					6								1	1			7	1	8				
67. ATILILI	220			1		3	1			2				2	2			5	6	11				
68. BAR-KOWINO	249					1	3	3		1						1		5	4	9				
69. BAR-MUOFU	358			1		1		2	1		1	1	1	1	3			6	6	12				
70. CHAMAGAHA	245					1		3						3	1			7	1	8				
71. DIER-AORA	44							2		1								3		3				
72. DUNYA	203					1		1	1	1				2				5	3	8				

SCHOOL	ENROL	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
73. GOT-ABIERO	147					5		2				1		2				8		8
74. GOT-KACHIENG	83					1		1						1				3		3
75. KIBUYE	160					5									1	1		6	1	7
76. KIPASI	325			1		3			1	1	1			3				8	2	10
77. MARANYONA	158					1		1			1			3	1			5	2	7
78. MATANGWE	265			1		3		1				1		2				8		8
79. MIGONO	238					1		2	1	1	1			1	1			5	3	8
80. MINYA	349					3	1	1						3	1			7	2	9
81. NYAGUDA	335					3	1	1	1					1	1			5	3	8
82. OIKO	132					2		2			1			3	1			7	2	9
83. ORENGO	348					2		1					1	3	1			6	2	8
84. OTUOMA	308			1		2		1						3		1		8		8
85. SIAGE	201					3			1			1		2		2		8	1	9
86. THIM	55					1									1			1	1	2
87. UHENDO	160					2						1		3	1	1		7	1	8
88. WARINGA	150					1		2				1		3	2			7	2	9
89. ABIDHA	316					3		3			1			2	1			8	2	10
90. ALINGA	348			1		2	1			1				4				8	1	9
91. BAR-KANYANGO	230			1		2			1			2		2	1			7	2	9
92. GOT MATAR	237					2		1				1		2	1		1	6	2	8
93. GOT RAMOGI	301					3	1	1						2	1			6	2	8
94. JUSA	248			1		2		1			1	1		2				7	1	8
95. KANYIBOK	356					1	1	2						3	1		1	6	3	9
96. KASAU	166					3		1						3	1			7	1	8
97. MAGETA	178					4		1				1		3				9		9
98. MAGO	258					4		2						2	1			8	1	9
99. MAHANGA	178					1		1						4	1			6	1	7
100. MAJENGO	404					4	1	1						2	1			7	2	9
101. MITUNDU	108					2		3						4				9		9
102. NDIWO	132			2		1	1			1		2		1				7	1	8
103. NYABONDO	336					3	1		1	1							2	4	4	8
104. NYAMONYE	279						2	2		1	1			1	1	1		5	4	9
105. NYANGERA	219					1	3	1		1				1	1			4	4	8
106. NYAYO	295					2	1	2						2	1	1		7	2	9
107. ODHURO	436					5	1		1					1	1	1		7	3	10
108. OTHACH	289	1				2	1	2	1					1				6	2	8
109. PALA	370			2		2	1	1			1		1					5	4	9
110. RAPOGI	354					3	1		1					1	2			4	4	8
111. SANDA	222					3	1	1						3				7	1	8
112. UHANGA	182					4	1					1		2				6	2	8

APPENDIX 5 CONTINUATION

	SCHOOL	ENROL	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	TOTAL
113.	ULOWA	430					2	1			1				1	2			4	3	7
114.	USENGE	494					1	2	1			1			2	1	1		5	4	9
115.	WAMBASA	399					3	1	1	1		1	1		1	2			6	5	11
116.	BAR AWENDO	25							1										1		1
117.	CHUNGA	21									1								1		1
118.	MUGUNA	229					4						1		2		1		8		8
119.	RAGAK	215					3		1		1				2	1	1		8	1	9
120.	SANGWE	130			1		3	1			1	1				1			5	3	8
121.	RABANGO																				
122.	BUR-LOWO																				
123.	RATIYA																				
124.																					

