Thesis By

MOHAMMED OSMAN EL KHIDER

Department of Sociology & Social Anthropology, U.of Khartoum.

A socio-economic appraisal of inland water transport in Sudan

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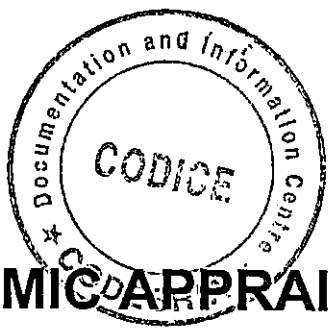
FACULTY OF ECONOMIC & SOCIAL STUDIES,
DEPARTMENT OF ECONOMICS,
UNIVERSITY OF KHARTOUM.



A SOCIO-ECONOMIC APPRAISAL OF INLAND WATER TRANSPORT IN SUDAN.

BY

MOHAMMED OSMAN EL KHIDER

A Thesis Submitted for Ph.D. Degree in Economics

Supervised by:

Professor,
Mohamed Hashim Awad,
Department of Economics,
U. of Khartoum.

Co-Supervisor:

Associate Professor,
Paul Wani Gore,
Department of Sociology & Social Anthropology, U.of Khartoum.

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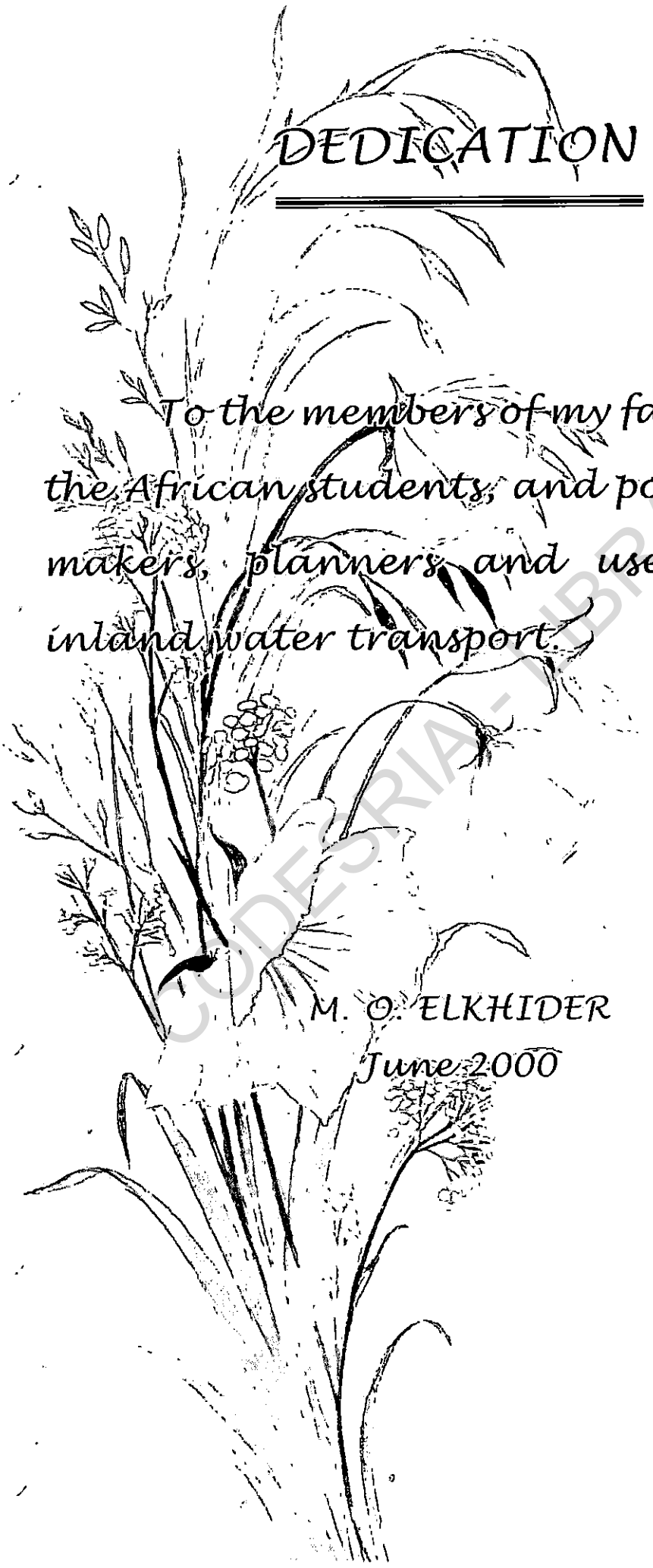
DEDICATION



To the members of my family, the African students, and policy - makers, planners and users of inland water transport.

M. O. ELKHIDER

June 2000

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critical themes for the newly adopted policy in the field of inland water transport in Sudan.

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Finally, very special thanks are due to the members of my family. Who are patiently bearing my absence away from them for longer periods of time since 1989 and for being instable in work for the last seven years i.e., in many instances a jobless man.

ABSTRACT

The aim of this study is to contribute in the scientific knowledge with some insights of Sudan's experience in inland water transport. Such an effort can not be materialized unless it is based on some elements of the social sciences. Although we are making use of the different human knowledge available at different branches of science, of both natural and social ones, our major theme is based on some of the theories of sociology of development and the economics of transport. At a very general level of both sciences, we are going to consider specific and relevant theories which are to be under careful analysis in testing river transport in Sudan. Thus, we are planning to apply cost – benefit and inductive analysis to base – line data and address the systems' poor fleet capacity utilization and check the rising cost – revenue ratios.

Sudan, as an underdeveloped country, should build up a genuine development strategy which can improve the conditions of the total population .To do this, among other economic measures, there is an urgent need to restructuring transportation net works which are currently designed to provide removal of the export product to the capitalist centres and reorienting other infrastructural facilities to meet the needs of domestic production for the producers' consumption.

On the other hand, for the sake of making comparative advantages with other international systems, we have to analyse the empirical situation in Sudan. By doing so, we are attempting a practical interest, hoping to come up with a comprehensive strategy and policy recommendation, that can enhance social and economic returns to river transport in Sudan and other developing countries, particularly in Africa.

خـــــــلاصـــــــــــة

الهدف من هذه الدراسة هو الإسهام في إثراء المعرفة العلمية ببعض كوامـن التجربـة السـودانية في مجال النقل المائي الداخلي . هذا الإثراء لا يمكن تحقيقه إلا إذا استند إلى بعض العناصر و المقومـات العلميـة الموجودة في كل العلوم الاجتماعية. فعلي الرغم مـن إننـا قـد قمنـا باسـتخدام المعرفـة الإنسـانية، المتوفـرة في العلوم المختلفة،طبيعية و اجتماعية ، إلا أن محور تركيزنا قد اعتمـد علـي بعـض النظريـات في مجـال علـم اجتماع التنمية وعلم اقتصاديات النقل. علي المستوي العام ،لكل العلمـين ، قمنـا باختيـار بعـض النظريـات المحددة والمناسبة التي أخضعناها لتحليل حذر عند تطبيقـها لاختبـار النقـل النـهري في السـودان. هكـذا فنحن نسعي لتطبيق تحليل ضمني مشتملاً علي نظرية المنفعة/ التكلفة لقولبة المعلومات ومعالجـة المسـتويات المتدنية لدرجة استغلال طاقة الأسطول النهري وفحص ارتفاع معدلات التكلفة/ الدخل .

السودان، باعتباره من الدول الفقيرة، يجـب عليـه أن يتبـني اسـتراتيجية تنميـة حقيقيـة ،غـير مقلدة، تنأي به عن التبعية الاقتصادية، التي يمكن أن تعمل علـي تحسـين أحـوال مجمـوع السـكان فيـه. لاتخاذ مثل هذه الإستراتيجية، بجانب معايير اقتصادية أخرى، هنالك ضرورة هامة لإعادة هيكلة شـبكات النقل ، التي صممت لتوفير فرص نقل سلع الصادر للمراكـز الرأسماليـة واعـادة تنظيـم بعـض عنـاصر البـني التحتية الأخرى بغرض مقابلة متطلبات الإنتاج المحلي واستهلاك أفراده المنتجين .

من الناحية الثانية، من اجل خلق فرص ومزايا مقارنه مع الأنظمة العالمية المثيلـة ، يجـب علينـا أجراء تحليل تطبيقي للوضع في السودان. بهذا العمل نكون قد حاولنا الاهتمام بجوانب تطبيقية، نـأمل أن تساعد في وضع سياسة وصياغة مقترحات تهدف إلى توفير الفوائـد الاقتصاديـة والاجتماعيـة المرجـوة للنقـل النهري في السودان ولرصفاه من الدول الأفريقية الأخرى.

FOREWORD

In the year 1985 the first draft proposal of this thesis was submitted to the academic authorities in Sudan. The Faculty Research Board (the Economics Dept.) had accepted the proposal and late, in the same year, the Graduate College, University of Khartoum had issued a Registration Certificate, which I received late in the year 1997.

No clear reasons were given to explain this inconvenient delay. By that time I was in the civil service of Sudan government. In June 1994, my post as a Research Director, River Transport Corporation was terminated after a new ruling government has seized power in the year 1989. So, by the beginning of the year 1997, I have renewed the study proposal, which has been accepted and by the beginning of the year 1998, I started to collect some data. Although Khartoum University has exempted me from paying the needed fees, because my wife is a lecturer in the same university, I was faced by a serious problem in financing the field work expenses. My work in Dongola University in the post of Assistant Professor, for the period March 1997 - April 1999, was not a good reason for Dongola University to participate in financing these expenses.

CODESRIA has provided a Small Thesis Writing Grant for this work which is considered as a great help in proceeding carrying out the research.

This foreword is necessary so as to understand the atmosphere of research in Sudan now. Without the assistance of CODESRIA, I believe that my efforts could have been expanded in terms of time required to achieve this work.

CHAPTER ONE

INTRODUCTION

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INTRODUCTION

The Nature of Transport Studies:

Writing on transport economics is not an easy task for the following reasons:

First, there are many definitions given to transport economics in different fields of scientific specialization, all of which agree on the essence of transport activity, i.e. the study and analysis of traffic movement. The history of economic thought, in the field of transport economics is prior to the scientific analysis, i.e. the provision of theory and methodology.

Second, as it is the case of many social sciences, transport economics has not yet developed an agreed upon theory. Research is still undertaken so as to find out meaningful and empirical generalizations and principles, which can help in building a unified human knowledge in the form of one theory.

Third, there are different schools in the field of transport economics, which can be classified in two groups; The European and the American as well- developed schools; and, the Russian and those of the third world countries schools, which are considering some empirical cases under different ideological setup. But all these efforts should continue research works so as to arrive at the maturity stage in developing scientific theory.

Fourth, there are different approaches in the field of methodology. Sometimes they are seen as interrelated and difficult to set clear-cut boundaries. This is quite natural since these methodologies are used empirically to provide analysis for unified and interrelated human phenomena.

Fifth, new fields of study in transport economics are emerging each is specializing in a specific area of transport activity. So, we find inland transport economics including the following activities such as pipeline, belt-conveyers, cable transport, railway, and road networks. Water transport is subdivided into, river, lake, canal, sea and ocean transport. Finally, the airlines transport economics. On the other hand, in the field of information and idea transportation, new interests are

growing in studying the satellite economics in the fields of radio, television, telex, fax, etc.

Sixth, concerning the historical development of transport research we find that it started as descriptive studies. In the same time, during the second half of the twentieth century, it made use of the developments in economics and econometrics through the establishment of quantitative analysis. That has facilitated the usage of many statistical techniques in the field of data collection, presentation and analysis. On the other hand, the sources of information have developed so rapidly during the last decades of the twentieth century. At the national level primary information is developing through the use of computer devices, which provided accurate quantitative information in many fields of the transport activity. The United Nations and the regional organizations are following the same trend. Secondary sources of information are also developing in the form of many scientific works that appeared in many parts of the world. The use of interdisciplinary research and techniques has helped in the development of many accurate fieldwork data collection tools in the field of collecting and analysing personal sources of information.

The Nature of This Study:

To conduct a study on "the socio-economic appraisal" of any project is a difficult and diversified task. This is because the term appraisal means, "a process whereby a public agency (or private enterprise) determines whether (it) meets the country's economic and social objectives ... efficiently. Appraisal provides a comprehensive review of **all aspects** of the (agency) and lays the foundation for its implementation ... and for its evaluation after it has been completed".[1]

Appraisal involves the investigation into the following aspects:

1. Economic appraisal; includes the identification and measurement of the economic costs of the project and the sizes and distribution of benefits.
2. Technical appraisal; includes studies of the engineering, design and environmental matters, and the estimate of capital and operating costs as they relate to the construction process and the operation of the project after it is completed.
3. Institutional appraisal; includes the management, organizational and staffing problems.

4. Financial appraisal; includes investment funds and returns, it focuses on costs and revenues.
5. Commercial appraisal; includes the procurement of goods and services to implement and operate the project, and, with the marketing arrangements for the sale of its output.
6. Social appraisal; includes the social objectives such as equity in the distribution of income, improving nutrition and health and the social cultural and human variables affecting the project, such as population resettlement, poverty eradication, literacy and the role of women in development.

This study attempts to investigate some of the elements included in the economic, technical and financial appraisal, outlined above, as major themes in the economics of river transport in Sudan. On the other hand, the social appraisal is intended to include some of the elements, mentioned above, in the institutional and social appraisal. The main stress here is focusing on population groupings and peoples' social interaction, making use of the available literature on sociology of development.

Since the concept appraisal is defined as a process that involves the efforts of scientists in "all aspects of the agency" this study selects some geographical literature that describes the vegetation zones and rivers' topography and hydrology.

The Selection of the Research Topic:

The title of this research is "A Socio-Economic Appraisal of Inland Water Transport In Sudan". The topic of this research has been selected as an outcome of the researcher's previous experience, who worked as a Director of Planning Research and Statistics in River Transport Corporation (RTC), for a considerable period of time (about 20 years). This post has facilitated the researcher to conduct, participate and read a good deal of written literature on river navigation in Sudan and other countries. Besides his personal interest as a part-time lecturer, he is able to read a considerable literature on the part of transport theories, especially those on transport economics.

The practical and theoretical experiences of the researcher have put him in the position of knowing quite well the information needed for such a research. As it is well known that most of the developing countries, including Sudan, lack the presence of adequate, accurate and reliable statistical information. The available statistics are, in most cases, undependable; therefore it should be treated in much more

attention and care. It needs to be checked carefully before analysis. Such statements are true for the statistical records prepared by government institutions and public corporations.

The inland water transport system in Sudan has recently been affected by the new government policies i.e. privatization and liberalization. The well-established River Transport Corporation is no longer the leading firm in the river navigation business. New organizations were set up as well. The Peace and Development Corporation, a government-owned organization, is recently established having authority to operate river transport in Southern Sudan. The regional link Karima-Dongola, in the North, is splitted from RTC and became under the administration of the Regional Government of the Northern State. In addition to the Inland Navigation Department, which is assigned the responsibility of inspection, registration and licensing all river crafts in Sudan.

Background:

River transport activity has been known and practiced since long time in Sudan's history. It was known before modern road or rail transport networks. Wood sailing boats of different loading capacity (5-40 tons) were used. Goods, passenger traffic and fishing were the main activities carried through river transport. This service was characterized as a small-scale transport system used to provide domestic consumption and participate to a limited extent in trade activities. [2]

By the beginning of the nineteenth century, the Nile River was used to conquer Sudan's hinterland from the North. In the year 1820 first attempts were made to introduce steamboats for military purposes. The first ship-dockyard was constructed in 1884 and the first steamboat was assembled in the next year at El Shajara (Khartoum) dockyard. [3]

During the first half of the twentieth century, many steamers using different technologies have been introduced into service in Sudan. With the construction and expansion of the railway trucks during the first two decades, river steamers were used as rail feeders providing complementary transport system in the South (Kosti) and in the North (Karima). Since then regular, all year, passengers and goods

traffic was provided in more than 2000-km. route length in these two reaches.

During the last forty years of the twentieth century, vast and fast river vessels have been introduced into service. Most of the present fleet is modernized, using diesel power. The total investment cost and the value of the fixed assets of the river transport fleet, amount to Ls. 200 million at current rates (the year 1980). [4] River Transport Corporation owned this fleet. [5]

In the year 1973, the River Transport Corporation (RTC) was established as a separate public corporation having full monopoly to invest and operate river services in Sudan. RTC was responsible for ship design, purchase, assembly and operation. It was responsible, as well, for channel maintenance, ports' construction and management, in addition to warehousing and handling activities. [6]

The RTC Establishment Act of 1973 was amended in the year 1980. [7] RTC was no longer monopolizing the river transport operations and the way was open for (new) firms to work in river transport. Invitation had been made for private national and foreign firms at the level of individual, joint venture and cooperative firms to invest in river transport. [8]

After June 1989, the military government has declared that Islam is the basic source for doctrine and life in Sudan, such concepts as liberalization of the economy and privatization of many public sector firms, are dominating and affecting the whole society. The war in Southern Sudan is considered by some politicians to be a religious war and not just a civil one. This situation has resulted in some many disadvantages as well as some advantages that have affected the different sectors of the economy among, which the transport sector plays a significant role.

The Area of the Research:

The Nile River and its tributaries avail the navigable inland water channels in Sudan. This system is not connected with sea transport. Lake Navigation is a joint-venture business between Sudan and Egypt on Lake Nubia. River-crossing ferries are found all over the Blue Nile, White Nile, the main Nile Rivers and their tributaries.

Due to the different climatic zones of Sudan, (latitude 4 -17 N), a variety of ecological conditions prevail. This geographical factor has resulted in the presence of widely different topographic and hydrologic aspects that strongly affect the water passes in Sudan. In the extreme Southern parts of the country, the river beds and passes are characterized by hard rocks, sharp bends, suds, moving sandy areas and presence of water hyacinth up to Kosti town (1436 km, See Map No.1-1).

It is well known that the Nile River crosses Sudan from South to North dividing the country into two equal parts. The population settings are concentrated around the banks of the Nile River. These factors necessitate the presence of efficient river transport that can help in the development of the efforts undertaken in the country.

For the purpose of this study the inland water navigation in the Sudan is divided into three stretches. The Southern Stretch covering the area between Khartoum and Juba, while the second is covering the area between Khartoum and Abu Hamad, an area in the centre of the country, and thirdly the Northern Stretch, which is between Karima and Wadi Halfa.

The Southern Stretch is under operation at the present moment. This stretch is a very important link, economically and politically, between Southern and Northern Sudan, as well as between Sudan, Uganda, Kenya, Congo and Ethiopia. If peace is maintained in the South, the future need for reconstruction and development of the infrastructure will highly demand that river transport activity to be rehabilitated and modernized. As happened in the year 1973, when Numeri Regime had concluded a Peace Agreement in the South. The present performance of this stretch shows that only up-stream traffic, from Khartoum to Juba, is economically feasible. The main reason behind this is the Civil War between the North and the South. Surely, any development project cannot be fruitful under situations of a war economy. War should stop, development should proceed and a balanced traffic should be maintained.

The Central Stretch was used during the 1960s to transport cement, seasonally, from Atbara to Khartoum, i.e. up-stream traffic. The transport network between Atbara and Abu Hamad, on the down-stream direction of the Nile River, is very poor. The area is served

through a light railway single-track. Paved roads do not exist. Hence, to enhance development in this area, transport networks should be introduced and improved so as to provide sufficient and adequate transportation among which river transport will be of a high significance.

The Northern Stretch is working between the area Karima-Dongola (287km), a down-stream direction, mainly. A service was introduced in 1986, to connect Wadi Halfa with Akasha towns. On the other hand, a joint-venture river business is working at the present time, linking Wadi Halfa (in Sudan) with Aswan (in Egypt).

The northern parts of Sudan can be described as an ideal self-reliance region in the world. Through history, most of the social and economic institutions are built, operated and owned by co-operative associations or by private individuals.

The Northern region lies on the desert zone where people settle on some very small land areas on the riverbanks. In the whole region there is no any reliable transport system, an aspect, which has contributed in under developing the area. The vicious circle of poverty in this region cannot be alleviated unless efficient transportation is made in addition to other measures in the field of land tenure and ownership. The Nile River avails the possible and cheap transport link in the region, as a production area, with Aswan region in Egypt, as a consumption area.

So, it can be argued that the presence of efficient and reliable river transport can play a significant role generating economic development and the alleviation of poverty in Sudan.

Research Problem and Justification:

This research is intended to focus on the socio-economic factors that affect the development of inland water transport in Sudan. The study aims at analysing both practical and theoretical concerns that are sought in scientific analysis. For the former, the study tries to establish decision-making indicators, evaluation measures and to find out the possible alternatives for better improvements in river business and finally to predict working actions and policies, which can be set up for future progress. On the other hand, the theoretical concern is mainly devoted to provide new general rules not well-known in Sudan's

experience. In this regard, as well as to find out how river transport in Sudan, is affected by the occurrence of other modes of transport i.e., rail, road, sea, air, etc, and finally to test the validity of certain theoretical hypothesis in the discipline of transport economics.

Hence, the following aspects, among others, are of high importance for the study investigation. [9]

a) The identification and measurement of the economic costs and the size and distribution of benefits.
b) The engineering, design and environmental conditions that affect capital and operating costs.
c) The management, organizational and staffing problems.
d) The financial allocations and returns.
e) The social objectives and benefits.

The aim of this study is to contribute in the scientific knowledge with some insights of Sudan's experience in inland water transport. Such an effort cannot be materialized unless it is based on some elements of the social sciences. Although we are making use of the different human knowledge available at different branches of science, of both natural and social ones, our major theme is based on some of the theories of sociology of development and the economics of transport. At a very general level of both sciences, we are going to consider specific and relevant theories, which are to be under careful analysis in testing river transport in Sudan.

Thus, we are planning to apply cost-benefit and inductive analysis to base-line data and address the system's poor fleet capacity utilization and to check the rising cost-revenue ratios.

Sudan, as an underdeveloped country should build up a genuine development strategy, which can improve the conditions of the total population. To do this, among other economic measures, there is an urgent need to restructuring transportation networks, which are currently designed to provide removal of the export product to the capitalist centres and reorienting other infrastructure facilities to meet the needs of domestic production for the producers' consumption.

On the other hand, for the sake of making comparative advantages with other international systems, we have to analyse the empirical situation in Sudan. By doing so, we are attempting a practical interest, hoping to come up with a comprehensive strategy

and policy recommendations that can enhance social and economic returns of river transport in Sudan and other developing countries, particularly in Africa.

Assumptions and Hypotheses:

The study examined the role of navigable inland waterways in the process of socio-economic development in Sudan. It is the first academic study in this field it presents critical analysis of the existing transport sector. It considered the experience of RTC as a case study and hence, provided in the end of the research, its results and findings. At the end it tried to draw some specific recommendations, which could generate further socio-economic development in the area between Karima (Sudan) and Aswan (Egypt) besides, Ethiopia, Uganda and Kenya.

The financial records [10] of RTC during the years 1977/78, 1978/79 and 1979/80 had shown an increasing cost/revenue rates as follows: 150%, 160% and 200% for the three years respectively on the other hand, the operational statistics for the same period stated that the average net return per ton-km for goods traffic was 13.93 m/ms, 21.69 m/ms and 20.14 m/ms for the same three years respectively. This return does not include the government subsidy. The total return of the three years presents an accumulated loss of Ls. 4.5 million, a fact that deserves serious study and consideration.

The present fleet capacity utilization, especially of the 500 barges is very poor [11]. The per annum capacity of these units provides 269,500 tons calculated on grounds of practical experience of RTC operational levels. Here we assume that 77 barges can make 10 round trips for each barge during the year, load-line is calculated at 350 tons per barge and only upstream traffic is considered. The highest utilization achieved was 64.5% of this capacity, as 1982/83 statistical reports of RTC shows. A major problem arises here i.e. poor capacity utilization may be attributed to down-stream empty running as well as inefficient port management. This should be attempted by research for a possible answer.

Many economists [12] argue that transport modes are essential infrastructure components of every economy. Historically, they have defined the process of transportation as the movement of produce from production areas- (farm, factory) to consumption areas- (home,

markets). The expansion in trade and manufacturing activities has resulted in the creation and growth of marketing centres. Hence, the agricultural and industrial products have to be transported from the production areas to the manufacturing and/or the marketing areas. Every finished product, consequently, has to be transported between four locations at least. Namely, these locations are; primary production locations, where raw materials are available; secondary production areas, where the materials become semi-finished or manufactured goods; marketing centres where finished commodities are usually transacted; and finally, consumption places, where purchased or exchanged goods are consumed.

Sudan economy shows many similar centres constituting different origins and destinations of traffic handling, because the country is an agricultural community having growing agro-industrial centres distributed among its urban and rural areas. [13]

Thus, the maximum benefit derived from the above-mentioned economic activities only takes place through efficient transportation. This point clarifies the assumption that Sudan economy depends to a great extent on transport systems.[14]

Man has utilized these means of transport, to the best maximum through his efficient adaptive mechanisms to environmental, political and economical interests. The utilization of the different modes of transport has resulted in what is known as complementary and competitive modes of transport. [15] In the former situation, we find two or more modes of transport complementing each other as in the case of sea-road, rail-river or sea-rail. In the latter case we find two or more modes are operated competitively at one time in one direction. Each of these situations has its own operational characteristics that affect the level of investment, costs and returns. To discuss this point with regard to Sudan, the study considers, comparatively, the conditions and features of transport networks with special reference to inland water transport in Sudan at its past, present and future structures. Following the above guidelines, the study focuses on the level of technology and input elements used in river transport operations as well as evaluating its output. (See Annex No. 1).

One basic assumption in transport operations is that transport charges are revenue sources for shippers and elements of expenditure for users [16]. Thus, transportation acts directly to influence the investment level for both transport suppliers and demanders. For the users, the better utilization of transport facilities takes place when the movement cost is low, time is saved and security is ensured. The

shippers usually try to cover the total operational cost of their services and attain a profit rate. This study tests this assumption with regard to river transport service in Sudan.

To materialize the shippers' and users' objectives mentioned above, some costing models and pricing functions have to be worked out so as to evaluate the results and suggest working and reliable measures for river transport operations. [17] For this same purpose a maximum operational utilization rate of the river fleet should be presented. Analysing and interpreting the trip turn-round efficiency facilitate this presentation. [18]

Research Methodology:

The study defined and described scientifically, the ecology and habitat as well as the administration and management performance of some of the working units in inland waterways.

The study also pursued a comparative line with other experiences, at an international level, where it seemed to be of an advantage to the analysis of the research results. One of the most important objectives of the study is to provide a critical framework for the government policies directed towards the transport sector in general and to those applied in the field of river transport in particular. Such policies have extended or ranged between full monopoly to liberalization and privatization processes.

As we know the sources of information for every study, are those; the primary, secondary, and personal information. The primary information in this work, is made up of government publications and RTC departmental files and records. The secondary information is the analysed material out of primary sources, it is found in scientific works and references. The personal information is collected from interested academicians, those who have long practical experience as senior personnel or as workers/sea-men, trade unionists and finally the transport demanders. The last category is sub-divided, those who use the available supply and those who (hope) to own some river crafts.

The nature of this study necessitates the definition of concepts and terms, which may not be known to readers who do not know much about river business. Such concepts are; mode of transport, transportation, transport suppliers and demanders; means and ways of transport; port, berth and harbour; region, stretch and link; transport fleet, convoying; steamer, push-tug and the different names given to barges.

Since this study aims at analysing river transport navigation, it should consider permanent water channels, i.e. excluding the seasonal tributaries of the Nile River. Thus, to discuss the socio-economic impacts of river transport in Sudan, we are dividing the Nile River into three different geographical zones. These zones are the Southern, Central and Northern ones.

The Results and Findings of the Study:

The expected results of this research are directed towards the building of specific policy recommendations, which can help in solving the immediate bottlenecks and handicaps of transport. So, people can be helped in alleviating poverty and to open chances for new division of labour, which can promote production specialization, an aspect that is of a high importance in creating a strong economy and prosperous society. Such a policy has to consider the establishment of strong restrictions to control the natural environment as possible as that can be. Additional efforts should be made to provide an efficient early warning system to help controlling the hydrology of the river.

The capacity building of policy related research is directed to find out the needed information for adding more, or even to establish new, services and to decide the type and quantity of such services. At this level the study should help in finding indicators to evaluate the impact of river transport on Sudan society. Thirdly, the study has to suggest better alternatives for successful river navigation. Lastly, the establishment of solid grounds for the prediction of future actions and policies, which can help development.

The scientific capacity building of this research can be traced through the efforts made in the building of human knowledge and to justify the tools and methods of data collection used in the study.

For the contribution in pure science, the following themes are considered as important ones. The first theme is represented in trying to find out some new general rules that are not known before; the second theme is seen in the examination of some of the working principles for checking their validity; besides the third theme, which is to find out if the occurrence of a specific phenomenon is affected by the occurrence of another one.

Since the practical part of the study is expected to result in bringing out some social and economic benefits for Sudan's people, it is hoped that this study shall have direct usefulness on macro economic level for both public and private individuals. The overall

development effort will need collaboration of many local and foreign agencies, both private and governmental, as well as the United Nations ones.

Thus, the outcome of this work is supposed to help in providing a course outline to be taught at university levels in Sudan. It is also hoped to help policy-makers in planning for transport in the country, besides intending it to be a guide for some United Nations' Organizations on some of the uses of the Nile River.

Objectives of the Study:

1. To provide a critical framework for the government policies directed towards the transport in sector in general and to those applied in the filed of river transport in particular.
2. To stress the importance of river transport in Sudan economy. Efforts should proceed to develop such a system in Sudan through the establishment of effective policies and other needed operational measures.
3. A proper Nile Water Policy, National Transport Plan and Transport Tariff are considered very important objectives in this study.
4. Sudan hopes to sustain multi-dimensional developments, during the twenty-first century, especially in the field of oil and mining economics. Such an effort is most likely to increase the number and quality of many research groups, at the public and private levels. Transport is an important element in the infrastructure of the country's economy. This study hopes a good deal of co-operation between different consultative groups who are interested in studying socio-economic aspects in the study's field, both on the practical and theoretical ends. A wide range of co-operation is needed, with both national and international institutions and research groups, to develop and adequate and efficient river transport in Sudan.
5. This work is hoped to be of a significance and an addition to the African library, because this topic is relatively little researched area, especially in the area of socio-economic development analysis and to recommend new areas for research in the future.

6. Many universities in Sudan do not offer courses on the economics of transport because of shortage in qualified staff members. So, the researcher hopes to draw an applied course, on transport economics, so as to be taught at university levels.

Organization of the Final Report:

This work is the first one in Sudan at university level that studies river transport. Its final report is organized in ten chapters.

Chapter One, is the introduction that contains a note on writing on transport economics, a thesis outline and the research proposal and methodology. Chapter Two deals with Transport Economics, Theory and Methodology. It includes the following topics: scope and nature of transport studies, methods of analysis, network theory, traffic flow analysis and modal systems. While Chapter Three presents an analysis of the existing literature, with special emphasis on the definition of transport, the science of Transport Economics and the significance and functions of transport.

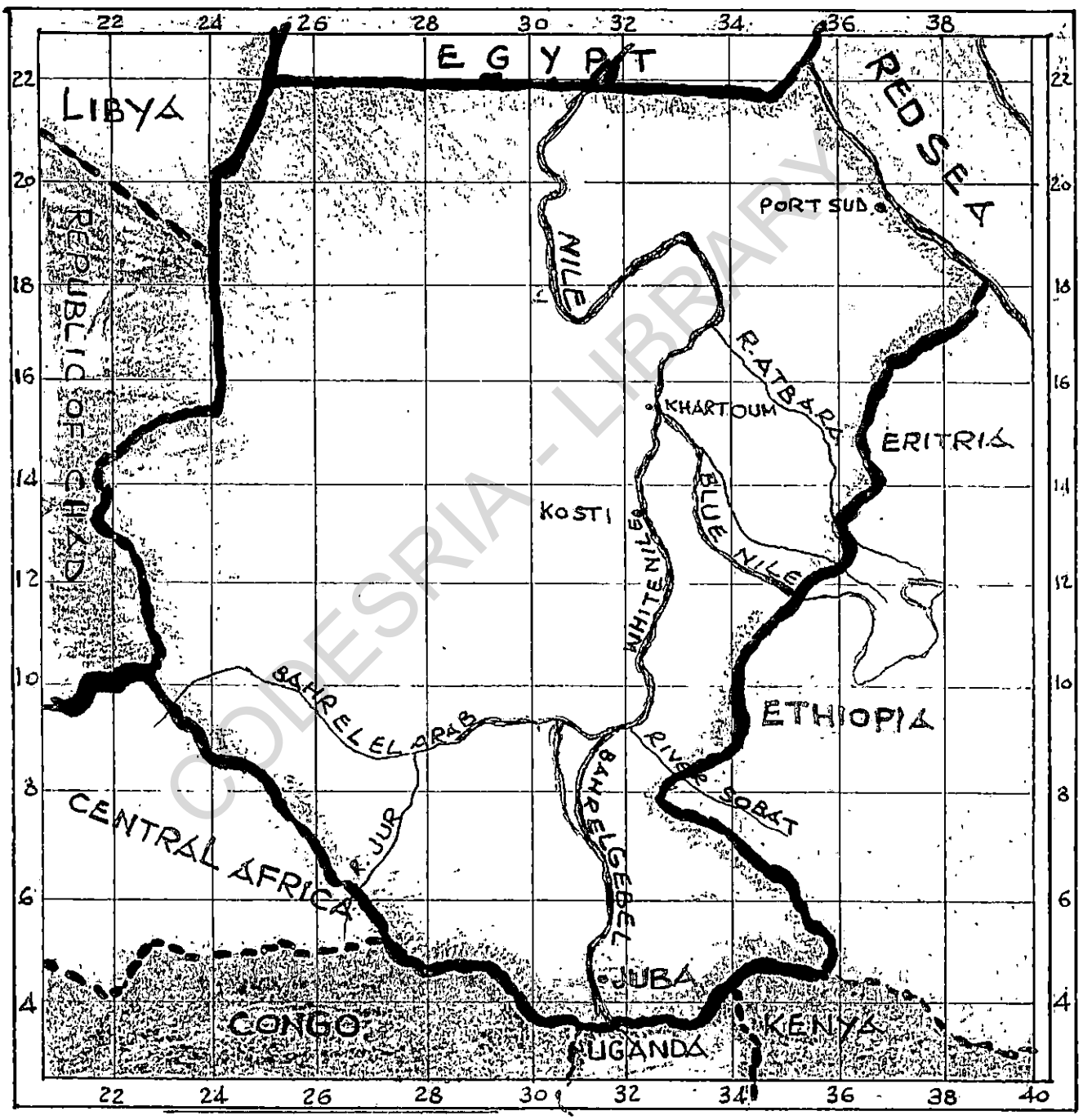
Chapter Four is devoted to analyse Sudan Economy and the Importance of Transport. This chapter discusses the agricultural sector, land use, the industrial, and the services' sectors besides, foreign trade. Chapter Five introduces working networks in Sudan in an effort to assess the supply of these modes.

Chapter Six describes River Navigation in the world. It presents an analysis of Inland Water Navigation As A Mode of Transport. It describes the World Inland Waterways for each continent separately and finally, it includes the importance of water transportation.

While Chapter Seven studies Sudan inland waterways, it provides an analysis for Navigation Routes in Sudan, Hazards to Navigation, river-crossing ferries and lastly it suggests a National Water Policy.

Chapter Eight is analysing River Transport Corporation, its establishment, administration, studies conducted and the development projects undertaken by RTC. Chapter Nine presents critical analysis for the working units in inland water navigation during the period 1980-1999. Chapter Ten provides an analysis of the process of policymaking and pricing procedures and techniques, as they should theoretically be, and compared with the existing situation in Sudan. Finally, it draws some working proposals in the field of transport policy, investment and pricing.

Map No. 1-1: The Study Area



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CHAPTER TWO

LITERATURE REVIEW

CHAPTER TWO
LITERATURE REVIEW

This review focuses on specific elements in transport. First, a brief discussion on the definition of transport is provided. Secondly, a short note is presented dealing with the need for an economic science for transport. Finally, the purpose, function and significance of transport are discussed.

2-1 The Science of Transport Economics:

Stubbs, Tyson and Dalvi (1980) describe transport as follows: "Transport is a keystone of civilization. The spread of production, trade, and ideas, and the economic ascendancy of mankind – all depend upon movement. Personal mobility is one of democracy's most valued freedoms; and surprisingly, high proportion of our income is devoted to our movement and to the movement of the goods that we buy." (1)

Marshall (1921) gives the following definition "The transport industries, which undertake nothing more than the mere movement of persons and things from one place to another, have constituted one of the most important activities in every stage of advanced civilization."(2)

El sheriff and Babiker (1990) make a step forward when they argued that "...communications involve the transfer of people, commodities and information over space. The transfer takes place along a line of communication between two places. Along the line will be a number of different modes involving telecommunications, including telephone, telex, etc. Physical transfer is performed by a number of transport modes including road, railways and airlines. These modes will not necessarily run parallel to each other, and sometimes it may be correct to refer to a corridor rather than to a line." (3)

Thus, it seems that there are many definitions given to transport in economic literature. Many of these definitions agree in that transport is a whole process; some call it transportation, in the cycle of production. It includes movements of production output (goods) and some factors of production (labour, capital and management).

Such movements are by necessity taking place between two places at least from a production centre to places of storing, marketing and consumption. Since human beings perform labour, it is important

to transport people from where they live to where they work. Also, people usually make other trips for different personal and social purposes. The transfer of people from one place to another, for so many reasons, is referred to as passenger transportation. Information, news, publications and newspaper are objects that need transportation in addition to other cultural aspects as well. [4] These are channeled through telecommunications nets. Passenger and goods traffic are carried through transport modes; inland transport systems, sea transport and air transport. Transport plays significant roles in social and economical life as well as in the political settings.

The essence of the economics of transport has been widely discussed by different economists although other specialists have contributed, to its literature as shown in chapter three. Nevertheless, transport, as an economic discipline is a recent science despite the fact that economic thought in transport is very old, as Cooley argued a hundred years ago. [5]

Bonavia (1936) states that "transport as a subject stands somewhat apart from the general body of economic phenomena. It does not evoke the scale of special theoretical interest attaching to monetary studies... yet transport with its immense financial and technical significance, is undoubtedly one of the major problems of the age, and the study of where, and how its organization fits in the apparatus of production is of great practical importance. And there is a very real theoretical interest attached to certain problems, such as the basis of road and rail competition, and still lack a satisfactory solution." [6]

Milne (1958), discussing the same issue of transport economics as a science, argues that "The economic significance of the producer – consumer gap ... lies in the economic distance as measured in terms of costs of transport ... (but)... economic analysis can never take into account all the complexities of real life ... at best, economic analysis can isolate only the more important forces at work and, then, reveal the main relationships existing between them". [7]

Stubbs, Tyson and Dalvi (1980) [8] argue that transport economics is "... a branch of applied micro – economics; while it uses many standard techniques of economic analysis, it faces a number of

special problems and characteristics that justify its consideration as a specific branch of the discipline (Economics).

The demand for transport … can not be stored or transferred; and from these seemingly simple statements follows a host of implications." Such as:

a) The simple canons of market economics cannot be applied to transport for a variety of reasons. Since journeys are unique in space and time, "monopoly is likely to arise in varying degrees, especially when technological change offers an advantage to a particular mode, or where economy of scale affects one mode more than another. The State has therefore intervened in transport. Sometimes the only means to realize economies of scale is to accept monopoly and constrain its behaviour by a statute."
b) The external effects of transport also warrant intervention. Pollution and congestion are both real costs imposed on the community by the users of transport, but they are not reflected in the private costs met by the individual user.
c) Indivisibility … impinges on both pricing and investment. Many investments in transport are large and infrequently made, and there are problems over how their costs should be allocated. Such complications make pricing and investment appraisal in transport a difficult and even subtle business…(while)…the ultimate decisions are frequently political ones.
d) Distribution of expenditure on transport: physical output comparison between different modes of transport may show that consumers are willing to pay a premium for movement by road. "Road system may be bigger, flexible but has a limited capacity (in tones), which gives it temporal flexibility … the depletion of oil resources may be mitigated by developments in batteries and the increasing expenditure on fuel cell technology." Roads bring hazards as well as benefits; fumes, noise, congestion and accidents upon society, which make it necessary to consider adjustments where social costs over strip social benefits." These issues are legitimate interests for the transport economist, and even if he cannot solve all the problems, however, he may shed light on issues where others are apt merely to generate heat." The economist must be aware of the conflicts that may arise between efficiency and equity." It is often possible to show that a

total transport operation would be made more profitable by eliminating some of its less efficient parts or that there would be financial gain by eliminating cross – subsidization."

Legostaev (1982) adds, "Thus, transport is considered to be an independent branch of material production – economics–mainly micro – economics." He differentiates the production process of transport; i.e. transportation, from the term transport. Accordingly, transportation may be for industry or for economic purposes. "It is the transport that continues the process of production in all national economy branches, and the industrial links of its enterprises are much more wider than those of other branches." (9)

The above – mentioned material on the essence of transport economics sufficiently reveal the main aspects that should be considered in this research. Since transport continues the process of production in all national economy branches, as Legostaev argues, it would be our ultimate interest to study such a phenomenon.

The extracts presented above reflect that transport economics is an economic science basically of a micro – applied nature. This means that it deals with aspects of the micro nature since it studies demand, supply and pricing structures. The competition between the different modes of transport is classified as a micro – based phenomenon that needs much more research, as Bonavia has stated.

The practical concerns that generate the study of transport classify this branch of science as an applied science. Among these we find the organizational structure of management a top priority in transport studies. When studying demand, as Stubbs, Tyson and Dalvi argue, there are certain elements that should be subject to careful analysis, such as the presence of monopoly in some conditions, and the government intervention to "control monopoly behaviour by a statute". The allocation of transport investment costs between the different bodies involved or affected by such business is another important factor in this study. Since the Nile in Sudan is mainly undertaken as a basic source for irrigation, energy production and drinking water, the units providing these activities should be involved in development efforts to improve navigation conditions. Pricing policies of river rates should be clearly set and made in a manner that ensures a permanent river service.

Other important aspects of transport demand, as stated by Stubbs, Tyson and Dalvi, are the decision – making process, use of technology and impact on environment. In Sudan, especially in the

South, the prolonged dragging civil war had a negative impact on river transportation. Together with the government's announced policy of a free market economy and its mis-uses of this concept, is one of the important points discussed in the final part of this work. In addition to these points, problems of equity and efficiency are considered in Sudan river transport system, making use of Khogali's thesis (1964).[10]

Economic analysis, as Milne argues, can not reveal all complexities of life; and transport can only isolate some of the important forces and show the relationships between them, or at least raise some issues for further studies through "heating", or, if the economist can not solve any of them, he could "shed light" on these issues.

2–2 Purpose And Functions Of Transport:

What do we want transport to do? Or what are the purpose, function and significance of transport? Stubbs, Tyson and Dalvi (1980) distinguish the purpose of transport as follows: -

First: The spread of production over regions.

Second: The transfer of trade, ideas, information and different mobile factors of production i.e. capital, labour and management.

Third: Passenger transportation and, finally, a considerable amount of the national income is devoted to movements of people and the carriage of their goods.

Milne (1958). [11] Discusses the purpose prior to the functions of transport. He argues that the purpose of transport is the provision of:

a) Division of labour
b) Extension of the market producing capacities
c) Increasing the size of productive units and,
d) Variation in scale and size of the structure of production.

Milne gives reasons for these purposes when he points out that "the essence of economic activity is the exchange of what is surplus to one man, for what is deficient to this man". The extent of the market or the volume of demand for particular goods – the ability to exchange relative surpluses–depends on the size of the gap separating producers and consumers and the means of transport available to bridge this gap …In such a way that "the smaller the gap between producers and consumers and more efficient the means of transport bridging this gap,

the greater will be the degree of specialization among producers and the higher will be the standard of living of the community concerned."

In discussing the functions of transport; we start with Bonavia (1936) who sums up the following functions: [11]

a) Creation of utilities of place, that is to say to carry commodities from points where their marginal utility is low to where it is relatively high, passenger transport is considered as a "consumer service".
b) The demand for transport is not fundamental in the human nature (i.e., not like elemental desires as food, shelter ...etc) "it is a derived demand". So that in certain aspects of transport the community similarly bridges the gap between demand and supply by special action, which ignores the criterion of "effective demand price", the common arbiter of economic activity. But the special place of transport in the production of welfare may lead the state to satisfy "the latent demand at the public expense. Transport expenditure comes under both these heads; private and public."
c) Specialization. Specialized production depends on an efficient system of transport. Until transport could be cheapened and extended their force was latent and the simultaneous expansion of population and wealth was baulked of its full momentum.
d) Bonavia considers some social effects of transport, although many of these effects are "so remote from contact" with the measuring – rod of money some attempt must be made to set economic and non-economic effects side by side".

Milne proceeds to discuss the functions of transport, making an expressive correlation between the extent of the market, specialization and transport efficiency. He argues that the degree of specialization is limited by the extent of the market and that transport facilities are a means of extending the market". The economic significance of the producer – consumer gap does not lie in the physical distance as measured in miles or minutes, but in the economic distance as measured in terms of transport". [12]

But the efficiency of transport in bridging the gap is also a matter of transport costs. The more efficient the means of transport, the lower will be the costs of transport. The costs of transport are, then, "the measure of both the size of the gap and the means of bridging it".

Thus, transport improvement, by enabling the market to extend, permits a greater degree of specialization, and besides the productivity achieved, a reduction in the costs of transport will result. This confers a benefit on the community, which is greater than just the saving in transport cost to the users.

Milne draws up two important general comments;

I. The availability of efficient transport facilities is an essential component for economic development "and in many cases an initiating cause of economic progress". The function of transport is considered with reference to the "long –term economic development".

II. The high degree of interdependence of various parts of the economy… makes it complex in its nature and delicate in its operation" and protective measures are made to safeguard producers and consumers. Such measures prevent division of labour from being exploited to its full extent. Also warfare economy is another obstacle for the division of labour. The interests of a warfare time economy (siege economy) are in the direction of self–sufficiency and independence; while the interests of a peace – time economy are in the direction of division of labour and interdependence.

Thus, the functions of transport, according to Milne, are:

a) In fitting transport into the economic picture, transport is regarded as a "process in the production of goods and services".

b) Transport is "an object of consumption". Any development that reduces the demand for transport without affecting the production of goods and services is to be welcomed. Nevertheless, transport has to be economized". And that improvement facilities are necessary but "only in the sense of being a necessary evil transport is the servant of industry".

c) The strategic function of transport; "The movements and supply requirements of the armed forces involve considerations of a different order from those relevant to the movement of commodities for civilian requirements". In so far as preparations for a possible war have to be undertaken in times of peace, it may be necessary to hold transport facilities in readiness for war–time movement purposes even though these facilities are in excess of peace – time needs. Just as there may be stock – piling of

materials in the interest of national defense, there may be created "a reserve of transport facilities, which while used to less than capacity in peace–time would be stretched to the full in the event of a national emergency"[13]

To sum up this section, it can be said that there is an agreement between "Milne and stubbs, Tyson and Dalvi on the purpose of transport, as follows:

Transport helps in developing division of labour among the society concerned; it works in direction of extending the market of specific products; it enlarges and increases the size of productive units, and finally, it reorganizes the production structure in that given society.

In discussing the functions of transport there is also an agreement between Bonavia and Milne, in that transport is a process in production that creates utilities of place. Transport is an object of consumption; demand for transport is derived; it helps specialization and has some social effects. Finally, Milne argues for armed forces movements and the necessity of providing a margin for strategic transportation.

These points are considered in the discussion presented in the sections dealing with river navigation in this study.

2 -3 The Economics Of Transport Modes:

El Sheriff and Babiker (1990) have [14] produced a schedule showing the comparative characteristics of some modes of transport as follows:

Railways:

a) Costs: Capital intensive: Large initial investment (including right of way); profitability rests on intensity of use: 350.000 to 500.000 ton/miles/year is operational margin; high terminal costs.
b) Distance: Increasing effectiveness with length of haul: Large shipments cheaper by long hauls
c) Rates: Subject to class rates, freight rate, territories in transit rates, etc
d) Goods characteristics: Minerals; unprocessed agricultural products; building materials; chemicals, passenger traffic,
e) Distinctions: Large volumes of bulk goods in comparatively short time at low costs.

f) Drawbacks: Cost and time of assembling units.