ADMINISTRATIVE AREAS	TOTAL	MALE	MALE CHILDREN	MALE ADULTS	FAMALE	FAMALE CHILDREN	FAMALE ADULTS	SQUARE KILOMETRES	DENSIT
BONDO	114387	54621	29328	25293	59766	27386	32380	1007	114
YIMBO	14960	7442	4016	3426	7518	3520	3998	212	71
NYAMONYE	4819	2353	1276	1077	2466	1117	1349	122	40
USIGU	3478	1682	949	733	1796	842	954	51	68
GOT AGULU	2183	1110	581	529	1073	521	552	13	167
USENGE	4480	2297	1210	1087	2183	1040	1143	26	172
NORTH SAKWA/ SOUTH SAKWA	35802	17037	8951	8086	18765	8436	10329	385	93
MARANDA	3581	1768	931	837	1813	789	1024	72	50
NYAWITA	3749	1779	992	787	1970	914	1056	39	95
AJIGO	3176	1419	790	629	1757	791	966	27	120
ABOM	4593	2130	1113	1017	2463	1083	1380	27	169
NYANGOMA	6752	3319	1694	1625	3433	1551	1882	82	82
MIGWENA	3804	1801	982	819	2003	894	1109	55	70
BAR-KOWINO	4327	2060	1027	1033	2267	994	1273	40	109
NYAGUDA	5820	2761	1422	1339	3059	1420	1639	44	131

Sourse: 1979 population census

APPENDIX 7

LOCATION: NORTH SAKWA

PARENT CODE	EDUCATION LEVEL	INCOME LEVEL(KSHS)	TOTAL NUMBER OF CHILDREN	NUMBER OF CHILDREN ATTENDING SCHOOL	OCCUPATION
1	Upper Primary	700	3	3	Smallholder
2	Secondary	800	3	2	Smallholder
3	Secondary	1000	2	2	Carpenter
4	Secondary	2100	3	3	Teacher
5	Upper Primary	1100	3	2	Smallholder
6	Secondary	1800	1	1	Smallholder
7	Lower Primary	1000	3	3	Samllholder
8	Higher Education	2500	3	3	Teacher
9	Secondary	500	4	2	Smallholder
10	Secondary	1300	2	2	Smallholder
11	Secondary	1100	5	4	Smallholder
12	None	400	9	3	Smallholder
13	Lower Primary	600	2	0	Smallholder
14	Upper Primary	900	1	1	Smallholder
15	Upper Primary	400	4	2	Smallholder
	AVERAGE	1080	3	2	

LOCATION: SOUTH SAKWA

1	Secondary	2000	2	2	Teacher
2	Secondary	1700	2	2	Teacher
3	Upper Primary	1000	3	2	Mason
4	Secondary	500	3	3	Smallholder
5	Secondary	400	4	3	Smallholder
6	None	700	3	2	Smallholder
7	Lower Primary	400	2	1	Smallholder
8	None	600	3	0	Fisherman
9	Secondary	1100	2	2	Smallholder
10	Upper Primary	300	3	2	Smallholder
11	Upper Primary	500	2	2	Samllholder
12	None	300	2	0	Fisherman
13	Secondary	700	4	2	Smallholder
14	Lower Primary	500	1	1	Samllholder
15	None	200	3	0	Fisherman
		727	3	2	

APPENDIX 7 CONTINUATION

LOCATION: YIMBO

1	Upper Primary	700	0	0	Tailor
2	Secondary	1300	3	3	Teacher
3	None	200	4	0	Smallholder
4	Upper Primary	1200	3	3	Fisherman
5	Secondary	400	2	0	Smallholder
6	Upper Primary	800	3	3	Smallholder
7	None	300	2	0	Smallholder
8	Upper Primary	700	3	3	Fisherman
9	Upper Primary	500	0	0	Smallholder
10	Lower Primary	1100	2	0	Fisherman
11	None	300	2	1	Fisherman
12	None	200	3	0	Fisherman
13	Upper Primary	400	4	2	Fisherman
14	None	150	4	0	Smallholder
15	Lower Primary	800	2	2	Smallholder
	AVERAGE	603	2	1	Smallholder

APPENDIX 8

ASSUMPTIONS OF THE TEST STATISTICS USED

I. THE CHI-SQUARE TEST:

(i) The data must be of the counted varicty, that is, in the form of frequencies.

(ii) Total observed frequencies must equal at least 20.

(iii) Generally, the expected frequency calculated for any fraction should not be less than 5,although it is permissible for 20% of the fractions involved in a calculation to have an expected frequency of less than 5, provided it is not less than 1.

II. LINEAR REGRESSION ANALYSIS

(i) The independent variable X is not a set of sample values.

(ii) The values of the dependent variable are normally destributed.