Waterways:

a) Costs: Investment low, especially where natural waterways are utilized; terminal and handling costs are several times less than haul costs.
b) Distance: Increasing effectiveness with length of haul.
c) Rates:
d) Goods characteristics: Marine, semi – finished products; Inland: bulk raw goods, coke, coal, sand, gravel, cement, passenger traffic negligible.
e) Distinctions: Low freight rates, slow speed especially of goods carriage.
f) Drawbacks: Slow speed.

Motor Transport:

a) Costs: Fixed costs negligible, operate on small margins, operating costs high, vehicle turn over high.
b) Distance: Short hauls less costly than rail, wide areal coverage.
c) Rates: Rail acts as price leader.
d) Goods characteristics: Perishable goods, lumber, and passenger traffic important.
e) Distinctions: Light loads, short distances, minimize distribution costs.
f) Drawbacks: Inadequate capacity for moving heavy volumes, bulk materials; high costs of long hauls; high vehicle operating costs.

Air Transport:

a) Costs: Fixed costs low, investment in stock very high; terminal take off costs high.
b) Distance: Long hauls; economy with distance.
c) Rates: Set by national and international regulations.
d) Goods characteristics: Passenger traffic dominant, perishable, light weight high – value goods.
e) Distinctions: Speed
f) Drawbacks: very high cost

Pipeline Transport:

a) Costs: Fixed costs high, large economies through diameter of pipe; costs increase almost directly with distance; velocity adds costs.
b) Distance: Long haul in bulk

c) Rates:
d) Goods characteristics: Crude oil and petroleum products in large volume; natural gas; some solids.
e) Distinctions: Bulk movement of liquids.
f) Drawback: Restricted commodity use; regular flow and demand needed; large market.

El Sheriff and Babiker argue that "each mode of transport has its own distinctive characteristics, its own spatial relationships, and each plays, though often (competing with each other) a different role in the supply of transportation...and technical change is increasing (competition). They have put two indicators for comparing the different modes of transport: "assesses movement in terms of one ton moved one mile" or "the revenue generated" by each mode. The researchers argue that the first indicator "tends to overemphasize those modes carrying heavy goods and those moving long distances", and the second emphasizes: "high – value goods and high value charges".

As it can be seen from the above – mentioned, "comparative characteristics of modes of transport", the column of waterway contained no information on the "rates" for the inland water navigation. And that on the section of water transport, we read the following: "The leading characteristics of water transport are low freight rates, specialization in a few bulk commodities, and low speed; for example, barges on inland waterways move an average of 5 miles per hour. Investments is small, compared to that of the railways, if natural waterways are used. Inland waterways tend to carry bulk goods such as oil and grain". Then it shifts to marine transport.

The empirical experience of river transport in Sudan has shown a different position with regard to the points mentioned above. It's known that Sudan railways and RTC were erected on complementary basis, i.e. they had never been in a competitive position. Secondly, the argument that "technical change increases competition" is likely not to be true. [15] It may reduce it. Thirdly, there is no "emphasis", for or against, when we promote a ton/kilometer indicator since this means a movement of one ton for a distance of one kilometer regardless the mode of carriage. Fourthly, the blank column of rates indicates lack of information and an inability to find out what can be documented. Finally, the nearly 60 words–paragraph reported on river transport

seems to be a general trend in most of the written material on river transport in Sudan.

Sudan's experience shows that river freight rates are low because "the cost of the first movement" is comparatively low, since the shipment load is big as it is shown in the forth-coming chapters.

River transport in Southern Sudan used to operate 2000- ton capacity push-tugs. The least towing capacity is1400 tons, between Kosti and Juba ports (a 1435 Km distance) to reach within nine days, bearing in mind that the navigation hours per day do not exceed 15 hours due to innavigability by night. Added to these operational conditions, is the continous rain for nine months a year. Given all these conditions the whole shipment is well protected from natural hazards to reach its destination port. For these reasons, it seems that such a work cannot be described as it is of a low speed.

CHAPTER TWO: END NOTES

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CHAPTER THREE

THEORY OF TRANSPORT ECONOMICS

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THEORY OF TRANSPORT ECONOMICS

This chapter discusses specific factors in the field of theory and methodology used in studies dealing with economics of transport. An attempt has been made to define the fields that transport economics usually cover.
Secondly, four approaches have been introduced. Finally, a trial has been made to group together the theories known to social scientists in three broad headings; the network, flow and modal systems.

Transport studies usually take into consideration specific areas to be researched, such as,

a) The study of existing "transport networks". The term "net work" means "a set of locations interconnected in a system by a number of routes". [1] It involves the presence of many links that are connecting specific areas. A study in this regard will investigate into these connections and explain the growth that takes place in a network. Many economic concepts are studied in this case such as the size of population, level of income, production levels and the main characteristics of the network under study.
b) To study "transport modes" available in a country. Normally, such modes are; first the inland transport modes, which include the following means; traditional transport systems, man and animals, in the rural areas, vehicle, locomotive, pipeline, cable and belt conveyers transport systems. Second water transport including the following systems; river, lake, canal, gulf, sea and ocean transport. "These modes will not necessarily run parallel to each other and some times it may be correct to refer to a corridor rather than a line". Third, air transport. Finally the transportation of ideas, information, news and capital [2] Each mode has different technologies, different economic characteristics and hence each mode will have some advantages that need to be studied and analysed. [3]
c) To study the "traffic flows". The main concern here shall be to analyse how specific cargo quantities or numbers of passengers are to be 'moved' from one place to another and to determine the origins and destinations of such traffic. In other words, to study the demand aspect of transport, which is derived in

nature, as well as the supply, or the number and volume of stocks required; that is supposed to materialize this demand. It is worth noting, "transport creates utilities of place". [4]

d) To study the "transport costs". This part includes many economical, social, political and technical aspects. Economically, it includes many different but interrelated factors that determine and affect other levels of cost. There are elements of fixed and operational costs such as the investment, establishment, administrative costs as well as fuel and lubricants, wages and salaries... etc [5]. Socially, there are indirect costs in the form of accidents to the public , noise and environment pollution. Politically, there are two levels of abstraction, the general policies performed by the government authorities, which affect greatly the level of transport costs and operations and on the other hand, there are regional and/or international policies, which can affect to a given extent, the level of transport routing [6]. The last three chapters of this thesis are devoted to analyse the socio-economic impacts on river transport in the Sudan.

So, it is clear that the fields of both theoretical and practical transport studies are so wide that call the participation of different social and natural scientists to be involved in these fields. Among these scientists, we find economists, sociologists, politicians, administrators, demographers, geographers, environmentists and engineers. So, the applied methodologies used in transport analysis are diversified. [7]

3-1 Methodology:

Transport economics as an applied micro-economic discipline has developed some ways of thinking, i.e. methodological approaches, besides a body of theories that distinguish it as a science. The following lines present some of these methodologies and theories as they suit the analysis in this work.

Historically, the research methodology in the field of transport economics has undergone many developments. The application of geometric and statistical indices and analysis procedures are the most recent developments. So, the use of models and graphs are the dominant techniques used in the analysis of "cross-section", "system analysis" and the "inductive" approaches used in transport economics. Other approaches depend to less extent on statistical models e.g. 'the

regional, environmental and welfare approaches'. A brief description is given below for each methodology [8].

3 -1-1 The inductive approach:

The main theme of this approach is to explain the development that takes place, through time, in a given network. Such development may be positive or negative that is to say, a network may reflect increases or higher growth rates or a declining trend. This approach assumes that transport phenomena are changing with changes in time while the location is fixed. This approach can be established, empirically, at various stages of the life history of a network. It can start from the simplest stage to reach a level of generalization an aspect that helps in future forecasting. So, it can be expressed in a model. [9]

3 -1-2 The cross-sectional approach:

Here the researcher has to consider a 'cross-section' of the transport network and to analyse it during a specific period of time, so that he can predict how intensive is the traffic volume or the traffic flow in this given network. [10]

3 -1-3, The regional approach:

The main objective of this approach is the description and analysis of the characteristics of some chosen region and the study of transport networks within it. [11] Such region may have remarkable features economically, politically and socially, which make it an integrated region. These characteristics may include the level of economic development of the region, the different production places, the technology available, the relative transport cost structures and the future of the region as perceived by the inhabitants.

The relationship between man and environment may be considered in this approach. The social demands and desires of individuals and groups, in the form of "the interest, perceptions and preferences of decision-making (including political and military decisions) groups" [12]

The main purpose of this approach is "to relate spatial structures and commodity flows and in the various attempts to create an

integrated regional system around movement, networks, nodes, hierarchies and surfaces". [13]

3 –1-4: The systems' analysis approach:

The main theme of this approach is the study of relationships between different economic inputs and outputs and the flow of traffic, which is dependent on the network and vice versa. The elements of such study are: [14]

a) As an inventory, that is to study the available capacities of transport systems, length of networks, number of vehicles… etc. It is the study of transport supply. The distribution of these stocks is most closely related to income, population and the size of the area.

b) As a network; here the study focuses on the geometric structure of the route system, i.e. the engineering works. It includes analysis of intersection places, modes and terminals, the length of routes, the accessibility of individual points and the distances traveled in order to reach every point on a network.

c) As traffic flows; the main concern here is the flows of people, commodities and messages. The study will determine what movement occurs and how intensively would it be.

d) As model system; i.e. what type of transport occurs? Traditionally, one of main approaches to transport has been via the examination of the various types or means of movement in order to identify their particular technical characteristics, their cost structures, their historical evolution and their regional growth patterns. "There is an overlap or a competition between the modes, and the technical change is tending to increase that overlap and competition". As well as the modes can complement each other in specific situations.

e) As interrelationships of the four elements of sub-systems noted above. It differs from them in that it does not attempt to codify structures or functions, but rather to look at the relationship with the whole socio-economic system. The main concern here is with the development of a set of principles of transport interdependence with the socio-economic system, which might illustrate how a change in modal or accessibility patterns influences the sites and development of economic activities in broad regional urban framework. At one hand, there are relationships between highroad and railway networks. The

relationship between these two networks may be of a supplementary, complementary or competitive manner. The network relations are evidenced by a combination of stock conditions, characteristics of flows, network structure, and other use features. On the other hand, viewing transportation interdependence with the larger milieu of which it is a part, requires the use of various means of transport in the economic growth of a region or within the linkages and structure of an urban hierarchy and intercity, or in interurban functioning.

To sum up such approaches would facilitate efforts to describe, analyse and understand transport movements as the infrastructure of an economy. Such movements may be limited and channeled by a composite transport system. Every change in the system changes the social and economic conditions within which the system operates and vice-versa. For example, the replacement of a primitive route system by a more satisfactory system in a developing country might "affect pattern of development profoundly" [15]. Some places on the old route may decline in the size while those on the new one may flourish having new rural market towns and the development of ways of land use in that area. The researcher has conducted a study on "Khartoum – Wad Medani Road", a 189 km- length, in the year 1972, which has shown the same results when the (new) road is compared to the (old) rail track.*

3-2 Network Theories:

As mentioned above, in addition to movements taking place, a given area has a stock or inventory of fixed and mobile facilities, relative to social, political and economic factors, which allow the movement to take place. So, we can ask what sort of network systems do? these facilities pass through? What are the characteristics of route location, the location of insertions and terminals, density and length of routes, accessibility, and centrality or connectivity of the network? The answers to these questions convey some notion of the spatial or geometrical arrangement of routes, intersections and nodes. We need specific method to analyse the common features of modal networks so as to measure and assess them. Such assessments deal with the geometrical properties of transport networks. So common geometrical properties can be analysed, such as:

a) Origins or nodes.

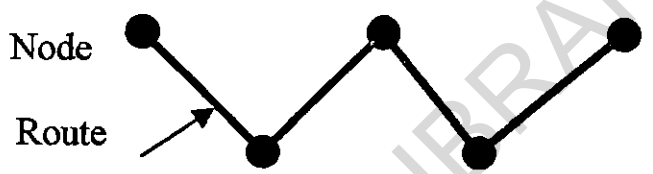
b) Links or routes.
c) Destinations or nodes. [16]

Networks are structures designed to tie together nodes via routes, whether they represent flows of people, goods, money, information or any thing else that is moved from one place to another. They can be presented graphically in one of three forms [17]

a) The paths.
b) The tress.
c) The circuits.

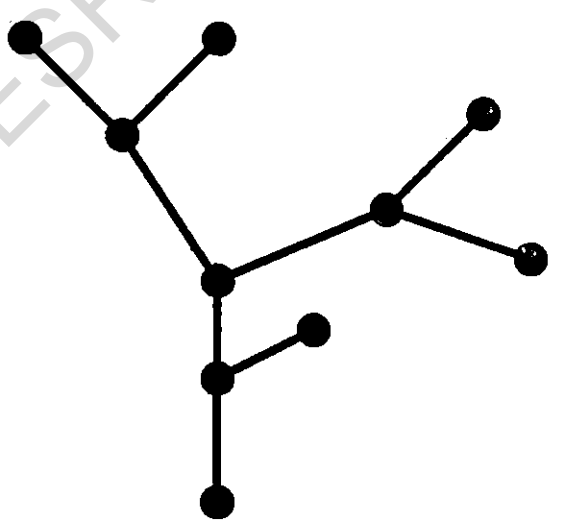
The path is a route or link that connects many nodes together with no feeder links between them i.e. each node is only connected with another one as the following figure shows

Fig.3- 1: A Route and A Node:



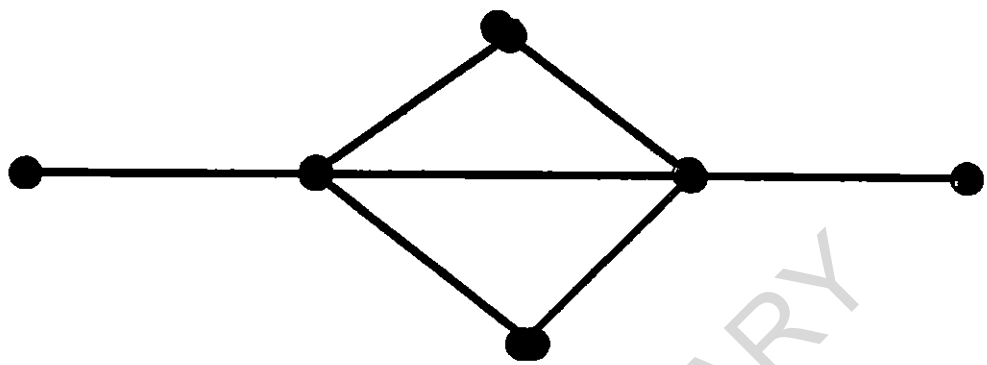
The tree – shape graph has circular links i.e. one cannot return to the origin through an alternative path.

Fig. No.3 -2: Tree – Shape Graph:



In a circuit–graph, one can go back to the origin because it is completely a closed network i.e. it is a place where a number of streets meet.

Fig. No.3-3 Circuit Graph:



The value of the geometric properties of networks is that it ascertains what measures will describe the structure of the transport networks and to ascertain that how these measures are related to the characteristics of the area in which the transport networks are situated.

In order to describe, analyse, compare and replicate network systems, a method of accurate and consistent measurement is needed. To this end, networks have been approximated by the use of graph theory. These graphs allow us to look at the entire transport networks, and their parts, in terms of the whole; more specifically, they have been used to translate observed relationships or networks into numerical and symbolic forms. Thus, a graph may consist of "edges" representing routes and "vertics" representing nodes. The manner, in which a number of edges and circuits are interconnected, may be measured by several indices developed within graph theory.

These indices reveal and translate into uniform and consistent measures the geometric structure of a network. Such studies of network structures vary in the amount of information they contain. At a minimum, edges and circuits are related by relatively simple indices but more complex analysis may include information on angles, lengths or capacities of routes. Now let us consider some of these indices as they are used in studying transport economics of a network.

3- 2-1 The Detroit Index [18]

This index is represented by the simple equation that the actual road length is divided over the straight-line length multiplied into 100%

$$\text{Detroit Index} = \frac{\text{Actual road length}}{\text{Straight Line Length}} \times 100$$

If the value of the index approaches 100%, this means that the actual route is tending to have a straight line distance which means high efficiency in the transport network. If it exceeds 100%, this means that there are many turnings in the route, which means that the transport network is less efficient.

It is not always true that the straight line between two points is the least link in terms of economic costs.

3-2-2 Accessibility Index [19]

Accessibility to network nodes is measured by the number of links between these nodes and the traffic direction of these links.

$$\underset{(a)}{Acc} = \Sigma_x k (a_1, a_2)$$

Where

Acc = Accessibility
a_1, a_2 = Nodes
K = Variable- usually distance
Σ_x = Total Value of the Variable of Node (a)

The accessibility of (a) equals the total value of the shortest routes that connect it with other nodes in the network.

3- 2- 3 Connectivity Index [20]

These indices can be measured by Beta, Gamma and Alfa indexes.

$$\text{Beta } (\beta) \text{ Index} = \frac{\text{No. Of Links}}{\text{No. Of Nodes}}$$

The value of this index ranges between (Zero – One). When it equals zero it means that the network has only nodes without connections between them. In this case, it will be called non-connected or null graph. If its value is equal to one; this means that there is a complete connection in the network or complete graph. If it is more than one, this means that there is more than one complete and developed network.

$$\text{The Gamma } (\gamma) \text{ index} = \frac{\text{No. of Links}}{3\ (\text{No. of Nodes} - 2)}$$

The connectivity in a network can be numerically calculated by gamma index. Its value ranges between zero – 1, when it equals one this means there is a full or complete connection in the network. It is preferred more than (β) index because it takes into consideration the maximum number of links available in a network.

$$\text{The Alfa } (\alpha) \text{ Index} = \frac{L - N + M}{2N - 5}$$

Or

$$\text{Alfa } (\alpha) \text{ Index} = \frac{U}{2N - 5}$$

Where: L = No. of links
N = No. of Nodes
M = No. of Network parts
U = Cyclomatic Number

- 2 – 4 The Centrality:

It can be measured through the consideration of the number of links that lead to the farthest node via the shorter path in the network.(21)

The Diameter Of The Network:

It is calculated by the number of links available on the shortest path that connects the two most distanced nodes on the network. It can be calculated by the following equation: -

$$\text{Index } \pi = \frac{\text{Total link length}}{\text{Net Diameter}}$$

Where $\pi = 3.14$(Irrational figure)

Eita index is used to give an idea of the spread of the network, through the following:

$$\text{Eita } (\acute{\eta}) = \frac{\text{Total Length}}{\text{No. of Links}}$$

Where:

$(\acute{\eta})$ = Average Length Link.

So, it is clear that the study of the different indices of a network has a strong relationship with the level of economic development in a country.

3 – 2- 5 – Network Density :[22]

The density of a network is one of the most important indicators that can help in reflecting the degree of economic development. It also indicates that if the transport network is adequate or not. It is calculated in relation to the country's total area or total population:

$$\text{Network Density} = \frac{\text{Total Network Length (km.)}}{\text{Area of the Country (km}^2\text{)}}$$

Or

$$\text{Network Density} = \frac{\text{Total Network Length (km.)}}{\text{Total No. of Population}}$$

The "population" is the important factor since they represent the core of transport flows. The density of a network, if intensive, tells that this network is sufficient, and if it is not, indicates that most of the regions do not have enough routes in the network.

In summary, the above discussed indices measure and reflect the typological attributes of a network. That is seen in the fact that they reveal and translate into uniform and consistent measures the geometric structure of a network so, that these attributes may be described, compared with other networks, and, related to regional characteristics such as the size, shape or level of economic development. Such studies of network structures vary in the amount of information they contain. At minimum, edges and vertics, are related by relatively simple indices, but more complex analysis may include information on angles, lengths, or capacities of routes. [23]

3-3 Traffic Flow Analysis:

It is important in this section to examine how much moves occur, as flows, as a result of the activity or the process of transportation. Researchers have to study the relationship between transport network structures and the flow of goods together with passenger traffic over that network.

By the term flow, we simply mean "the volume and direction of the movement of goods, people and messages. Thus, flows and the interaction that they involve are the chief objects of many investigations, from the diffusion of innovations to the movement of consumers."[24]

Flow patterns are complex; there are also some complex techniques to try and analyse these patterns. Linear programming is among the techniques used in regional and other flow models. "Linear programming rests on the assumption that there is a linear relationship of the form A + B = C. Typically, there is a series of simultaneous equations, which represent the basic conditions of the problem, and a linear function, which represents the objective." The word "programming" means that a set of programme or series of rules is followed in order to solve the equations. Here we are concerned with the following aspects:

a) Supply areas with known surpluses
b) Receiving centres with known demand,

c) Known link routes and transportation costs.

The problem is how are the flows arranged between the nodes? Given the network, stocks, and relation of demands to supplies, what flow pattern results?

Here, it should be added that flows should follow the least – cost routes. Thus, the linear programming technique is a step-by-step measure to allocate the flows from and to known points of demand and supply to the optimal least – cost routes.

Flows are volumetric measures of place interaction. Flow patterns can be analysed and explained in terms of real characteristics, the positive or negative factors being supply and demand on one hand, and cost and distance (among other factors) on the other hand.

Economic development, regional growth and change, consumer taste preferences, cultural traits, or governmental and military direction can all alter the spatial imbalance that usually must be present to initiate movement. Flow analysis can act as a link between the concept of interaction and the analysis of spatial distribution and relationships.

3 - 3 – 1 The Gravity Theory: [25]

The interaction expected between any two-population settings, X and Y, will proportionally increase with the multiplication of their total population; P_x, P_y and inversely with the distance between them; D_x, D_y. This can be expressed by:

$$\text{Gravity}_{x,\,y} = \frac{P_x,\ P_y}{D_x - D_y}$$

Or

$$\text{Gravity}_{x,\,y} = C \left| \frac{P_x,\ P_y}{D_x.\ D_y} \right|$$

Where:

C = Constant

The use of the gravity model in traffic flow gives large figures of the components of transportation. So, for this reason the index is amended through the addition of a constant (c) as shown above.

Retail Trade Gravitation: [26]

If we want to know the volume of the retail trade between three towns, we can apply the following formula.

Example: -

Assume that we have three towns; town (a) with 40000 total population, town (b) with 20000 total population and town (c) with 60000. If we are given that town (b) lies in the middle; the distance between (b) and (a) is 100 km. and 200 km. away from (c). What is the trade volume between (b) and both (a) and (c)

Solution:

$$\frac{\text{Trade bet. (b), (a)}}{\text{Trade bet. (b), (c)}} = \frac{\text{pop (a)}}{\text{pop (c)}} \text{ X } \frac{\text{Dist bet (b), (c)}}{\text{Dist bet. (b), (a)}}$$

$$= \frac{\text{Pop (a)}}{\text{Pop (c)}} \text{X} \left| \frac{\text{Dist bet (b), (c)}}{\text{Dist bet (b), (a)}} \right|^2$$

$$= \frac{40000}{60000} \text{ X} \left| \frac{200}{100} \right|^2$$

$$= \frac{2}{3} \text{ X } 4 = \frac{8}{3}$$

This means that every three units of a commodity price bought by the people of town (b) from town (c) equals the price of (8) units from town (a). This law can be put as:

The degree of interaction, between the populations of a given town with another one, is proportional with the total population of the

second town and inversely correlated with the square distance between the two towns.

3–3–2 Complementary Theory: [27]

Economic exchange is a direct result of efficient transportation. Commerce takes place, between different consumption centres, if price differentials between these centres, can cover the transportation cost. There are so many factors that can directly influence such relationship.

The interaction between two centres takes place if a commodity is demanded at one place where there is a supply of produce in the other centre. Specialization in production, with the availability of modal transportation, leads, if economy of scale is operating, to complementarity between the different centres. This can be expressed by the following formula:

$$T = C\ [P_1, P_2]$$

Where;

T = Traffic Volume
P_1, P_2 = Population of P_1, P_2
C = Constant.

Transferability: [28]

This concept indicates the substitute of a demand, by an alternative, when the friction of distance may reduce the opportunity for interaction between two regions.

3–4 Modal Analysis:

If demand and supply exist, the movement, transportation, takes place through a network on which certain stocks of transport occur. That movement or intensity of usage being measurable by volume or flow. It can be stated that these relations and connections between areas are measurable also in terms of different modes of transport.

Each mode of transport – air, road, rail, waterways, pipes line, etc has its own distinctive characteristics, as has been shown above, and each mode plays, though often competing or complementing, a

different role in the supply of transportation. Each transport system, in reality, is influenced by the presence and absence of other modes of transport, their relative efficiencies images, and aptness for technical change.

When we come to compare these different modes of transport, one of the problems is to find a common denominator [29]. If we choose the ton-kilometer hauled, we find that such a denominator tends to overemphasize those modes carrying heavy goods and those moving long distances. An alternative indicator is to measure transport activities by the revenue generated, which in turn tends to emphasize high – value goods and high – value rates. "The pattern of the relative modal share in domestic traffic differs from one country to another depending on differences in the standards of living, population densities, differing conceptions of distance, and differing spatial and developmental conditions.

So, we should not need to compare one mode in relation to another country's similar mode. What we shall consider is the modal comparisons within one socio – economic context.

The ton/Kilometer approach is the most appropriate indication for the purpose of this study especially in the analysis of river transportation in Sudan.

The modal economic characteristics are to be discussed in a coming chapter, for the time being a brief description of the general advantages and disadvantages of some selected modes of transport is given. [30]

3 - 4-1 Railways:

The advantages of railways lie in its large volume of carrying capacity of heavy materials in comparatively short time at low rate of cost, while the major shortcomings include handling, terminal and time costs. The general characteristic of railways is its suitability for long hauls than for short ones.

3 -4–2 Road Transport:

The advantages of road transport are convenience, greater flexibility and a concern with factors other than costs. On the other hand, road transport is inadequate for moving heavy volumes of bulk goods for long hauls.

3-4-3 Air Transport:

This mode is expanding in the field of passenger traffic and for high-value goods, light weight, need for speedy delivery and perishability.

3-4-4 Pipeline Transport:

Large volumes of liquid, solids or gas can be moved "at costs similar to those of waterways, at about 15 to 25 percent the cost of rail, and at 15 to 18 percent the cost of trucks."

3-4-5 Water Transport:

Low freight rates, bulk commodities and safety characterize inland water transport and investment is small if natural waterways are used. One of the major disadvantages is low speed.

Marine transport hauls a much larger proportion of semi finished and finished commodities. Costs are complex, handling charges are high, and the terminal and handling costs can be almost triple those of the voyage proper.

CHAPTER THREE: END NOTES

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CHAPTER FOUR

SUDAN ECONOMY AND THE IMPORTANCE OF TRANSPORT

CHAPTER FOUR
SUDAN ECONOMY ANDTHE IMPORTANCE OF TRANSPORT

This chapter gives a brief analysis of Sudan economy in order to show the importance of transport on it in general. Particular attention is paid to river transport in the process of production and consumption at both the national level and linking of neighbouring countries.

Sudan is the largest country in Africa, with a total area of 2506800 km^2. It lies between latitudes 4° – 22.5° north, and longitudes 22° - 39° east [1]. Thus, Sudan has diversified vegetation zones and climates, ranging between equatorial forests in the south, desert in the north, and Mediterranean ecology in the northeastern parts of the country. The Nile River flows from south to north dividing the country into two almost equal parts.

More than 80% of the total population lives around the riverbanks and its various tributaries. [2] The total population of Sudan is estimated at 28 million in 1998. More than 65% of this population works in agriculture. In the year 1996, the share of the agricultural sector is estimated at 45% of the Gross Domestic Product, rising from 28.7% for the year 1990/1991. The agricultural sector includes crop production, animal wealth and forests, as shall be detailed in this chapter. [3] For more details see Annex No. 5.

The second economic sector is the services sector; it contributes 40.6% of the GDP as estimated for the year 1996. Since 1990 up to 1995 this sector was leading in its contribution to GDP. The present decline is due to decreases in the services provided by the government. The leading position of this sector indicates that the productive sectors, the agricultural and the industrial, were declining during that period of time. This means that the economy is imbalanced and inconsistent. (See Table No 4-1).

The contribution of the industrial sector comes on the third level. Its contribution to GDP is estimable at 14.5% during the year 1996, while it was 17.5% in 1990/1991. The same declining trend is continous during the 1990's. This is due to the sharp decline in the manufacturing sub sector, as will be detailed in this chapter.

Priorities in the Budget allocations are given to war affairs in the South, rather than expending in industry and agriculture.

Nevertheless, the three sectors generate the actual demand for transport. Imports and exports are essential components of transport demand. They constitute origins and destinations for the different types of commodities and goods to be transported, i.e. they create demand for transport. So, the following lines shall discuss the importance of each sector in the process of demand generation. (See Annex No. 7 for further information on imports and exports)

Table No 4–1: The Share of the Economic Sectors in the Gross Domestic Product (%)

Sector / Year	90/91	91/92	92/93	93/94	1995*	1996**
The Agricultural	28.7%	33.7%	38%	40%	43%	45%
Irrigated Schemes	10.3	12.6	10.4	11.1	11.1	13.3
Mechanized Rain-Fed	01.5	04.8	04.6	02.3	02.7	02.2
Traditional Rain Fed	01.9	02.5	03.9	04.0	06.7	06.0
Forest Products	03.1	02.8	02.7	03.1	03.3	03.4
Animal Wealth	11.9	11.0	16.4	19.5	19.2	20.0
The Industrial	17.5	17.0	17.3	16.4	14.1	14.5
Mining	-	-	-	-	00.1	00.9
Manufacture	09.4	09.6	10.1	08.8	06.6	06.5
Electricity and Water	02.3	02.1	02.3	02.4	01.9	01.9
Building and Construction	05.8	05.3	04.9	05.2	05.5	05.2
The Services:	53.8	49.1	44.5	43.5	42.9	40.6
Government	11.7	10.3	07.8	07.8	08.4	07.5
Others	42.1	38.8	36.7	35.7	34.5	33.1

Source: Ministry of Finance and National Economy, 1997

*** In 1995 the fiscal year has been changed to the calendar year.**

**** The second six months are estimated.**

4–1: The Agricultural Sector:

During the period 1899–1925 efforts were made to explore Sudan's possible investment potentials. Sudan Railways and River transport were highly established in a vast country like Sudan before the colonial authorities could have ruled the country. Land use was organized by the government being the sole owner of land not occupied by Sudanese. Cotton was planned to be cultivated in the Gezira area, so in 1925 the Gezira Scheme began its first production season. This was the practical experience, for Sudan, to enter the international market economy.

Agriculture was sub divided into three divisions; irrigated, mechanized and rain-fed agriculture each of which is going to be discussed later in this chapter. As it was mentioned at the beginning of this chapter, Sudan has different vegetation zones that result in a very wide range of plantations as well as different types of animal resources. Starting from the North, these zones are:

4–1–1: The Desert zone:

This zone covers 29% of the country's area having a minimum rainfall, while vegetation is absent except along the water courses (See Table No 4 –2). The Northern State is found in this zone. It is quite a remote area Republic of Sudan. The transport systems operating in this area are, mainly, rail and river transport. There is a railway track which ends at Karima town, and a desert line that links Abu Hamad with Wadi Halfa. While River Transport operates between Karima and Kerma with a total length 327 km. There is another river route that connects Wadi Halfa with Akasha town. A third river route is found between Wadi Halfa (Sudan) and Aswan (Egypt). Air transport is only found at Merowe, Dongola and Wadi Halfa airports. Finally, there is a poor road network linking the internal towns and villages together. Traveling on such roads may result, in some cases, in cars loosing its way in the desert, causing death to passengers. Although a new asphalet road is planned to connect this state with the centre of the country, it is still insufficient to cater for future transport uses.

Before the establishment of Port Sudan, on the Red Sea in 1905, Sudan exports and imports used to depend on Swakin (Sea Port) and Wadi Halfa (River Port). Thus, Wadi Halfa town, which is connected with the remaining parts of Sudan through a desert railway via Abu Hamad, and via river transport with Egypt, is an important regional river port. This importance was historical since many international contacts had taken a place on the Nile River.

Sudan camel exports to Egypt pass through the Northern State. Dates, citruses, wheat and other cereals could be very important crops for trade with Egypt. The future expansion in these products together with the population growth necessitates the development of adequate transport facilities, which can connect this region with both Sudan and Egypt. In this study, special emphasis is laid on the development of a river stretch of about 750-km in length, connecting Dongola with Wadi Halfa. Thus providing a navigation route between Karima and Aswan.

4–1–2: The Semi–Desert Zone:

This zone covers 19.6% of Sudan area with a rainfall of 75mm. Scattered trees and shrubs dominate the zone, while forest products are limited to firewood consumption. This zone covers the northern parts of Dar Fur and Kordofan, the River Nile State and some parts of the Eastern State. (As is shown in Sudan Foundation Course).

At a second level, this study, stresses on the river stretch that connects Abu Hamad with Khartoum. Thus, this region can be linked with the North, East, West and the centre of Sudan. A recent asphalet road has been constructed linking Khartoum with Atbara. It is planned to be extended to Haiya where it joins the existing Khartoum-Wad Medani-Port Sudan road.

The presence of Atbara town at the middle of this route gives it an advantage in connecting Wadi Halfa, Karima and Port Sudan. Thus, the Khartoum–Atbara rail head is the most intensively used allover the Sudan.

The area between Abu Hamad and Khartoum is rich of dates, onions, beans, cereals and citrus fruits. The potential demand for transport is estimated at 500.000 tons annually. Vegetables and garden products are most likely to be marketed at Khartoum area while the other products are to be exported to Egypt together with those of the previous zone mentioned above.

The two zones together can provide a good deal of Sudanese exports to Egypt. The amount of camels, which is exported at the present time exceeds to 500 heads every month. Herders usually travel to Egypt riding camels, taking a desert way in Sudan (Darib-al-Arbaien) and another desert way in Egypt following the various oases found in the desert. This can be changed if a suitable means of river transport can navigate between Eldebba and Aswan in Egypt. The only handicap is the remaining parts of the third cataract. In addition, if mining activities are encouraged in these zones, the potential demand shall undoubtedly increase.

The cement industry, at Atbara, can make use of river transportation to Khartoum, as it was tried successfully, during high – flood times, many years ago. Thus, the potential demand for river transport in these two zones in both directions, up and down – stream, is estimated at one million tonnes every year.

Table No 4–2: Sudan Vegetation Zones:

ZONE	AREA KM^2	%
Desert	725800	029.0
Semi – Desert	491000	019.6
Low – Rain – Fall	691000	027.6
High – Rain – Fall	347000	013.8
Swamps	246000	009.7
Mountains	006000	000.3
Total	2506800	100.0

Source: Sudan Foundation Course, Juba University, Sudan.

4–1–3: The Low Rain Fall Wood land Savanna Zone:-

This zone covers 27.6% of Sudan's total area, having an annual rainfall of more than 300 mm. It covers the central parts of Sudan. The most rich and productive areas of the country exist in this zone. The majority of the country's exports and imports are either generated or consumed in it. For areas under cultivation, its out put and productivity (See Annex No. 6).

River transport is operating her between Khartoum and Juba, with a total length of 1748 km. (See Annex No. 10 which shows the tons and ton/km transported during the last 50 years. For passengers' transport during 1970-94 see Annex No. 1).

4–1–4: The High Rainfall Woodland Savanna Zone:

This zone covers about 13.8% of Sudan area. The annual rainfall is more than 900 mm, having thick vegetation, big trees, forming forests. This zone is the major source for all forest products.

4–1–5: The Swamps Zone:

It covers 9.7% of the country's area. This zone and the one mentioned above constitute the remote southern parts of Sudan. These two zones are rich of animal wealth including mild animals. Here, river transport is the most important means of transport, which has been operating for more than 150 years. The main river route here is that which connects Kosti – Juba ports (1436 km) with an extension Kosti–Khartoum (312 km). The Malakal Gambila reach was connecting Ethiopia with Sudan, up to the year 1965, through the Sobat River. The Akobo tributary was used for administrative purposes in the Nuerlands. And many parts in south–west Ethiopia.

On the western parts, Wau town was connected with Malakal river port through the Jur River. This river route is strategically

On the western parts, Wau town was connected with Malakal river port through the Jur River. This river route is strategically important since it can provide links with Central Africa and Congo Republics.

4-1–6: The Mountain Zone:

This zone covers less than 1% of Sudan total area. It is found at Jebel Marra, in Western Sudan, the Red Sea Hills and the Imatong Mountains. It produces soft wood, fruits and other crops as major products. The Imatong area is of high importance to be developed through a river route transportation.

4-2: Land Use:

Early in the twentieth century, Sudan Government had issued a decree announcing that all lands not used by that time, are to be as government property. Hence, the distribution for housing or agricultural, purposes, should be permitted by a government authority. We are concerned with what is considered to be a government land. Looking at the land use in Sudan (See table No4-3) we notice that the total area under cultivation is small in comparison to the total area of the country. On the other hand, the water surface is about 150% of that utilized by agriculture. When the utilization of water surface is considered it would be of a very low rate. As was mentioned at the beginning of this work, water surfaces have many uses in man's life. None of these uses, including water transport, are used in the best way as one can wish in Sudan. For the utilization of land in agriculture see Annex No. 6.

Table No 4-3: Land Use in Sudan.

TYPE OF USE	%
Desert	29.0
Pasture Range	26.0
Forests	22.5
Water Surface	05.1
Agriculture (all)	03.4
Others	14.0
TOTAL	100

Source: Sudan Foundation Course, Juba University.

The sectoral contribution in the GDP for agriculture, during the last six years, shows that it has increased from 28.7% in the year 1990/1991, to 45% in the year 1996 as is presented in the beginning of this chapter. The contribution of each sub – sector, of agriculture, is as follows:

4-2–1: The Irrigated Agriculture:

The contribution of this sub – sector in 1990/1991, was 10.3%, increased to 13.3%, in 1996. This sub – sector includes the planned national schemes such, as the Gezira, El Rahad, New Halfa etc. as cash crops, these schemes produce different varieties of long – stable cotton, mainly for export, in addition to other crops for local consumption such as, wheat, sorghum, groundnuts and a variety of vegetables. (See Annex No. 6.)

The Mechanized Rain–Fed:

The contribution of this sub – sector to the GDP was 1.5% in the year 1990/1991 increased to 4.8% for the next year. It is expected to score 2.2% in the year 1996. This sub – sector includes the following privately owned schemes; Gedaref Mechanized Schemes, Dali-Mazmoum, Renk, Habila, Agadi and many others.

Other joint–venture schemes between Sudan government and some international organizations such as the Arab Organization for Agricultural Development, the Libyan Integration Schemes, the Egyptian joint – venture and other bilaterally operated schemes. These schemes produce all – seed plants as sesame, groundnuts and sunflower. On the other hand, food crops are also produced such as, sorghum, millet, okra, watermelon etc. to meet the local market demands.

The Traditional Rain–Fed:

This sub – sector has shown positive increases since 1990 when it contributed at 1.9% to the GDP, and it is expected to increase to six percent in the year 1996. Generally, it is found all over the low – rain zone. This sub – sector is very important in Sudan's socio – economic life since most of the rural population depends on it. Land is cultivated rotationally and is communally owned. Domestic household labour provides the required tasks for this mode of production. On their

regular movements, nomadic tribes make use of the agricultural production in this land. So, crop yields of these schemes, though they are not produced in market scale, are locally transacted to meet the needs for money.

The main crops produced are; short – stable cotton, okra, sorghum, millet, sesame, groundnuts and karkadi. Many national and foreign organizations are involved in this sub – sector.

The Riverean, Delta and Equatorial Agriculture:

This is not considered as a sub – sector in the Economic Review published by Sudan Government. Nevertheless, the schemes, of this sub-sector, are important when discussing issues in Sudan economy. There is no reason why they should not appear in the above document. Reasons for this negligence may be attributed to lack of reliable information because the majority of these schemes are operated privately, or because these lands historically, are not included in the market economy. In most cases, these schemes are considered as private self – sufficiency schemes The Equatorial and swamp schemes are found in Southern Sudan. The main crops and products of these lands are; short – stable cotton, tea, coffee, mangoes, pineapple, bananas, tabeldi, gum – Arabic, kasava, sorghum and millet.

The delta schemes are found at the Gash, Baraka and Tokar deltas, as well as on many seasonal river–beds and streams such as, the Dinder, Rahad, Atbara, Bahr ElArab and Wadi El Magdam. Soils of these deltas are very fertile. The crops produced here are; short – stable cotton, karkadi, watermelon, sunflower, in addition to other cereals for local consumption. The Gash delta was sown with dura during the 1940's, so as to supply the British troops, fighting in East Africa, with food.

The Riverean schemes are found all over the Nile River and tributaries. These schemes are privately owned, in the form of companies, as it is the case of the Blue and White Nile Rivers. While others are registered as cooperatives as in the Northern Region. Private individual families own the remaining cultivable lands, on riverbanks. The private ownership of these lands and the way in which land is administered, prohibit large scale development planning, and hence reduces the total output.

The main products here are; dates, wheat, beans, onions, pepper, different types of citrus plants in addition to short – stable cotton.

The total produce of these three types of land is insufficiently manufactured. Lack of proper and dependable river transportation, hinders exporting these products to the different nine countries neighbouring Sudan.

4-2–2: The Animal Wealth:

The animal wealth contribution in the GDP has increased from 11.9% in 1990/1991 to 20% as was estimated for the year 1996. The following table shows the numbers of animals in Sudan. The annual growth rate, in average for the period 1990-1996, for cattle was 2.2%, for sheep it was 3.3% for goats it was 6.3% and 0.8% was the growth rate for camels. [4]

Table No. 4-4: Number of Animals in Sudan: (In 000)

YEAR	CATTLE	SHEEP	GOATS	CAMELS
1990 – 91	20551	20590	15034	2835
1991 – 92	20933	21180	15312	2851
1992 – 93	21379	22265	15714	2870
1993 – 94	21571	22929	15944	2889
1994 – 95	32083	24394	20665	2966
1995 – 96	24702	25954	26782	3045

Source: Economic Review 1996, p. 49.

The animal wealth of the country is classified into two classes; wild and tame. The wild animals of Sudan, like many of tropical African States, is composed of different kinds of lions, tigers, elephants, hippopotamus, crocodiles, deer's, bucks, bighorns, jaguars, rhinoceros, gorillas and many of the tropical and desert birds and mammals. This animal wealth makes a considerable portion in Sudan economy through the different tourism locations.

On the other hand, nomadic tribes who rear cattle, camels, sheep, goats, horses and donkeys dominate the country. The ownership of animal wealth determine to a great extent, individual's social status and prestige.

4-2 – 3: The Forests:

This sector contributes about 3.4% of the GDP. Africa is famous for its forests both in the equatorial and savanna zones. Since Sudan is a "microcosm of Africa" it has its rich forests as well. The economic value of forests is seen from its positive contribution, in GDP, as a branch of the agricultural sector, since 1992/1993 when revenues exceeded expenditure by 0.2 million Dinners. This surplus is expected to increase to 36.8 million Dinners in 1996.

The main products of forests are sawn wood and gum Arabic, firewood and charcoal, besides some animals' by-products as, bees' honey, skins and hides, ivory etc. The role of forests in the socio-economic development dates back to the beginning of mankind. In the past and till now, people depend entirely on forests for their various social needs such as, food, shelter, protection against enemies and the provision of land for cultivation. At the present, and for the near future, the role of forests, in socio-economic development, will still remain important. [5] Forests contribute in other services, which cannot be quantified or measured in money terms, i.e., it improves soil fertility and protects it against wind and rain erosion, it helps in preventing desertification and desert creeping, provides protection against radio active materials, helps controlling oxygen in the air and finally it has some functions as recreation and tourism.

There are certain elements that face the proper utilization and the development of forests resources in Sudan. Among these, it is known that forests make an important source of energy supply in the country. According to the Survey of Forest Products (consumption), which was held in 1995 the energy supply in Sudan was as follows:

Fire wood and charcoal	71%
Petroleum products	20%
Agricultural Residues	08%
Electricity	01%

Secondly, regarding the distribution of forests and population it is found that 32% of the growing stock occurs in the Northern parts of the country where the living population is estimated at 85% of the total population. Whereas 66% of the growing stock is found in the Southern parts. Here, 15% of the total populations do live.

Thirdly, there are natural and man – made problems, which make forest reservation quite impossible tasks since men work on deforestation and forest conversion into other purposes, as for agricultural production.

Fourthly, forests are generally found in remote areas that lack proper infrastructures.

And finally, there are difficulties of accessibility since all the production are difficult to reach or absolutely inaccessible.

The public corporations of the agricultural sector have been subject to revision by the government in the light of the new policy undertaken i.e. privatization and liberalization of many of these units. (For more details see Annex No. 3 and Annex No. 4) The following actions have been taken against the agricultural firms mentioned under each heading.

1. Sale: Abu Niama Kenaf (March 1992). The White Nile Tannery (April 1992), Khartoum Tannery (Nov 1994) Koko Dairy (Sept. 94) and Sudan Cotton Company (Dec 1994).
2. Joint venture: The Gezira Tannery (March 93), White Nile Agricultural Corporation (1993) and the Blue Nile Agricultural Corporation (93).
3. Transfer without value: The Nuba lake Fishery (March 93) and Khartoum Dairy Company "Butana" (Aug. 1992).
4. Transfer to States: Delta Tokar corporation (1993) Delta EL Gash (1993) Northern Agric. Cor. (1994) and Om Haraz Timber Workshop (1994).
5. Dissolution. The Nuba Mountains Agric Cor., The White Nile Agric. Cor., The Blue Nile Agric. Cor., Southern Kordofan Agric. Equipment Cor. and the Mechanized Agric. Cor.
6. Restructuring of Management. The Sudan Gezira Board, The Rahad Agric. Cor. New Halfa and Suki Agric. Cor.

In fact, the above actions should not be considered as privatization, in the economic sense. It is rather an undervalued transference to specific private individuals, some of them were unable to pay the meager amounts estimated as values of these units. This has resulted in a negative impact on the society as a whole since many of employees have become job – less.

4-3: The Industrial Sector:

The share of this sector to the GDP is as follows, 17.5%, 17%, 17.3%, 16.4%, 14.1%, and 14.5%, for the years 1990/1991, 91/92, 92/93, 93/94, 1994/95 and 95/96, respectively. The reasons for this decline can be seen as follows:

a) lack of foreign currency to import inputs and essential spare parts,
b) lack of local credits and,
c) some owners of industry preferred commercial transactions instead of running their industry, because the capital investment cycle is short and secured. Thus, to invest in currency transactions is more rewarding than running a manufacturing plant.

The industrial sector includes the following sub – sectors, manufacturing, mining, electricity and water supplies, besides the buildings and construction sub–sector. The manufacturing sub – sector includes the following industries sugar, wheat – flour, textiles, cement, edible oils and petrol refinement. Table No. 4-5 shows the production of each industry for the period 1991–1996. Most of these industries have shown a sharp declining trend.

Mining seems to have an increasing role in the few coming years, which may bring about so many changes in the socio–economic structure of the country. Iron and gold were old activities in the history of Sudan an aspect, which had led in the year 1820 the country to be conquered by foreign invaders. Many parts, all over the country, are rich in precious minerals. At the moment, Sudan produces (15) tones of gold annually from the Red Sea Mountains, while other areas are still not yet utilized as in the Nuba Mountains and the Imatong highlands of Southern Sudan. (See Table No.4-9).

Uranium, cooper, brass, limestone and other minerals are of considerable amounts in different areas of the country.

Oil has been discovered in many places in Sudan. Oil exploration had started in the mid of the 1970's. At present, efforts are undertaken to export it by the end of this year (1999). Some of the produce is consumed locally. Many oil refineries are established at different locations of the country. A 1610 km long pipeline is constructed connecting the fields in the South–Western parts of the country with the refinery at Khartoum and the oil seaport at the Red Sea. (See Annex No. 3 and Annex No. 4)

Many of the publicly owned organizations of the industrial sector are subjected to change, as is the case with the agricultural units discussed above in this chapter. The same actions taken in the case of the agricultural corporations have been taken in this sector as well, as it is explained below.

a) Units sold: The Sudanese Mining Corporation, Port Sudan Weaving Plant, Sata Company, Ria and kirikab Sweet Factories.
b) Transferred without Value: The Vegetable-Canning Factory, at Karima, Aroma Cartoon Factory, Urban and Rural Water Corporations.

4-4: The Services Sector:

This very important sector supports the socio–economic structure of the whole society. Other sectors cannot develop without the development of this sector, since the efficiency of transport modes is very essential in connecting production centres with population groupings as well as the export ports. (6)

The main components of this sector are; the Transport and Communications, Education, Health and National Security sub-sectors.

At present, only some of the transport and communications working units are included in the GDP. This is because of government control over expenditure in addition to increases in inflation rates. So, the services, which, were provided in the past by the government, are no longer provided. The sharp decline in the contribution of this sector is the result of such policies in which the market forces have over weighed the social welfare. This means that, with other factors, Sudan economy is imbalanced and distorted.