(iii) The variance of the dependent variable is constant for all values of the independent variable.

(iv) The value of the residuals (the differences between the observed and predicted values of the dependent variable) have a normal distribution.

(v) The values of the residuals are independent of each other i.e. they are randomly arranged along the regression line.

III. SPEARMAN RANK CORRELATION TEST

(i) The data should be measured in ordinal scale i.e. ranked forms.

(ii) The variables shqould not necessarily be normally distributed. The test works for any kind of distribution.

IV. ANALYSIS OF VARIANCE (ANOVA)

(i) The variables must be measured on an interval scale.

(ii) The population from which the samples are taken are normally distributed.

APPENDIX 8 CONTINUATION

V. THE KRUSKAL-WALLIS H TEST

The H test is a nonparametric test and therefore does not rely on possibly unrealistic assumptions about the distribution of the variables in question. It can be applied to ordinal (ranked) data.

APPENDIX 9

A: QUESTIONNAIRE FOR HEADMASTERS/HEADMISTRESS

1. Name of school.....
2. Name of Location.....sub-location.....
3. When was this school founded? 19.....
4. By which religious organization was it founded?.....
5. Was it built on Harambee basis?.....
6. In which year did it take the first K.A.P.E/K.P.E./C.P.E/K.C.P.E. examination? 19.....
7. Write out your C.P.E./K.C.P.E. examination results for the last 5 years as follows:

YEAR	PASSESS	QUALIFICANTS	TOTAL NO. OF PUPILS
1983			
1984			
1985			
1986			
1987			

KEY:

(i) "Passes" refers to all those who obtained more than 18 points in C.P.E. or 36^{72}points in K.C.P.E. examination results.

(ii) "Qualificants" refers to all those who obtained more than 24 points in C.P.E. or 48 points in K.C.P.E.

(iii) "Total No. of pupils" refers to the total number of pupils enrolled in the whole school from standard I-VIII.

8. How far apart is your schoold from the nearest neighbouring school.....KM/miles.
9. How far is your schoold from the nearest:
   (a) Main road?.....KM/miles
   (b) Dispensary?.....KM/miles
   (c) Water supply? .....KM/miles
   (d) Local Market/Trading centre?.....KM/miles

APPENDIX 10

B: QUESTIONNAIRE FOR PUPILS

1. Name of pupil:.....
2. Name of school:.....
3. Name of Location:.....sub-location:.....
4. Class:.....
5. Age:.....
6. Denomination:.....
7. Why did you decede to come to this school?
   (a) Because my parents belong to this denomination.
   (b) Because it is nearer to my place of residence.
   (c) Because it is famous for good performance in the C.P.E./K.C.P.E. examination.
   (d) Because it has good buildings.
   (e) Because it has good teachers
   (f) Because it is famous for out door activities.
   (g) Because it is near:
      (i) water supply
      (ii) Despensary
      (iii) Trading centre
      (iv) Church, e.t.c
      (v) Other (specify):.....
   (h) Because my friends are students here.
   (i) Other (specify):.....
8. How far is your present place of residence from the school?
   .....KM/miles.
9. By what means do you come to school?
   (i) by bus/bicycle/motor bike/matatu.
   (ii) on foot.
   (iii) other (specify).
10. How lond do you take to travel from your place of residence to school?.....hrs/min.

APPENDIX II

C. QUESTIONNAIRE FOR PARENTS

1. Name of parent:.....
2. Name of school: .....
3. Name of Location.....sub-location:.....
4. Denomination.....
5. SOCIO-ECONOMIC DATA
   (a) Level of education:
      (i) None .....
      (ii) Lower Primary.....
      (iii) Upper Primary.....
      (iv) Secondary.....
      (v) Higher education.....
   (b) Type of occupation.....
   (c) Monthly household income.....
6. How many children of school age (5-14) do you have?
   .....
7. How many of them go to school?.....
8. How many do not go to school?.....
9. Why don't they go to school?.....
10. Why do your children go to this particular school?
    .....

D: QUESTIONNAIRE FOR CHIEFS/ASSISTANT CHIEFS

1. Name of Chief/Assistant Chief:.....
2. Namw of Location:.....sub-location:.....
3. Write the number of children aged 5 to 14 years in each home you visit as indicated below:
      (i) Name of the owner of the home.....
      (ii) Number of children of schoold age:.....