The following units are no longer considered in this sector, because they are subjected to: (See Annex No. 3 and Annex No. 4)

1. Sale: Sudan Hotel (Jan 1993). The Red Sea Hotel (Jan 1993). Atbara Rest House (1992), Kosti Rest House (1992). The Commercial Bank (1992).

2. Rent: The Friendship Palace Hotel (Mar. 1993) The Telecommunications Department (Feb. 1993). The Grand Hotel (1996). Arosa Tourism Village (Aug. 1993).
3. Transfer Without Value: The Cattle Marketing Corporation (March. 1992), Arkaweit Rest House (1992), Refreshment and Supplies Department (March 1993). River Transport Corporation, Karima (Aug. 1993). Free Zones Corporation (Sep. 1993), Sudan Exhibition Corporation (Sept. 1993) and the Public Estate Corporation (Oct. 1992).
4. Transfer to State Authority: Juba Hotel (1992), The Sudanese Company for Building and Constructions (1994) and the Thermal Bricks Factory (1993).

Table No. 4-5: The Production of the Manufacturing sector (000 tons):

Product / Year	1991-92	1992-93	1993-1994	1994-95	1995	1996
Foodstuffs: -						
Wheat flour	0610	0530	0423	0300	0350	0360
Sugar	0470	0515	0425	0428	0450	0460
Edible Oils	0072	0180	0090	0090	0070	0118
Cab – Drinks	0033	0040	0028	0029	0033	0029
Textiles	0050	0070	0075	0030	0024	0018
Shoe Industry	0001	0002	0002	0005	0006	0007
Consumer Goods: -						
Cigarettes	0875	0890	1935	1417	1317	1300
Tyres	0229	0300	0111	0133	0186	0198
Intermediate Goods: -						
Cement	0175	0170	0186	0249	0199	0380
Petroleum Products	1152	1000	1000	=	=	=

Source: Ministry of Industry

In the "Economic Review 1996" the Service Sector contribution to the GDP, is classified as government services and other services. The government services' contribution in 1990/91 was 11.7% and declined in 1996 to 7.5%. On the other hand, the other sub –sector contributions are 42.2% and 33.1% for the years 1990/91and 1996 respectively. The contribution of the whole sector has declined since

1990/91, when it was 53.8%, to 40.6% in 1996.None of the private sector performance is reflected in the Economic Review 1996 (See Table 4-1) and certain public sector activities are not shown as well. For example in the transport sector neither the road nor the Sea Ports activities are presented.

Similarly, the Inland Water Navigation Department does not appear in the Economic Review.

Sudan Railways performed tonnage is given in the following table:

Table No: 4-6: The Performance of Sudan Railways During The Period 1993/93 – 1996

Item / Year	1992-93	1993-94	1994-95	1995	1996
Exports	0525000	220580	0422913	0409879	0279153
Imports	0661500	960646	0800120	0814709	1059417
Local Tonnage	0550800	570426	0512262	0711536	0963218
Dept Transport	-	-	-	0025154	0062895
Animals	0012700	0009700	0020972	0067854	0135860
Total	1750000	1761333	1836160	2039132	2500543

Source Sudan Railways

The performance of River Transport corporation, excluding the Northern Reach, is given for two years only, as shown in the following table:

Table No. 4-7: The Cargo Transported By RTC For the period 1995-1996

Year	Ton	Passengers
1995	132844	17908000
1996	132526	22452000

Source: River Transport Corporation.

The Sudan Shipping Line Company is presenting its carriages for the years 1990, 1991, 1995, and 1996, with a three-year gab of information i.e. the period 1992-1994, as shown in table 4-8 below:

Table No. 4-8: Tons Carried By Sudan Shipping Line Company:

Year	Exports	Imports
1990	125771	598432
1991	094679	393932
1995	143981	095425
1996	090190	100583

Source: Sudan Shipping Line Company.

(For more details see the transport modal share in Annex No. 8, the passengers transport by each mode as in Annex No. 9)

The comparison of exports/imports between Sudan Railways and Sudan Shipping line indicates that the company is not the sole transporter for neither exports nor imports.

The communications sector is composed of two organizations; the Post and Telegraph Corporation and the Sudanese Company for Telecommunications (Sudatel).

4-5: FOREIGN TRADE:

The following sections focus on Sudan foreign trade. They consider the main imports and exports.

Table No. 4-9: Sudan Exports Percentage Ratios:

Commodity	Year						
	1990	1991	1992	1993	1994	1994	1995
Cotton	48	43	20	14	18	22	21
Groundnuts	00.3	00.9	00.3	01.5	00.6	00.5	00.2
Sesame	14	10	15	16	13	15	23
Gum Arabic	12	16	07	08	13	09	05
Dura	00.8		03.1	15	02.2	08	00.4
Cattle	07	07	12	18	17	15	13
Leather	04	05	05	03	02	04	05
Umbaz	01.1	00.2	01.4	02.6	02.3	01.5	01.6
Meat			04	04	02	03	05
Gold		-	04	04	07	08	09
Sugar		04	05	04	10	04	05
Others	12	13	24	10	12	10	14

Source: Bank of Sudan.

Sudan exports represent the major source of foreign currency. Sudan Government has taken many measures to develop this

important part of the economy. But it seems that such measures alone are not sufficient to balance its foreign trade. After the year 1993, the United States of America has declared economic sanctions against Sudan Government in addition to other penalties. On the other hand, the Civil War in Southern Sudan is exhausting the economy. So, it can be said that Sudan economy is facing siege and warfare economics. This matter affects the volume of Sudan exports in addition to its effects on other components of the economy. For more details see Annex No. 7.

From Table 4-9, it is clear that the entire export component, except gold, are agricultural products, which make great deal of the transport demand in Sudan. [7] As has been shown earlier in this chapter, Sudan Railways and Sudan Shipping Line Company are the main carriers of both exports and imports of the country. In addition to that, river transport is very important in both local and foreign trade if it is utilized to the best maximum. This point shall be elaborated when dealing with transport demand.

Table No. 4-10: Sudan Imports Percentage Ratios:

Commodity	Year						
	1990	1991	1992	1993	1994	1995	1996
Petrol	50	35	28	23	21	16	20
Raw Materials	00.4	00.6	03	02	02	03	03
Finished Goods	11	17	18	22	22	23	10
Equip & Tools	10	13	14	16	18	18	17
Transp. Means	07	13	16	14	07	09	09
Chem & Medicines	08	07	07	09	09	11	15
Wheat & Flour	03	08	04	05	10	08	07
Tea	01	02	01	03	02	02	02
Coffee	00.5	00.8	00.2	00.7	00.7	00.8	00.9
Sugar	00.6			-			
Foodstuffs	06	03	09	04	07	05	04
Textiles	00.5	00.9	00.6	01.4	01.5	03	02.4

Source: Bank of Sudan.

Table No. 4-10 shows the percentage of Sudan's imports. The same factors affecting the level of exports can be said to hold true in the case of Sudan imports. It is clear that some of the imports are inputs to the agricultural and industrial sectors. The other goods imported are essential for the use of the public in the country. Such goods need to be distributed all over the Sudan. This distribution makes an important factor in the generation of transport demand,

within which inland water transport is an important component. (See Annex No. 12 for the expected traffic forecast up to the year 2013).

In summary, this chapter has focused on two important issues of Sudan economy. First, it analysed the most important sectors of the economy. The three basic sectors, the agricultural, the industrial and the government services play an important role in the generation of transport demand, they create demand for transport. Second, transport networks in Sudan should be highly integrated and economized to the benefit of the whole economy. To safeguard the population's interests and to work toward the welfare of the nation of this spacious country.[8]

In general one can argue that Sudan economy is characterized by the following:

a) Sudan has rich potentials in agriculture, animal resources, mining and water resources, which are underutilized, in the field of agro–industry. Improvement and application of suitable transport modes would increase the rate of utilization of these resources.
b) The integration between agriculture and industry is the only feasible way to attain sustainable development.
c) Thus, Sudan economy depends on agriculture and agro–industry, hence the GDP, should be top–listed by the contribution of these two sectors, if not, then the economy is rather described as an inconsistent economy.
d) The economic infrastructure in Sudan is so weak, especially in the field of transport sector.

CHAPTER FOUR: END NOTES

1. Lecture Notes on Sudan Foundation Course, "Forests Production", Juba University, Khartoum, 1999.
2. Ministry of National Planning, Ministry of Transport and River Transport Corporation, River Investment Policy Study, Khartoum, 1980, P. 12.
3. Ministry of Finance and National Economy, The Economic Review 1996, Khartoum 1977.
4. ———— Ditto.
5. Lecture Notes, above cited.
6. Richard Hill, Sudan Transport: A History of Railway, Marine and River Services in the Republic of the Sudan, Oxford University Press, London, 1956, P. 57.
7. Ali Mazrui "The Multiple Marginality of the Sudan", In Yusif F. H. (ed) Sudan In Africa, Khartoum University Press, Khartoum, 1971.
8. ———— Ditto.

CHAPTER FIVE

SUDAN TRANSPORT NETWORK

CHAPTER FIVE

SUDAN TRANSPORT NETWORKS

Chapter Four has shown the importance of transport, as an essential component of infrastructure, in the development of industry and agriculture in Sudan. This is relevant in identifying demand for transport. This chapter stresses the importance of the supply of different modes of transport in Sudan. For this purpose it follows the line of analysis that incorporates the theory of costs. Since transport economics represents a somewhat specialized application of cost theory.

So, this chapter discusses the different types and functions of transport modes through their historical progress in Sudan's history. This step is important in analysing the present system as a whole and, hence, to shed light on the different capacities available for each transport mode; i.e. to determine the supply of transport in Sudan.

5-1: The Share of Transport in GDP:

The Sudan is a country of flat plains and neither the soils, the topography, nor the climate are unfavorable to transport development. As Professor Omer Mohammed Osman argued fourty years ago [1]. On the other hand, H.A. Morrice wrote in 1949, an article on "the Development of Sudan Communications" he says "This paper is written for those who refuse to believe that progress is impossible merely because the accountants can not balance their books – for those to whom stagnation is anathema"[2]. Now after more than fifty years, have we made any progress?

The share of the transport sector in the Gross Domestic Product, for the period 1978-1987, was in average 12.3% [3]. By the end of 1995, the same share is calculated at 11% [4]. (See Table 5-1). This table shows that the share in 1985, was 14.4% it started to decline till it reached 11%, in 1995.

The legitimate question which arises here is that why such contribution is low? Why does it show a decreasing trend? The answer could be found if the historical evolution of this sector is studied. This can be achieved if supply is known to us. This means that a careful

investigation of the different modes of transport should be worked out, in the way that it can be understood at the macro economic level.

Table No. 5-1: The Share of Transport In G.D.P. (L.S. Million):

Period	GDP	Share of Transport	Share%
1978-1979	3254	0364	11.1
1979-1980	3972	0463	11.7
1984-1985	5387	0774	14.4
1985-1986	5937	0812	13.7
1986-1987	6244	0780	12.5
1990-1991	8111	0995	12.3
1995	9966	1100	011

Source: 1. Reader for the course on transport and communication Economics.
2. Econ. Rev. 1996
3. Statistical Bulletin 1990 – 1993

According to " type" transport systems can be classified into the following:

a) inland transport, including a country's internal networks of roads, railways, tramways etc.,
b) marine transport, including sea and/or gulf transport, which is linking different countries;
c) inland water navigation, including river, canal or lake transport;
d) air transport that provides inter and intra country's airways;
e) pipeline transport for liquids, gas and solid materials; and
f) satellite, wire and wireless telecommunications.

These types can further be divided in rural and urban transport networks. Taxis, buses and tramway services, in Sudan, were primarily licensed as urban transport systems.

On the other hand, the functions of transport systems can be seen in the following activities:

a) spread of produce i.e., cargo handling
b) passenger traffic; the movement of people from one place to another, and
c) the conveyance and broadcasting of news, messages and ideas through a system of telecommunications. Thus, the function of transport is to create a possible market for produce.

In the field of cargo and passenger transportation, we find the following working systems; Sudan Railways, River Transport Corporation, Sudan Shipping Line, Sudan Airways, Mechanical Transport Department, and previously there was a Tramway network. For liquid transport, Sudan has a pipeline system of more than 2400 km length [5].

Sudan has a well-established private transport system composed of trucks, buses and taxi associations. Private autombile ownership started after the First World War [6].

As far as the "ways" of transport are concerned, the following organizations are responsible for the provision of maintenance and service operations; the Sea Ports Corporation, Roads and Bridges Corporation, Civil Aviation Dept, Inland Water Navigation Department and the Pipeline Authority. Generally, these units take the responsibility of the provision of final work approvals, licensing and other related certificates needed for the concerned activity.

Concerning the telecommunication's sector the working units are; the Post Department, the Telegraph, the Telephone and Wireless. Different sub – departments are working in this field of activity including the Radio and Television Broadcasting. This sector is becoming of an increasing importance, in the socio–economic life in Sudan, because of the international developments that are taking place in the means of news conveyance and the easy movements made all over the world. It is not surprising that "the world has become a small village" in this regard. Thus, the use of the various systems of satellite and the modern equipment attached to it, have a considerable impact on people's social life, especially those of the telex, fax, airmail and internet systems.

To study the supply side of transport modes in Sudan, let us consider the historical evolution of each mode and then the task of comparing the past to the present shall be a useful indicator to measure the progress, which took place in supply components.

5-2: The Colonial Transport Policy:

The use of rivers for navigation purposes seems to be the most ancient one. "The exact date of the use of river boats for military or trade purposes is not known. But there is an evidence of Egyptian

boats (52 meter long) being used between Egypt and Northern Sudan during the reign of Seneferuw at about 2900 B.C. By about 2500 B.C. river transport became the dominant mode of transport between the two countries" As Professor O.M. Osman had argued [7]. In Nubia, Northern Sudan, wood–sailing boats were used in the up – stream direction to Khartoum during 1900 – 1700BC [8]

The introduction of modern technology can be traced to the era of the Turko – Egyptian Rule (1820 – 1881). During that period, new steamers, using wood as a source of energy, were introduced to service for the first time in Sudan's history. Some temporary – erected ports and docking facilities had been constructed in the area between the fifth and sixth cataracts. In 1874, a well-established dockyard was constructed at AL Shajra area [9]. Few years later, the "Askila" was built, at the present location of the Friendship Hall. The "Askila" is a huge building of rocks errected along the left bank of the Blue Nile before it joins the White Nile. Few years later, the present dockyard of River Transport Corporation (RTC), and its administrative headquarters, was established, on the right bank of the Blue Nile at Khartoum North, which is connected with Port Sudan through a railway line. As it can be seen, all these efforts were undertaken in central and Northern parts of Sudan and they were ertected before the establishment of the railway network.

During the Mahdia, a national rule, 1882-1899, Sudan government made political uses of river transport south of Khartoum. It used the Turko-Egyptian fleet without introducing any modifications to it [10].

In the period 1899 – 1955, the Anglo – Egyptian Rule, was the most important era in the development of Sudan communications. This regime started with the development of Sudan Railways, as a main activity, followed by similar developments in river transport, as a complementary service, to areas, which the railway cannot reach for economic reasons. Two river reaches were established; one on the south to connect Kosti with Juba (1436 km) and the second on the north linking Karima with Kerma towns. The functions of river transport were military and administration [11].

In 1949, H.A. Morrice wrote an article in "Sudan Notes and Records" in which he traces the very beginning of Sudan Railways. He quotes Churchill "the first spade of sand of the desert railway was turned on the first day of 1897. Rail head [12] reached Abu Hamad on November the first, Atbara on July the third 1898, and Halfaya by the end of 1899. The Atbara Bridge was opened next year. The railway

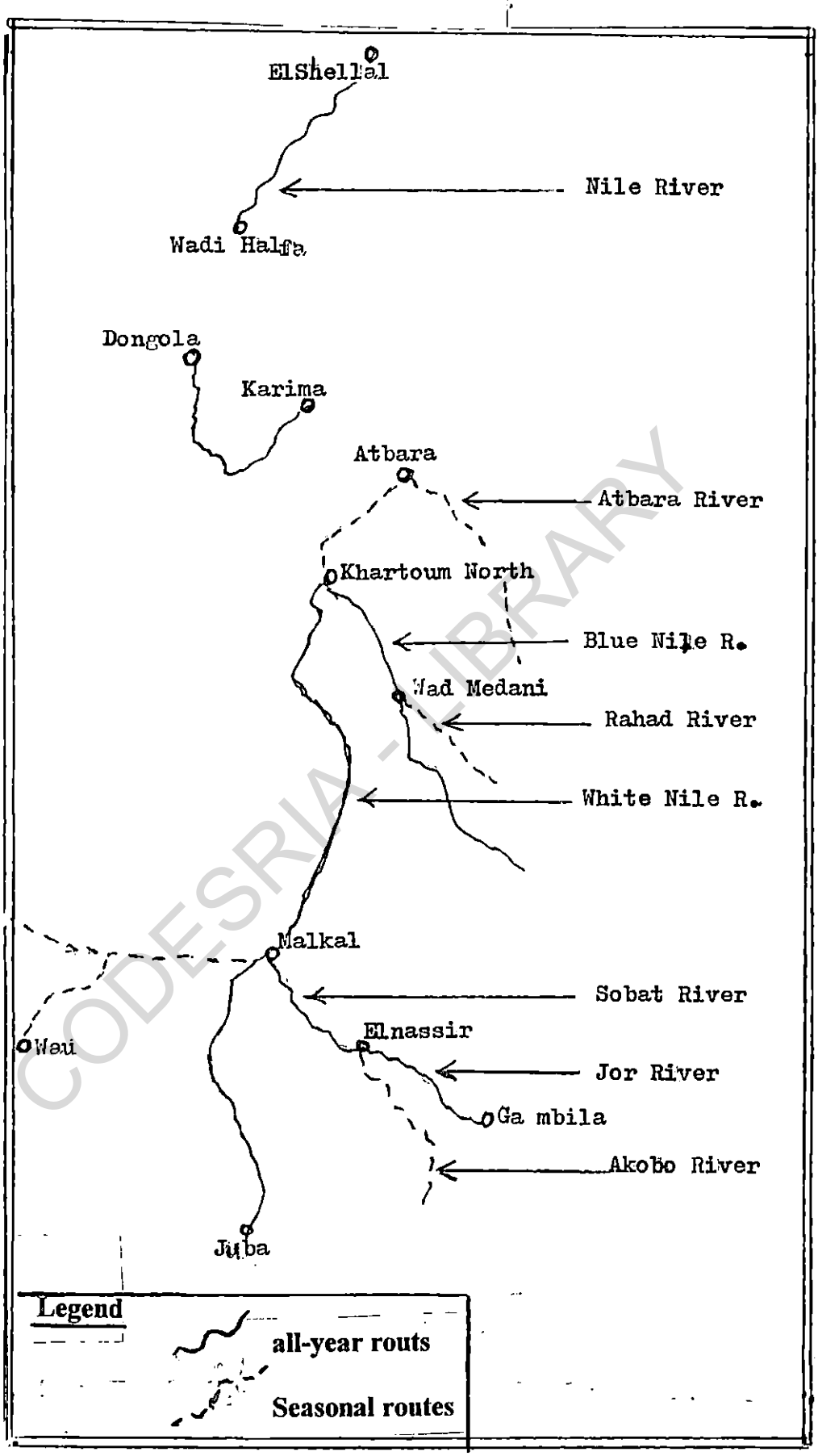
line from Atbara to Port Sudan, with a branch to Suakin was completed in October 1905. Four years later the new port was officially opened and since that time it has almost entirely supplanted Suakin. Work on the line from Khartoum to Wad Medani was begun in 1909, and later that year the Blue Nile Bridge was opened to connect Halfaya (Khartoum North) with Khartoum. Next year the bridge over the White Nile, four miles south of Kosti, was completed. On December 30, 1911, the railhead reached Elobeid, 428 miles from Khartoum, 1005 from Wadi Halfa and 917 from Port Sudan. Karima which stands on the right bank of the Nile River at the head of the navigable Dongola reach is connected with the desert railway some 16 miles north of Abu Hamad by means of a branch line 138 miles long which is opened in 1906. Up to 1918 almost all the Nile tributaries had been tried for navigation possibilities [13]. (See Fig. 5-1)

"Thus, in a period of exactly 15 years the railway system of this country was constructed substantially as it now is with the exception of the Kassala Gedaref loop"[14]. As Morrice argues.

At the same time Sudan Government had undertaken the "laborious work of clearing the sud blocks, which was formed in the Bahr El Jebel during the last years of the nineteenth century. This task was completed in 1905 and since then the waterway has never been seriously blocked for any length of time" (as it was in 1949, the year of writing Morrice's article)

The outbreak of the First World War in 1914, made it impossible for Sudan to take immediate advantages of its excellent railway communications. The development of the Gash Delta, on Eastern Sudan, as an irrigated area has led Sudan Government to extend a railway branch from Haiya Junction, which reached Kassala on April 21st, 1924. It was prolonged to Gedaref in 1928 and to Sennar in 1929. Thus completing a loop – line 500 miles long. The Butana Bridge over the Atbara River was constructed in January 1928, a new bridge over the White Nile linking Omdurman with Khartoum by road and tramway was constructed and in the same year, work was started on the new terminal port and provincial capital of Juba. River services remained much the same as before, but terminal facilities were greatly improved by the construction of a large inland harbour at Kosti during the thirties of the twentieth century.

Fig. No. 5-1: Waterways Used in Sudan By World War2



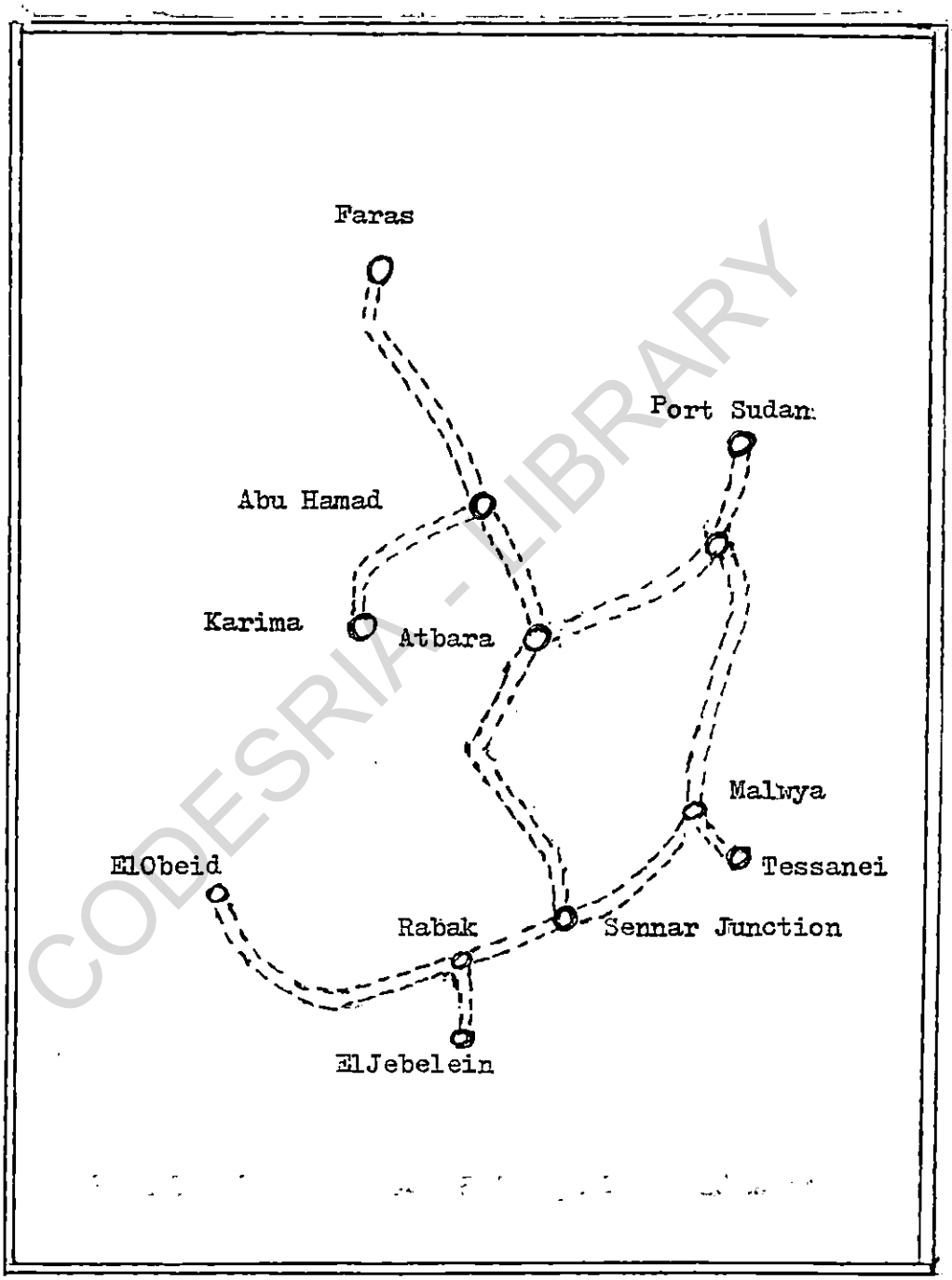
During the ten years before the outbreak of the Second World War, in 1939, the inland transport system of the south was greatly developed, but that of the north remained so primitive that it could scarcely be said to exist. No attempt was made to extend the railways until after the outbreak of the war, but three short branches were constructed in the early fourties, Wadi Halfa - Faras, Malwiya - Tessenei and Rabak - Jebelein. (See Fig.No.5-2)

The foregoing account has shown that "the surface communications of the Sudan have developed surprisingly little during the last twenty years (1929 – 1949); the contrast with the achievements of the first thirty years of this century is remarkable. It is also disconcerting for it can hardly be seriously maintained that the present (1949) system has reached a state of perfection which admits of no extension." The fact that it stood up very well to the strain of the recent war should not be allowed to obscure the noless important fact that serious weaknesses then became obvious. Of these, the most outstanding were the inadequate links with Egypt, Uganda and Eritrea, and the lack of any but the most primitive lines of communications with Ethiopia, the Congo (Zaire) and the equatcrial Africa. Even internal links were often dangerously weak; thus to supply the airfields of Darfur with petrol became a major undertaking instead of a simple routine operation, and the lack of any reliable road from Khartoum to any of the Sudanese towns, is a serious inconvenience." [15]

To sum up the period 1899 – 1955, it shows that the colonial regime had made every possible means to exploite Sudan's natural resources. Rail and river transport were the most suitable systems to achieve the colonial goals.

Since it was argued that "the function of transport is to create a possible market for the produce [16], and that "The growth of external trade also resulted in the gradual development of an internal system of transport to enable the collection of the export products from the various parts of the country ... had a very unifying effect ... under one independent political system [17]. Thus, it is clear that both Sudan Railways and River Transport, together with other telecommunication systems, were primarily developed to link Sudan with Britain through the process of "international capitalist market economy. This point is

Fig. No. 5-2: Railways Used In Sudan By World War 2



very important especially when discussing the socio-economic appraisal of River Transport as a separate mode of transport in Sudan.

During the same period Sudan Railways administration was able to manage the following activities; rail, river, air, seaport, hotels and survey in the country as a whole[18]

In the year 1973 each of these activities has been developed to separate public corporations. The reasons for this were:

i) To facilitate foreign credits, grants and aids. This is because the international donors cannot lend money to government departments. So, each activity was given a legal character, separate entity and has been considered as a self–financing public corporation.

ii) Each unit was established according to a legal Act signed by the head of the republic. The Establishment Act, of each of these public corporations, gives the Boards of Directors, free hand in planning, seeking local and foreign finance and to run the business on commercial basis;

iii) River Transport Corporation was given full monopoly to assemble, operate and supervise all river activities. Thus, RTC was the sole national carrier for river transportation. Besides, Sudan Railways Corporation was the main carrier of exports and imports while Sudan shipping line was the only national Sea carrier

iv) Each Public Corporation was considered as specialized in its field of activity.

v) When they were affiliated to one department they had unified Trade Union Organizations. The new set up, followed later by a labour decree, necessitated that each corporation had to have its own trade unions' associations. An aspect that had affected the solidarity of the labour movement.

5-3: Assessment of Networks' Performance.

Tramway:

The tramway service in Greater Khartoum stopped early in 1960s. It used to connect Khartoum town with Omdurman through the White Nile Bridge. It started from Khartoum to Omdurman Central

Stations. It also linked Omdurman with Khartoum North via Abu Rouf – Shambat ferryboat.

Late in the 1970s and early in 1990s, the traffic congestion in addition to the economic crisis, had led the government to reconsider the tramway experience. During both eras, serious efforts were planned to make use of Sudan Railways, River Transport Corporation and the privately owned saloon vehicles in releasing transport congestion in the capital town. Soon after the problem was solved, such efforts were forgotten.

This service was characterised by cheapness, regularity and continuity. No reasons were given for stopping it.

Telecommunications:

As was shown earlier in this work Sudatel is anewly-established company as a joint-venture between Sudan Government and private individual foreign and local firms [19]. The introduction of modern technology in this field has resulted in considerable developments in fields of both domestic and international calls through telephone, telex, fax, etc. Sudan is linked through satellite services, with some other countries. Television and Radio Broadcasting Services have shown considerable increases in the length of its coverage areas compared with the level of services in 1978/1979, 1987/1988, and 1997/1998. Post and Telegraph Services have increased as well.

Pipeline:

The pipeline started operations in Sept. 1977 [20]. It was designed to transport imported gasoline, gasoil and kerosene from Port Sudan to Khartoum. However, during the first years of operation, and due to certain technical reasons, only gasoil was pumped. Later kerosene followed, while transportation of gasoline started from 1990/1991 [21]. Compared with its designed capacity, the performance of this pipeline is less than 40% [22]. The quantity pumped during 1992/1993 declined by 13%, compared to 1991/1992, level. This was mainly due to programmed stoppage, technical problems and non–availability of products [23]. The total length of the pipeline is 815 km. The total designed capacity is supposed to reach one million metric tonnes at its third phase, which is not yet errected. The capacity now is only 0.8 Million tons [24].

Compared to 0.65 metric tonnes per year in 1979. It is an 8" diameter pipeline" [25]. Recently, it has been readjusted, to pump on the opposite direction i .e from Khartoum to Port Sudan, to carry Sudan's exported petroleum products.

In June 1999, another pipeline started pumping crude oil from the fields in the South. It passes to Elobeid and Khartoum refineries. It is basically constructed to export Sudan oil via El bashair Port on the Red Sea. The total length of this pipeline is 1610 km.

Belt – Conveyers:

This system of transport is found mainly at Atbara Cement Factory for transporting cement stones across the Nile River to the manufacturing plant. It is used, in some industries, as internal transport means.

Airlines and Air Ports:

The civil Aviation Department is a public unit responsible for airports construction, operation and the provision of services for domestic and international flights. It issues licences for both craft and pilots.

In the mean time the country has four international airports, i.e. Khartoum, Port Sudan, Kassala and Elobeid. In addition to other 16 air ports and 47 landings that provide air services to different regions of the country. Generally, the poor port facilities are the main reasons for poor air services in Sudan [26].

The total number of aircrafts working in Sudan is estimated to be 44 according to the National Transport Plan. The Economic Review 1996, shows that Sudan Airways owns 14 air crafts, where in the above mentioned plan it is only 12. (See table 5-2).

After the year 1992, a free – entry policy was issued by the Government and as a consequence some private companies have joined Sudan Airways in the transportation of goods and passengers.

The "Economic Review 1996", argues for the decline in air services, to the international sanctions imposed on Sudan Government, in 1996. Nevertheless, the general, trend in tonnes and passenger transported, is increasing (See Table 5-3).

Demand for air transport is increasing, as the whole life in Sudan due to the natural progress in humanity since the country is so vast. "Because of lack of other reliable means of surface communication over vast areas of the Sudan, air transport has a crucial role to play in the country. The domestic air transport system connects 17 towns with Khartoum, the central point of the system, through which most connections are made. Ground facilities and runway conditions are minimal. Only Khartoum, Port Sudan and Elobeid have right landing facilities" as argued by El Sheriff and Babiker [27].

Table No. 5-2: Air Transport Companies in Sudan:

Company	Activity	Crafts
Sudan Airways	Cargo /pass	12
Azza "	Cargo / pass	03
Fedral "	Passengers	03
Trans Arbian	Cargo	02
West Airlines	Cargo / pass.	02
Sudan Transport	Cargo	02
Farinas		02
I.B.k and Butra	Cargo	01
Rick Airlines	Cargo	01
Transcontinental		07
Nile Safary		07
Dinder Airlines		01
Atico Airlines		01
Total		44

Source: National Transport Plan, 1995.

Table No. 5-3: Air Transportation Passengers and Cargo hauled (1970–1999) in (000):

Period	Tonnes	Passengers
19970/1971-1974/1975	3.2	194
1975/1976-1979/1980	6.4	413
1980/1981-1984/1985	3.4	452
1985/1986-1989/1990	4.6	515
1990/1991-1994/1995	4.2	588
1995/1996-1999/2000		

Source: National Transport Plan, 1995.

The domestic relative modal share of air transport is calculated at 0.24%, ton/miles and %38.34 revenue up to 1988, while the performance can be computed as follows [28] : -

Table No. 5-4: The Relative Modal Share of Air Transport:

Period	Pass (000)	Pass/Km (mil)	Ton	Ton/Km (mil)
1982-1983	409	4.3%	5	0.05%
1984-1985	451	4.1%	3	0.07%
1987-1988	570	2.5%	3	0.24%
1993-1994	590	(2.6%)	4	(0.3%)

Source: Reader for Transport and Communication Economics.

Roads and road Transport:

Up to the mid of the 1960s, there was no constructed road in Sudan connecting any two towns together. This is so, because road construction had no priority in the colonial policy. The national efforts, public and private, took this responsibility with some foreign donors and companies.

Khartoum Wad Medani road was the first success, which was opened early in 1970s. It has been extended to Gedaref, Kassala and finally it reached Port Sudan in 1980. At another stage this road was extended southward to Sennar – Rabak and Sennar – Damazine.

Recently, many roads have been constructed connecting many regions in Sudan. The total length of all completely constructed roads is about 2845km. While those under construction are estimated at 2325 Km. Gravel roads are of 3431 Km most of which are found in Southern Sudan. On the other hand, earth surface roads constitute the longest length in the country, 9800 Km. (See Table No. 5-5).

The topography of the country affects these surface roads. In the north, where the desert and semi – desert zones prevail, earth roads can be used easily during winter rather than during summer times. In many of the central parts of the country, during the rainy season, rain, floods and heavy soil composition make road transport impossible. [29]

Plans are drawn to link Sudan with other neighboring countries as Egypt, Uganda, Chad, Ethiopia, Eritrea and Central

Africa Republic, but lack of finance constitutes an obstacle in materializing these plans.

Table No. 5-5: The Highway Network in Sudan (km):

Surface type	National	Second ary	Feeder	All
Bitumen completed	02388	0225	0232	02845
Bitumen Underway	02032	0000	0293	02325
Gravel	03186	0203	0042	03431
Earth	04636	3814	1350	09800
Total	12242	4242	1917	18406

Source: 1. Reader For, Transport and Communication Economics Khartoum, 1990
2. The National Transport Plan, Khartoum 1995.

A general remark should be stated here, which is why most of the constructed roads, if not all of them, run parallel to the existing rail tracks? The answer for this is that "Road transport was basically oriented to feed railway heads, but when the railway failed to meet the increasing transport demand particularly at the peak demand, efforts were extended to expand road network" [30]. This argument seems not to be true and it was a misguided conception towards the economic and political presence of Sudan Railways, especially during the second half of the 1970s. It is not true because of the following reasons:

a) The railway heads are at Wadi Halfa, Karima, Elobeid, Damazine, Wau and Nyala towns. Of course there is no road originating or ending at any of these towns with the aim of connecting its hinterlands with the railway head.
b) Problems of the peak demand time were never considered because of the inadequacy of Sudan Railways. It was rather for storage capabilities of the Seaports as well as for general economic crisis facing the country then.
c) The extension and expansion of road network were due to the political pressures made against the government and not to the interests of the national economy.

For the benefit of the national economy, this study argues for the provision of government expenditure for paved roads to act as true feeders for national transport agencies. Such as railways and river transport so as to minimize the carriage costs. Paved roads, on the

other hand, should be allocated for passengers use only and not to the transport of heavy–low-valued commodities. This is because of the high social and economic costs that arise when using road transport by trucks.

As has been discussed before, the Government provided the major transport infrastructure. Early in 1920, British companies introduced private automobiles. Since then taxies and buses were privately owned and operated. After the Second World War trucks were introduced in limited numbers, by British and Sudanese individuals [31]. During the same period, or may be a bit earlier, Sudan Government had established the Mechanical Transport Department to cater for the import, maintenance and supply of spare parts for government cars and trucks. Government buses worked as feeders to river transport at Dongola and Juba towns, as well as feeders to Sudan Railways.

The following table (No. 5-6) shows the ownership, number and the loading capacity of trucks found in Sudan [32].

Table No. 5-6: Ownership, Number and Loading Capacity of trucks:

Owners	15-25 Tons	30-40 Tons	50-60 Tons	70-80 Tons	Total
Companies	315	1197	216	65	1793
Individuals	574	1884	-	-	2458
Government	602	0206	-	-	0808
Total	1419	3287	216	65	5059

Source: National Transport Plan, 1995.

The above table shows that big companies own 1793, trucks out of these 1197, are of 30-40 tonnes loading capacity. They also own trucks with higher capacities. On the other hand, the government, excluding the arm forces, owns 808 trucks, 75% of which are of low carrying capacity not exceeding 25 tonnes. While the private individuals own about 49% out of the total trucks found in the country. The total number of trucks with loading capacity of 30-40 tonnes is estimated to be 3287, which is 65% out the total number of trucks found in the country.

During the second half of October 1999, the Mechanical Transport Department was dissolved.

The following table shows the tonnes and passengers carried by highway trucks and buses during the period 1970/1971 – 1994/1995[33]

For more details see the modal transport share as presented in Annex No.-8

Table No. 5-7: Highway Passenger & Goods Traffic (1970-1995):

Period	Tonns in (000)	Passengers in (000)
1970-71 / 1974-75	1296	15652
1975-76 / 1979-80	2457	19658
1980-81 / 1984-85	3809	24024
1985-86 / 1989-90	4903	25400
1990-91 / 1994-95	4450	26700

Source: National Transport Plan, 1995

It is clear, that both tonnes and passengers carried by road transport are increasing in number. The tonnes have increased by 343% while the passengers' increase is about 171% for the years 1970/71 and 1994/95.

Inspite of the difficult road conditions and the high transport cost, road transport has gradually developed to become the predominant mode of transport in Sudan. The Government has undertaken various measures to promote road transport. "Among these measures, were the expansion of paved road network, and the provision of various concessions to encourage investment in this sector" [34].

Nevertheless, it is known that economic theory postulates that the supply of a commodity is a function of price, the prices of other goods and services, the prices of factors of production, the state of technology, etc. this results in an up – ward sloping function relating to the price of the commodity to the quantity supplied (Other things remain equal). A more advanced analysis can be pursued; part of it incorporates the theory of costs. Transport economics represents a somewhat specialized application of cost theory [35]. Hence, the actual amount of transport supplied (offered) at any price level will, however, be heavily influenced by the cost involved. Now, we have to look at the various costs associated with supplying transport services

and in particular in the relationships between the resources required to provide these services and the type of output finally consumed by passengers and freight consignors. For road transport we can find the following costs: [36].

1. Variability over time, i.e. the physical life – span of motor vehicles is less durable. Since costs are variable in the long run, the cars costs become variable over a period of only five years.
2. Road vehicles tend to have less chances in economies of scale since it can not be grouped according to specific fleet types an aspect that hinders economies in maintenance, standardization and crew scheduling.
3. The unit of demand measurement for bus services is the passenger /km, however, the minimum unit in which supply can be carried is the bus/km. Any bus has a limited seat capacity hence, the opportunity cost of carrying additional passengers is equal to zero. This means that, as very few costs would be avoided if one fewer passenger traveled almost all the costs of running the service are joint costs of all passengers using it.
4. On the other hand, there are specific costs of using and providing roads; such cost can either be fixed or variable. These are private users public and social costs.
5. The private users costs: These include fuel oil, lubricants, tyres, repair and maintenance, interest charges and the cost of crew operating the vehicle. The economic cost of vehicle includes the local cost component other than customs and duties. The total financial and economic costs per 1000 km of vehicle operating on paved road are calculated on a different assumption of those operating on earth tracks. In general, the rougher the road, the higher the vehicle operating cost. The speed is also a function of the road condition, the better the surface the faster the speed and the lower vehicle cost. Lower speed would be associated with higher running costs and affects the fixed cost component through prolonged journey time and reduces vehicle utilization.
6. The public costs are those types of costs that fall upon central and local governments and are closely related to the road system such as construction of new roads or upgrading of existing roads, strengthening or rehabilitation of paved roads, routine and periodic maintenance.

A Pavement Evaluation Study [37] has been carried out during the second half of the 1980s. It argues "an extremely high axle loads of the vehicle presently using the roads when over loaded may each reach to about 40 times its standard axle load. The consultants have called for the urgent need for the strengthening and rehabilitation of many road sections and the immediate enforcement of axle load restrictions, as much measure will automatically reduce the rapid deterioration. The routine maintenance requirements depend on the volume of traffic, remoteness of the availability of raw material to the site and the nature of the terrain. The routine maintenance includes cleaning and repairing of structure earthing and making up of shoulders, which is more or less a daily work. The patching by repairing pot holes, resealing of the cracked sections, repairing and reprinting of traffic signs which could be carried out at least annually in order to preserve the road in adequate conditions.

6. The social costs affect the whole community through noise, congestion, air pollution, fumes and accidents. The congestion cost compromises the value of delayed time and the additional vehicle imposes on other motorists when it decides to take a journey. Such costs will vary with road and traffic conditions as well as the type of vehicle. In Sudan, the level of congestion is minimal outside urban settings, the Khartoum – Wad Meani road is some what congested, cities in Sudan have not reached a size where motorization level is high enough to cause serious congestion by international standards.

The intercity traffic police costs. In 1985/86 some studies indicated that severe deterioration in the surface of all paved networks in Sudan were caused by extremely high axle loads of the vehicles using the road. To improve the axle load restrictions enforcement, and substantial support for the Intercity Traffic Management is needed in the form of additional manpower, training, procurement of modern traffic management equipment, besides the replacement and supply of specific vehicles with communication facilities.

The administration costs of roads take place on three different levels, district, province and headquarters. Those at district level are to be included in the maintenance cost estimates. The other two components of costs are to be estimated separately.

Road traffic has definite impact on environment. It causes two types of environmental disturbances, namely, noise and air pollution. Air pollution can take place as a result of fumes, dust, petroleum residues, ignition smoke, etc.

Accident costs include cost of property loss, loss of production, grief pain, hospitalization and administrative cost. If the road tolls are to influence the consumer behoviour, road users, it should, consider the possibility of charging the user with the expected accident costs i.e. the probability that an accident will occur multiplied by the cost of the accident if it actually occurs. The number of accidents in Sudan is the function of traffic, the deterioration in road conditions and the availability of animals crossing the road.

Sea Ports and Sudan Shipping Line:

Prior the year 1973, the Sea Ports was a department in Sudan Railways Department. It is now a full self-financing public corporation. The port handling capacity was about 2 million tons in 1973 it increased to about 3 million tons during late the 1970s, and to 5 million since 1985(See the Table 5-8). The increase in Port Sudan handling capacity was an economic and political necessity. During the 1970s, Sudan had political instability due to the economic crisis that faced the country. The military government, by then, was so aggressive politically. It tried to reach a national settlement with the political parties, which were dissolved in 1969, who were in opposition with the rulling military. In 1976 an agreement was concluded between the Government and specific political parties. So, the new government coalition sought the economic crisis hence, the low port handling capacity and the poor storage were considered as the main reasons for port congestion, and the transport bottlenecks. This had led to establish many policies and measures that can help in solving the transport problem. Some transport means; as railway and river, were considered unreliable and inadequate to solve Sudan economic problems.

In 1992, a new port was built at Suakin. It is intended to shift passenger and animal traffic to this port. Before this date, an expansion and modernisation efforts were undertaken to increase and improve the handling capacity of Port Sudan. Berths were enlarged, hadling equipment improved, a container jet was made in addition to many warehousing and storage facilities had been constructed. In June 1999, El bashair seaport was officially inaugurated to export Sudan's crude oil.

Table No. 5-8: Port Sudan Handling Capacity (000 tonnes):

Period	Export	Import	Mean Average
1965 – 1968	0889	1504	2393
1968 – 1971	1015	1699	2714
1971 – 1974	1112	1970	3082
1974 – 1977	1175	2344	3519
1977 – 1980	1147	2619	3766
1982 – 1985	0627	4042	4669
1985 – 1988	0871	4570	5441
1988 – 1991	0618	4391	5072
1991 – 1994	1029	4079	5108
1994 – 1999	0117	0098	0215

Source:
1. **Transport Statistical Bulletin 1980**
2. **National Transport Plan 1995**
3. **Economic Review 1996.**

Sudan Shipping Line Company owns ten cargo ships and one livestock ship. The majority of these ships are of twenty years age. (See Table No. 5-9).

During the year 1993, the Sudan Shipping Line Company had contributed 29% of Sudan's exports, and 32% of the imports. These ratios had increased in the next year, the Company transported 40% of the exports and 51% of the imports.

The Company's participation in Sudan's foreign trade transportation is poor because of the following reasons:

a) High degree of international transport competition.
b) The private companies are not obliged to transport on the Company's fleet. So, the Company transports only the Government shipments.
c) Foreign aid donors prefer to transport on their own home fleet.

Table No. 5-9: Sudan Shipping Line Fleet:

Assembly Date	No. of Units	Total capacity (ton)
April 1964	1	00833
July. 1973	1	05665
Sept.1979	2	19382
Nov. 1979	2	19382
Dec. 1979	2	18831
Jan. 1980	1	10066
April. 1980	1	09140
July. 1995	1	06000

Source: National Transport Plan, 1995

Sudan Railways:

Table No. 5-10: shows a mean average of five years, of Sudan Railways performance for the last thirty years. It is known that the main function of railways is the movement of freight and passengers, over long distance between Port Sudan and other production and population centres. The railway until very recently has been the major carrier in Sudan.

But due to specific reasons, to be discussed soon, its performance has shown a declining trend in both freight and passenger traffic. For example the tonnes carried during the periods ending in 1975, 1985 and 1995, was 2.96 million 1.44 million and 1.1 million,for the above periods, respectively. While the number of passengers transported during the same periods were as follows 3.2 million, 2.1 million and 0.6 million respectively.

Table No. 5-10: Sudan Railways Performance; Mean Average of Freight and Passengers For the Period 1970-1996(In Million):

Period	Tonnes	Passengers
1970-71 / 1974-75	2.96	3.2
1975-76 / 1979-80	2.40	2.8
1980-81 / 1984-85	1.44	2.1
1985-86 / 1989-90	0.70	1.1
1990-91 / 1994-94	1.10	0.6
1995 – 1996	2.10	0.3

The above table has been computed from diffevent primary and secondary sources of information prepared by some government agencies such as the Ministry of Finance, Economic Planning and the Ministry of Transport. As well as that material prepared and analysed

by Sudan Railways administration, and a reference called: "Reader for the course on Transport and Communication Economics" prepared by Abulla El sheriff and Mustafa Babiker, 1990 University of Khartoum. In addition to other documents as; Transport Statistical Bulletin 1979/1980 and 1991 – 1993, the National Comprehensive Strategy, 1991, the National Comprehensive Transport Plan, 1995 and the Economic Review 1996.

El sheriff and Babiker, recall the argument provided by some government officials, for reasoning the decline in rail performance for the following factors.

1. The increasing competition from road transport.
2. The deteriorating and the poor conditions of the rail track, signaling and telecommunication system.
3. The lack of adequate spare parts for the rolling stock and the locomotive.
4. The deficient operating and pricing policies.
5. The lack of management skills and the inability to innovate in the face of road competition.

The reasons presented by Sudan Railways, are as follows: [38]

1. Little attention (at governmental levels) is paid to the issues of competition and substitution among transport modes.

   "Each transport mode has certain inherent technical superiorities, which no other transport mode can provide satisfactorily. These superiorities, when displayed effectively in terms of cost advantages, make the particular transport relatively unique in performing this technical operation. If every transport mode is made to reflect its technical superiority in terms of cost advantages, and pricing schemes, then the rational choice of transport users is bound to result in a minimum transport cost bill".

   In Sudan, this is not the case, since the competition between rail and road is unfair due to the fact that the latter enjoys so many benefits and they do not pay for the use of the infrastructure.
2. "Before the year 1972/1973 the flow of spare parts was not a problem, because every shortage in spare parts at that time, was completed immediately" After the above date the position was reversed. It appears that the value of spare parts was not coping with the actual demand for the following reasons.

a) The value of US. $ 1 increased from 35 piasters in 1972/1973 to 133 piasters in 1982/1983 and to L.S. 2850 in Oct 1999 [39].(See Annex No.2)
b) Escalation of price in 1974 and the increase in inflation, which followed afterwards, and
c) The increase of number of locomotives and its varying sources of manufacture together with increase in age of those existing with the lapse of time. Moreover, if we consider the present worth of money we find that the actual value of spare parts in store in 1972/73 is very higher in realistic terms than that in 1982/1983 notwithstanding higher amounts in 1982/1983 and in 1999.

3. The relationship between Sudan Railways and the Ministry of Finance in many cases, was to refuse increase in tariff structures, and it imposes special rates for the "Exception of commodities" to be carried at charges below the marginal operation cost determined by the railways. In addition to the higher interest rates imposed by the government on foreign loans allocated for Sudan Railways, than those paid by the government to foreign donors. [40]
4. "The lack of management skills and the inability to innovate." Such an argument seems to be just a sophistication of those who do not know how transport modes operate as well as ignoring a great deal of Sudan economy.
5. Complete stoppage of external finance especially from UN agencies and other bilateral agreements, which resulted in the absence of foreign assistance.
6. Absence of just and qualified planning of the transport sector in general. The following factors which are of planning or a procedural nature have contributed to the deteriorating performance of Sudan Railways: -
    a) Concentration of the development plans of Sudan Railways Corporation on capital investment rather than on rehabilitation programmes.
    b) Lack of co-ordination between different sectors of the economy at the time of drawing national development plans and full negligence of the transport cost in other sector's plans.

c) The non-existence of reliable and up–to–date information from traffic generation sectors hampers the railway to draw its anticipated future traffic demand. The general practice is a deviation from targets set especially in the agricultural sector, which normally leads to distortion in railways plans meant to satisfy future traffic demand.
d) Physical implementation of development plans is usually hit by factors beyond the corporation's control. This affects the set targets ie operational efficiency targets as the standards for wagon turn round time average haul, average load per wagon. In addition to physical targets in terms of ton/km, and passenger/km, which the corporation aims to achieve while the plan period, had been projected as well. The attainment of both efficiency and physical targets were spelled out on the basis of implementing the railway plan with specified time schedule. This means that every deviation from the set time schedule will have direct effect on the general targets.
e) Absence of a long term strategy for the development of the transport sector. This leads to a non – optimal allocation of available funds among different transport modes as reflected by their cost advantages.

The following lines concentrate on the position of the running stock, of Sudan Railways, for the periods; 1963/1964, 1973/1974, 1983/1984 and 1993/1994. (See table No 5 – 11).

It is clear from the above table that the railways available running stock is deteriorating in 1999 when compared to 1972/1973. Although the absolute number of locomotives and wagons have increased the number available for operation decreased tremendously. The main line diesel locomotives in stock, at present time, have increased by 105% but the available number constitutes only 36.5%.

It is clear that the non–availability and inefficiency of locomotives was caused by the continuous lack of the necessary spare parts an aspect that shall result in the low level of transported tonnage.

The turn round time of wagons has also shown similar increase. It was only 9.8 days in 1973/1974 compared to 24 days in 1993/1994.

Table No 5-11: Sudan Railways Running Inventory:

Description	1963/1964		1973/1974		1983/1984		1993/1994	
	Stock	Available	Stock	Available	Stock	Available	Stock	Available
Main Line Loco								
Diesel	0072	0058	0103	0046	0165	0073	0148	0054
Steam	0112	0096	0096	0058	0089	0016	-	-
Shunting								
Diesel	0038	0038	0059	0031	0076	0028	-	-
Steam	0055	0050	0031	0031	0010	0060	-	-
Wagons	4089	3798	4613	4470	5316	3190	5187	3355
Coaches	0342	0324	0402	0393	0507	0497	0296	0281
Turn-round (days)	9.8		15.6		35.7		24	

Source:

1. **Transport Statistical Bulletin 1979 – 1980**
2. **National Comprehensive Strategy, 1991**
3. **National Comprehensive Transport Plan, 1995**

Table No. 5-12: The Modal Share in Transporting Sudan's Exports and Imports (Average in (000) ton.) :

Description	Port Sudan		Shipp Line		Road Trans		Railways	
	Exports	Import	Exports	Import	Exports	Import	Exports	Import
1960–1970	0918	1507	058	050	060	0060	N.A	N.A
1970–1980	1142	2287	127	105	413	0915	685	1370
1980–1990	0781	4307	115	124	487	2647	145	0616
1990-1994	0782	4254	114	297	710	2942	284	0692

The above table shows the relative share of Sudan Shipping line, Railways, Port Sudan and Road Transport modes in moving exports and imports of the country. It shows the shift of imports transportation from rail to road.

The gasoil consumption during the last thirty years, shows that the share of both River and Railway transport has declined from 13.6% in 1970 to only 5.9% in 1980. Recent figures are not available. While the percentage consumption of road transport remained almost constant for the same period, 40.5% in 1970 and 41% in 1980. At the same time road transport consumes all quantities of the imported benzene. This point clarifies the assumption that road transport is much more expensive than river and rail transport. In addition to its unsuitability for heavy cargoes as has been shown earlier in this work.

To sum up this section we repeat that the role of transport in a large country like Sudan, depending entirely on agricultural exports, which remained the main source of national income and foreign exchange and with almost scattered population over a wide area, is of a paramount importance. This is because economic development in other sectors of the economy whether agricultural, industrial or commercial can only be achieved by having an efficient transport system functioning up to a given standard [41].

Generally, the transport sector received higher attention by the Government. In spite of this fact, the road system received the greatest share of investment in all development plans. Due to this, road users invested heavily in the purchase of trucks thereby utilizing the road system, which has been constructed and maintained by the government. As a result large number of trucks entered Sudan and put into service benefiting from the fact that government does not tax them.

On the other hand, the heavy investment in the construction of roads parallel to the railway was not followed by enough investment to rehabilitate the railway [42]. The outcome of that was the deterioration in the tonnage conveyed by the railways as mentioned before. This gloomy situation is due to the lack of an effective planning between the different modes in the transport sector. This in turn will levy heavy burden on the present and following generations due to the tremendous increase on both the price and consumption of petroleum products, the outcome of which will be an adverse effect on the standard of living.

In short, it can be argued that distance alone is not enough to achieve the desired goals in the absence of effective planning and policy – making measures supported by rules and regulations, and to organize the role to be played by every mode of transport.

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CHAPTER SIX

RIVER NAVIGATION IN THE WORLD

CHAPTER SIX

River Navigation In The World

In this chapter there is going to be a general description of inland water navigation as a mode of transport at the international level. Generally speaking, a mode of transport consists of ways, means and terminals. Thus, we can speak of airways, rail tracks, roads and water channels as examples of some of the known transport ways. Similarly, we can speak of aircrafts, trains, cars and water vessels as examples of the means of transport, as well as airports, railway stations, buss stops and river and seaports as terminals. Our stress here is on the inland water navigable channels at the global level, and to focus on the importance of the Nile River in this regard. (See Map No. 6-1).

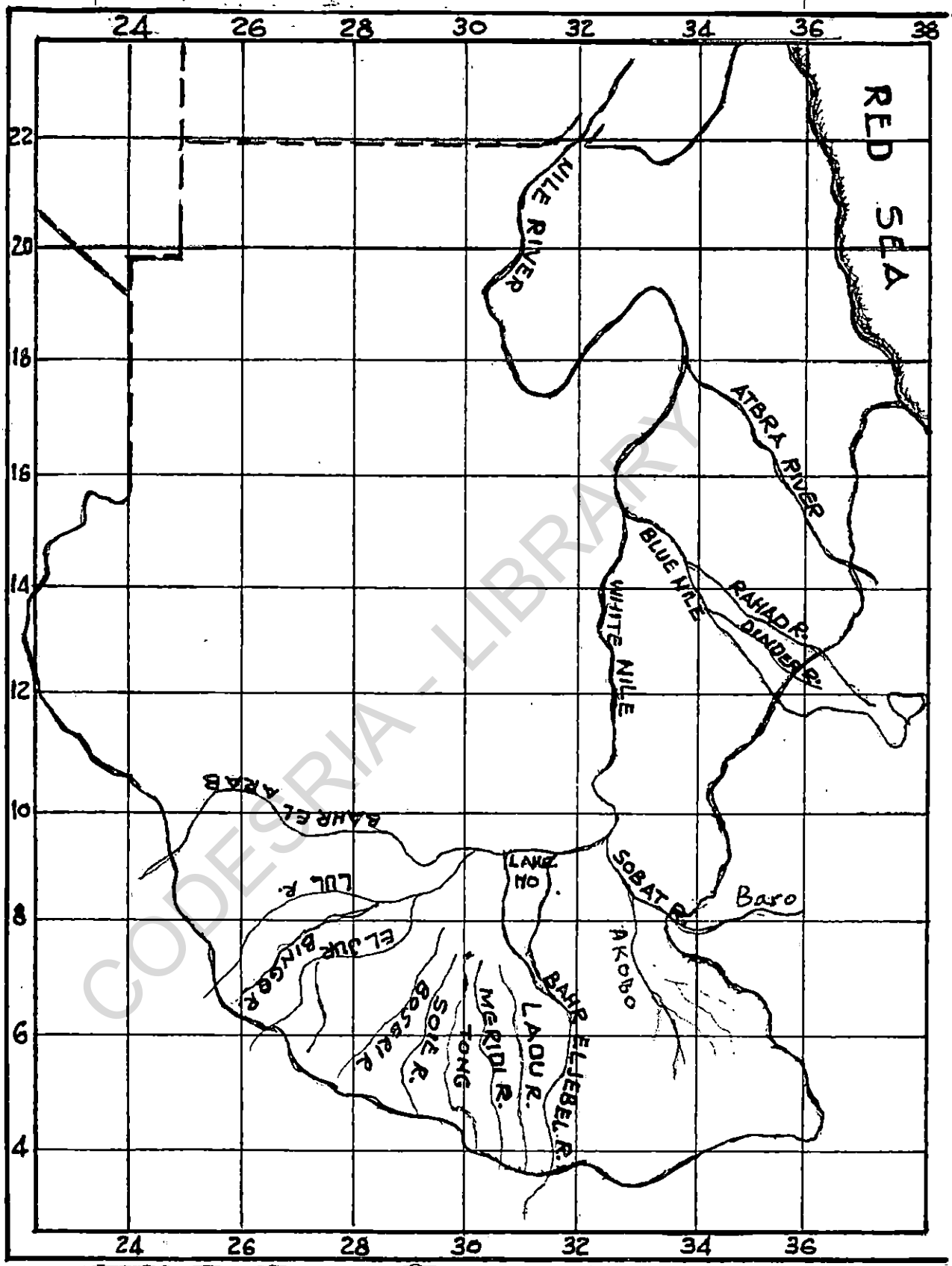
As a mode of transport, inland water navigation in every country is composed of rivers, lakes and/or navigable canals. The most important water channels in the world are those navigable rivers. The use of water surface by man since long times ago had marked the beginning of river transport as a very important human activity. Thus, river transport is one of the old means of transportation known in human history.

The history of many nations shows that almost all human civilizations had been established where rivers run. In Sudan, this is true as the history of the country shows; this is the same as the Egyptian's, which is found around the Nile River

The Chinese civilization has centred on the Huang He River, the Indian's on the Ganges, the Babylonia on the Euphrates. [1]

Rivers have other important uses for human beings as the basic source for drinking water, fishing, irrigation, energy generation and as a national defense corridor. In transport, it is used to facilitate long haulage transportation for goods and passengers as well as providing links across riverbanks. Water is considered as a natural gift, while some economists consider it as a commodity [2]. On the other hand, rivers have played important roles in communicating nations in different social aspects. For example the Russians could not have reached the European plains without the use of the different rivers like the Volga and its various tributaries. The French had used Saint Lawrence River to conquer North America. Meanwhile, the Mississippi and its tributaries were

Map No. 6-1: The Nile River and Tributaries In Sudan



used to develop the central plains in the United States of America. The exploration of the African continent would be impossible if the different rivers were not put in use. [3]

The expansion in river transport in Europe, during the sixteenth century, took place when the demand for iron ore and cereals had increased sharply making full utilization of the Seine River. Further developments took place during the eighteenth century, after the Industrial Revolution, due to increase in demand for raw materials, and the transportation of produced goods, specially on the Rhine River. [4]

The picture of the international importance of inland water navigation is only possible for specific transport characteristics available in utilizing river transport. Among such characteristics is the low operational cost of river transport. This is because of the low motive power used in addition to the large amounts that can be carried through river navigation in comparison with other transport modes. [5] Rivers are considered as natural channels free off maintenance costs, thus, the annual running expenses are relatively low. In addition to that, the costs of safety and security are minimal in river transport handling and carriage operations. Thus, it is argued that river transport is the most appropriate means for transporting low – valued and heavy commodities as mining products, besides construction and building materials including timber, sand, iron and steel or rocks in some cases. [6]

There are negative features of river transport, namely these are; seasonality, slow-move and inelasticity. Many of the inland water sources all over the world have low and high water level times during every year. In most cases, this makes navigation easy during high water level times while specific difficulties arise during low water level times. Some rivers freeze during winter and flow during summer. Thus, the periods of time in which navigation is highly possible depends on the climatic conditions in which rivers are found. Such periods may be short in the tropical zones as well as in snowy areas. Controlling navigation possible for long periods of time necessitates current stability measures to be established on the concerned rivers an aspect, which is both economically and technically unattainable for many underdeveloped countries.

Slow movements may be attributed to natural conditions partially and in some instances to man-made obstacles. Natural hazards may result when the water level is low, presence of rocks,

suds, moving sands, sharp bends, and natural changes in channel's flow direction and finally, the presence of cataracts. Man-made obstacles may result where locks, weirs, dams and bridges are constructed upon a river. The outcome of these hazards is that river convoys spend more time than the usual one scheduled for transportation. This is due to the many stops and maneuvering operations made to avoid or to by-pass such hazards.

The third negative feature is the inelasticity of river transport. By this term it is meant that door-to-door river transportation is, in many cases, impossible. This means that feeder transport facilities are needed in these cases, so as to provide connections between the places of demand with the river harbour to the user's needed location. This shortcoming is always a problem, where competition with other transport modes exists. It depends on the distance and volume of commodity that is to be transported. [7]

6-1 Inland water Navigation as a mode of transport:

Inland water navigation, as a mode of transport, is composed of the following three components: -

a) The navigation channel or water surface,
b) The river harbour or berth
c) The crafts or river vessels.

6-I-1. The navigational channel:

The United Nations has defined the inland water navigation channels as "Water surfaces not connected to sea and it is used by river vessels of not less than fifty tones capacity". So, following this definition, we may find some lakes, canals and rivers, which are used as navigation channels in many countries in the world. The term "river route" is used to mean every stretch that is taken or planned as a way between two places.

Some writers [4] on international strategy [9] studies argue that the struggle for water shall be more acute during the twenty–first century an aspect, which is expected to use power to get it. [10] This is of course not the direct concern of this study, considering water as a strategic commodity but rather the costs, which are to be paid to make such channels navigable. These costs include the expenses made for dredging canals or improving navigation on a specific

river. The efforts undertaken to clean and open-up some river stretches and the provision of the needed draught to float a ship, are expensive. Other costs are also made to facilitate fast and secured navigation. The use of different navigation signals and aids is specially designed to increase the ship's speed and to make it run during all bad weather conditions and by night as well. Surely, such costs are highly expensive and in so many instances, in the underdeveloped countries, cannot be done without international help, due to the many economic difficulties facing these countries. In Sudan, we do need such helps to improve our infrastructure. (See Map No. 6-1) Thus, channel improvement goes directly into the fixed costs, because it will not be done every year. So, it will not be included in the annual budget. This means that there will be a limited impact on the running or current expenditure of river transport at the national level.

6-I-2. The Harbours:

This term, "harbour" means a place of shelter for ships, and when the term "berth" is used, it means every suitable place to land ships, while the term "port" shall mean a town with a harbour.

The river harbour is an important component in every mode of inland water transport. It is an establishment on a riverbank facilitated by numerous constructions to provide for the different cargo handling and passenger operations together with the technical provision of services to steamers. The harbour includes fixed and mobile equipment for loading and unloading of cargoes, such as cranes, forklifts belt-conveyers, e.t.c. Weighing, cargo storage and warehousing buildings are also constructed in a harbour in addition to passengers' rest houses. Slipways and dockyards are very important constructs to assemble river vessels, and workshops of different specializations are to be found in every harbour. Harbours are usually connected with other parts of the world through sufficient and adequate telecommunications means, which are using the different devices known in this field, also, it should be connected with other transport feeders, as roads, railways and in some cases airways [11]. The expenses, of all these constructions are obviously infrastructural costs i.e. fixed costs.

The location of harbours may be one of the following:

a) River-junction harbours;

Such harbours are found where two rivers join together. In Sudan, we can find Malakal, where the Sobat and the White Nile Rivers meet, and Khartoum North, where the Blue and White Nile Rivers make their confluence. In Europe, there is Mannheim, where the Rhine and Neckar Rivers join each other, and Duisburg, where the Rhine unites with the Ruhr River. In the United States of America there is Saint Louis, where the junction of the Mississippi and Missouri Rivers. In South America, Manaus is found at the confluence of the Amazon and Negro Rivers.

b) River-Sea Harbours:

These harbours are located where inland rivers discharge into seas. In Sudan, we do not have such a harbour but the Nile discharges into the Mediterranean Sea at Rashied and Dymiat Harbours in Egypt (See Map No. 6-2). In Australia, we find Victor where the Murray River flows into the Indian Ocean, while in Asia there is Guryeo harbour where the Oral discharges into the Caspian Sea.

c) River– Railway. Harbours;

In these types of locations, the two modes of transport, river and railway complement each other. This case may be as a result of ineconomic conditions that prohibit the extension of railways in the regions where rivers run. This situation is found at two locations in Sudan; at Kosti and Karima ports, the first connects Central Sudan with the Southern part of the country, while the second connects the farther Northern State. In Egypt we find a similar port at El Shellal, which connects Sudan with Egypt.

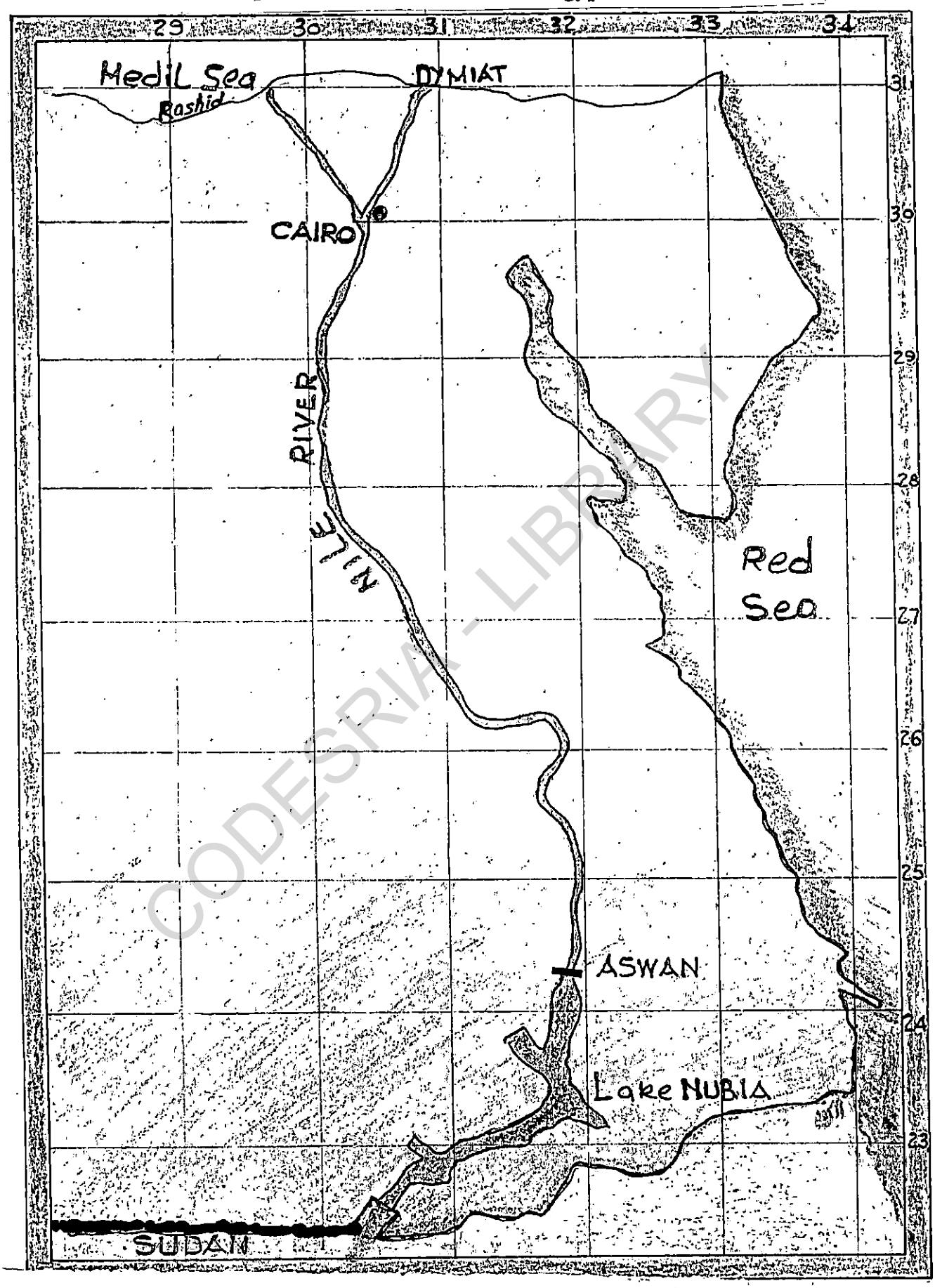
d) Regional Harbours:

These harbours are connecting two neighbouring countries together. In Sudan, there is Wadi Halfa harbour at the borders between Sudan and Egypt, and Juba port, which connects Sudan with Uganda.

e) Local Harbours;

These are the internal Harbours and berths that provide river transport services for both passenger and goods traffic. In Sudan, there are so many similar Harbours and berths especially if we consider the local Governments berths allocated for river-crossing ferries.

Map No. 6-2: The Nile River In Egypt



6-I-3. The River Crafts:

River crafts constitute the supply capacity of river or inland water transport system. River crafts are composed of different manufactured vessels and barges. In Sudan, we refer to passenger vessels as "passenger ships" and "river buses" while we refer to cargo vessels as "push tugs" and "steamers". Different barges are used in Sudan. There are different "dry" cargo barrages used in Sudan, oil barges, flat–top barges, passenger and self- propelled barges. Hence, the term "river crafts" means all ships, push – tugs i.e., it denotes both dump and autombile units, while the term vessel means a big ship [12].

The technical specifications of the crafts have been developed through man history. At the beginning, straw rafts were used and then hollow-roots of trees, as canoes, later these were developed by the addition of paddle and stern. Afterwards, the sails were introduced making use of the wind as a source of energy.

The increase in river transport demand had increased the rate of progress in the industry of river crafts. During the eighteenth century, the coal industrial equipment had been changed, through different technological advancements, into electrified river crafts. Consequently, the river drought had been increased an aspect, which has facilitated the introduction, into service, of big and fast river vessels and, resulted in the utilization of many rivers in the world.

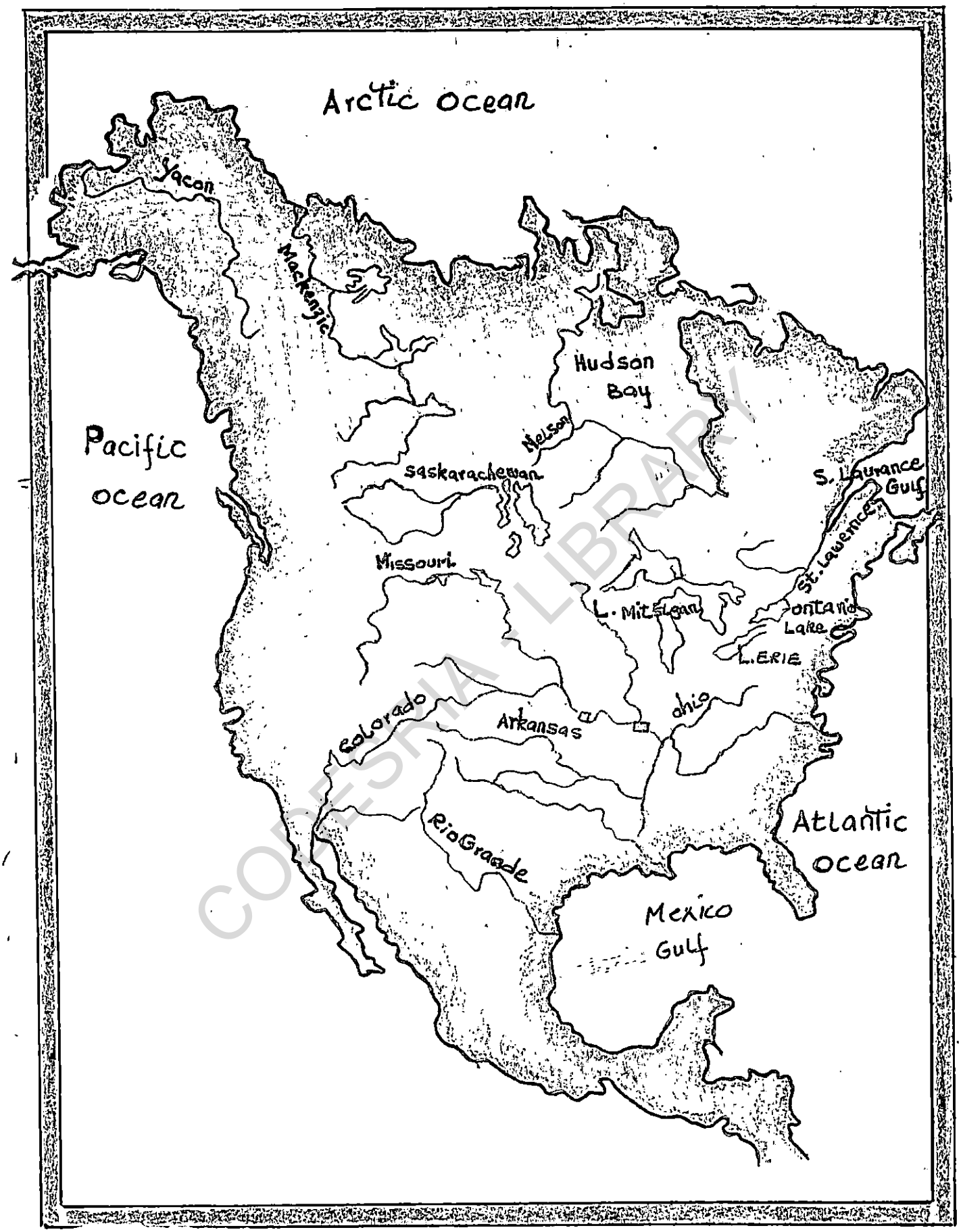
6-2 The World's Inland Waterways:

6-2-1: North America:

Rivers, lakes and gulfs constitute the main inland water surfaces in North America. Rivers are as follow; The Mackenzie with a total length of 4240 Km. The Missouri (3969 Km.). The Mississippi (3779 Km.). The St. Lawrence (3058 Km.). The Rio Grande (3030 Km.). The Yukon (3020 Km.). The Nelson – Saskatchewan (2750 Km.). The Arkansas (2330 Km.). The Colorado (2330 Km.). And the Yellow Stone (1080 Km.). The water depth in these rivers ranges between six to twelve feet in average. [13]. (Se map No. 6-3)

The famous gulfs are; the Mexico, the Hudson and the Baffin, while the lakes are; the Superior, the Mitchiyan, the Horn, the Erri and; the Ontario. In addition to these, there are also a number of man-made canals specially dug to connect some of these lakes so as to provide inland water transportation.[14]

Map No. 6-3: Rivers In North America



The important rivers for navigation are, the Mississippi-Missouri in a length of 6020 Km. And the St. Lawrence River.

The former had played a significant role in trade progress during the nineteenth century. The construction of rail tracks, toward the end of this century, had decreased the importance of river transportation but after the year 1920 it restored its position. At the present time, the Mississippi- Missouri route is very important in the transport of various heavy products for long distances. On the other hand, the St. Lawrence route (3058 Km.) and the lakes are very important ways of inland water transport that connect the central parts of the United States of America with the Atlantic Ocean. [15]

6-2-2 Water Ways In South America:

The running rivers in South America are; The Amazon with a total length of 6570 Km. Which is the second longest river in the world, the Parana River with a total length of 4500 Km. The Madeira (3240 Km.) The Sao Francisco (2780 Km.). The Orinoco (2060 Km.). The Negro (2000 Km.) and the Maranon (1609 Km.).[16] (See Map No. 6-4).

The most important rivers for navigation are the Amazon and its tributaries, the Parana and the Orinoco. The most important ports along the Amazon are Manaus and Iquitos. Cataracts on the Amazon are serious bottleneck to navigation as well as for population growth.

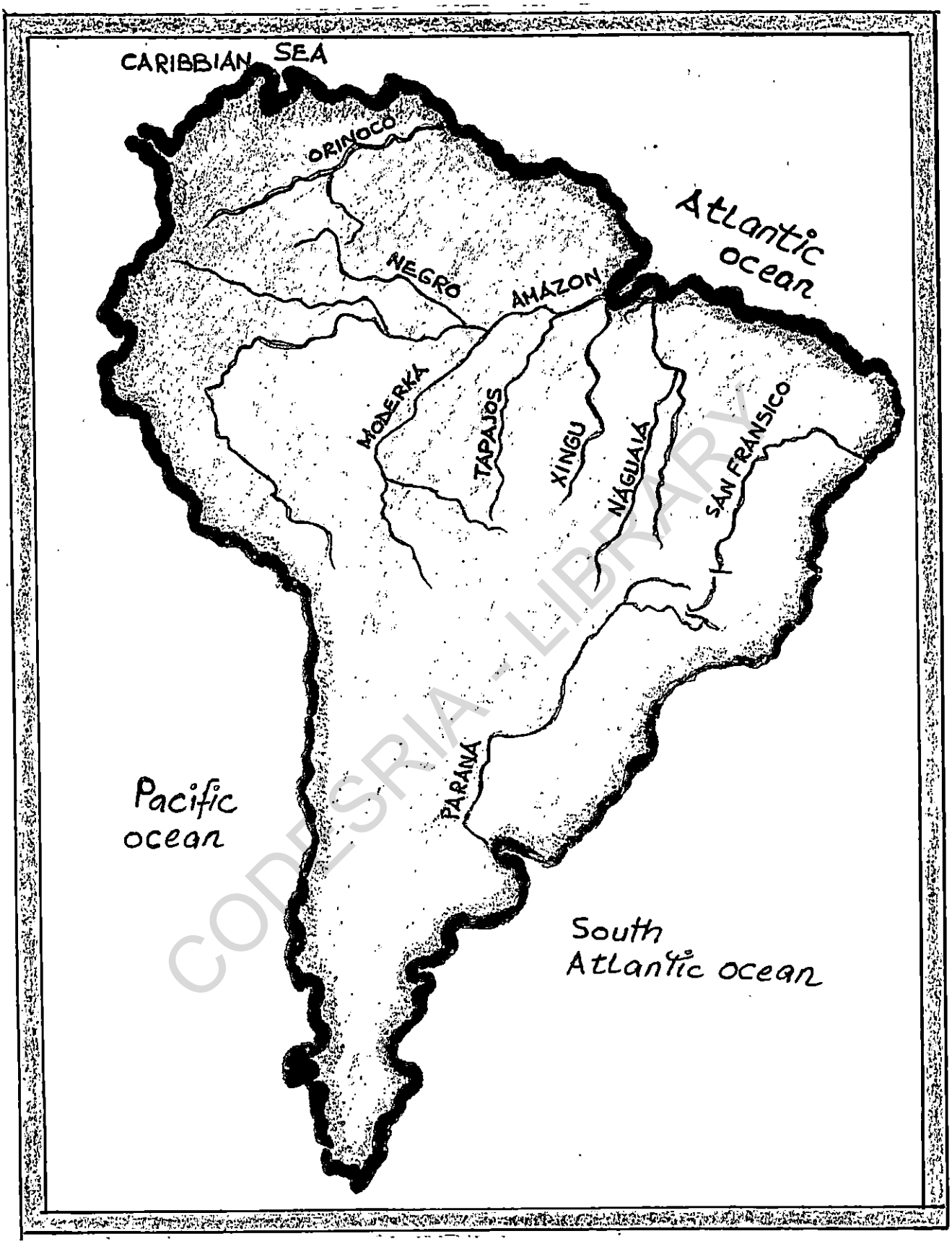
The Parana River and its tributaries are used in transporting local products within the continent. Rosario and Asuncion are the major ports on the Parana.

The Orinoco River is an important navigation route in Colombia. On it iron is exported for Venezuela using many roads and railways as feeders. [17]

6-2-3 Rivers and Canals in Europe:

The important rivers that run in Europe are; The Volga with a total length of 3688 Km. The Danube (2850 Km.). The Denper (2200 Km.). The Don (1870 Km.) The Pechora (1798 Km.). The Dnestr (1410 Km.). The Elbe (1159 Km.). The Vistula (1014 Km.).

Map No. 6-4: Rivers In South America



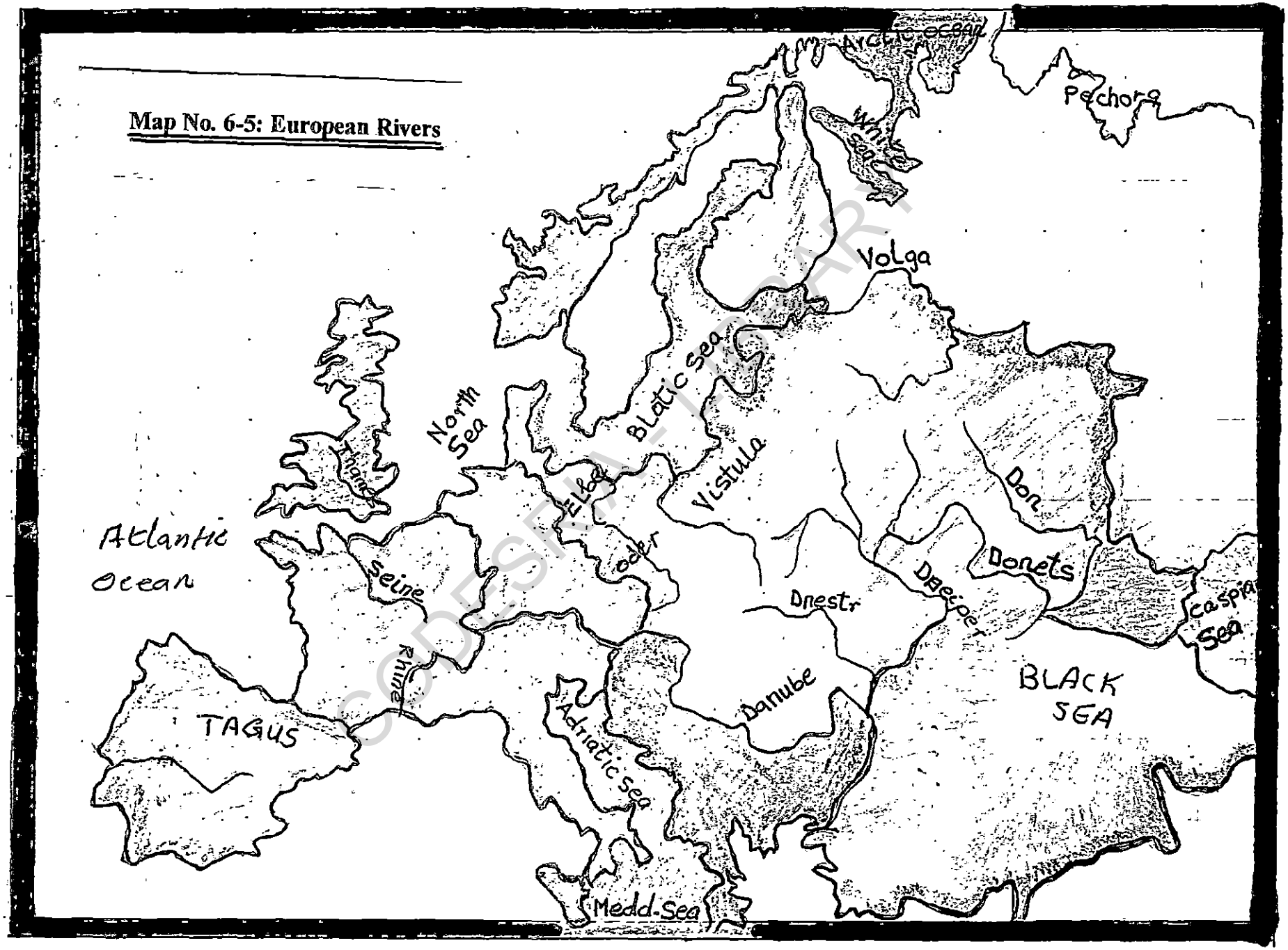
The Tagus (1006 Km.). The Oder (909 Km.). The Seine (761 Km.). The Thames (336 Km.). And liffey (80 Km.). [18] (See Map No. 6-5).

Looking at the map; we can see that these rivers run into different directions in Europe. They are, in many cases, connected through man-made canals to make navigation accessible to the Baltic Sea, the North Sea and the Atlantic Ocean. The Volga runs through the old U.S.S.R. the Vistula crosses Poland while the Rhine and the Elbe run into Germany. On the other hand, the Danube is an international inland water route, which connects eight European countries. All these rivers and the constructed canals are necessary ways of inland water navigation in Europe.

The Rhine, flows from Switzerland, is the most important navigable river after the Volga. The Germans have controlled the Volga River through dredging and the introduction of many systems of navigational aids. This river is navigable most of the time during the year and it has a considerable economic importance since the coal industry of the Rohr district depends largely on river transportation. [19]

The Seine River, one of the shortest rivers in the world, is the most important transport link in France. It connects the capital city, Paris, with the richest regions of the country as well as connecting France, Belgium, the Netherlands and Germany. Recently, efforts have been made to improve navigation conditions on the Seine through dredging and canalization. Big ships can navigate, from sea to river up to Rouen port, which is one of the important river Harbours that connects France with other European countries. [20].

In the previous USSR, the Volga carries half of the country's goods transported through the Soviet rivers. The Volga links Moscow, in the north to the Caspian Sea (south–east). This country was famous for having many constructed locks and canals so as to improve river transportation, which is considered of high strategic, political, security


Map No. 6-5: European Rivers
Arctic ocean
Pechora
White Sea
Volga
Baltic sea
North Sea
Thames
Elbe
Vistula
Don
Atlantic Ocean
Seine
Oder
Donets
Dnestr
Dnepr
Caspian Sea
Rhine
BLACK SEA
Danube
TAGUS
Adriatic Sea
Medd-Sea

and economic significance. It has a ministry for inland Water Transport and specific academy was established for this purpose, ie the Leningrad Institute of Inland Water Transport as a unique organization at the international level. [21].

6-2-4 The Waterways In Asia:

The big rivers in Asia are; the Yangtze with a total length 6380 Km. Being the third longest river in the world. The Ob-Irtysh (5410 km.). The Huang He (the yellow river) (4840Km.). The Irtysh (4440 Km.). The Amur (4416 Km.). The Lena (4400Km.). The Meckong (4180). The Yenisey (4090 Km.), The Indus (3180 Km.) The Brahmaputra (2760 Km.). The Salween (2820 Km.). The Ganges (2700 Km.). The Euphrates (2430 Km.). And the Irrawaddy (2090 Km.). (See Map No. 6-6).

The most important rivers in Asia used in transport are the Yangtze, the Huang He, the Meckong, the Euphrates and the Irrawaddy. [22]

Although the Siberian rivers are only navigable during a very short period of time in summer, they are very important in transporting timber. During winter, when they are completely frozen, these rivers were used for automobile transport or through the use of horse–driven wheels. [23]

In China great efforts were undertaken to develop the river transport networks. The superior canal was constructed in the fifteenth century (24) to connect the Huang He with the Yangtze River in the North–South direction. This canal is used to transport passengers and goods to Peking. The total river transport network of China is about 14200 Km in length including the Yangtze and the Huang He rivers.

6–2–5 The African Inland Waterways:

The important rivers in Africa are:
The Nile River (6695 Km.) the first longest river in the world. The Congo-Zaire (4630 Km.). The Niger (4100 Km.). The Zambia (2653 Km.). The Orange (1859 Km.). The Gambia (1094 Km.) [25]
(See Map 6-7).

Map No. 6-6: Rivers In Asia

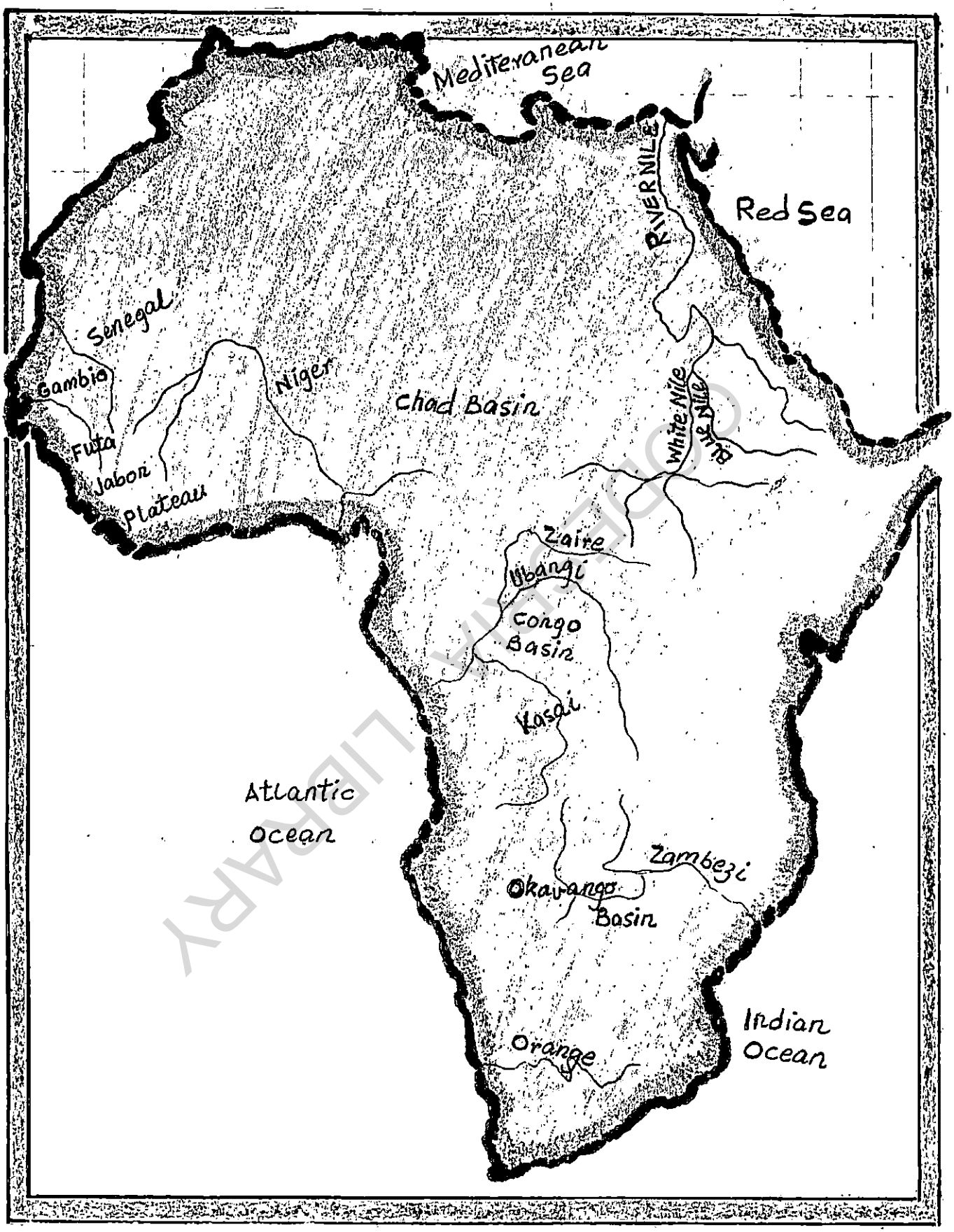
Although these rivers cover almost all parts of Africa, nevertheless, they are not sufficiently utilized for transport purposes, due to the presence of many natural hazards and man–made obstacles as was mentioned earlier, besides, the absence of flood control mechanisms and early warring systems. Details of the obstacles and its impact on the Nile River shall be discussed thoroughly in the chapter dealing with Sudan's inland water navigation, at present; we are going to consider the main features of the remaining African rivers.[26]

I. The Congo River:

This river starts from the middle area of the African Great Rift Valley, where it is known as the Lualaba River that starts to run from lake Upemba. So, it runs northwards up to the town of Mwanza till it reaches Kasongo town where it starts to change its direction when it reaches Kisangani, to Northwest, till it reaches Bumba town, it starts to slope to the west up to Anvers town; almost southward till it joins the Ubangi River, coming from the north, at the north of lake Tumba. Then, it runs up to Kwamouth town where the Kasai joins it. South of this junction, we find both Brazzaville and Kinshasa towns at the opposite direction on the riverbank. The river slopes downwards then it turns to the west where it discharges into the Atlantic Ocean. The Ubangi tributary flows from the line of division of water between Sudan and Congo. It runs to the west, where it makes the boundaries between the Central African Republic and the Congo. The most important town here is Bangui, the Capital of Central Africa. From Bangui, it flows, southwards till it joins the Congo River at Kwamouth town. On the other hand, the other tributary is the Kasai River, which flows from Angola making the boundaries with it and the south– western parts of the Congo Republic. The Kasai runs northwards up to Basongo where it starts to run in the north–west direction till it joins the Congo River at Kwamouth. The Congo River and its tributaries make the boundaries between the Congo (Zaire) and the Congo Kinshasa Republics. [27]

Although the area covered by the Congo River and its tributaries is rich of mineral resources such as diamonds, gold, tin, copper and oil, this river is poorly utilized in transport purposes. Its uses are limited to domestic activities, such as fishing and other minor

Map No. 6-7: Rivers In Africa



activities. This low rate of utilization is attributed to the Colonial regin in the past and to the political instability, especially the on- going wars and fightings between the different national tribes and population groupings. Richard Hill has written an article in which he compares the Nile and the Congo Rivers with respect to transport utilization. (See Annex No. 1)

II) The Niger River:

This river flows from the Futa Jalon Plateau at the remote southwestern corner of Northern Africa. It starts to run to the northeast direction into the continent, up to Bamaku city in Mali Republic. Before it reaches Timbuktu city, it crosses a swampy area. From Gao it starts to run south–east up to Niamey city in the Niger Republic. South of this town, there are the boundaries between the Niger and Dahomey made by the Niger River. It enters Nigeria from the north – western parts and it runs up to the middle of the southern boundaries of Nigeria making the Niger Delta. It discharges into the Gulf of Guinea. The important Nigerian towns found by the banks of the Niger River are; Onitsha, Warri, Yenagoa, Brass and Bonny on the Niger Delta.

It is known that this river is used for transportation especially in Mali and Niger Republic. But this knowledge is insufficient for scientific analysis since we cannot stand on empirical grounds on such experiences.

III) The Zambezi River:

This river is composed of two tributaries i.e. the Cubango and the Kwando, which flow from the Bie highlands in Angola. These tributaries run into the Okavango basin, and then they join the Zambezi River that crosses the Victoria cataracts at the borders between Zimbaboyi and Zambia. It runs into the Kariba Lake taking a northward direction to reach the city of Lusaka. It crosses the Republic of Mozambique from west to east where it crosses more than 500 Km. It turns to run in the south –east direction to discharge into the Indian Ocean.

IV) The Orange River:

The Orange is rich of mineral resources ie coal, manganese, uranium, gold, cooper, iron and diamoneds, in addition to rich livestock and agricultural resources. Due to these resources, the South Africa Republic is considered as one of the richest countries in the world. It has well developed economic infrastructure. So, the Orange is expected to be utilized to the maximum, for river transport, despite the existing natural hazards. At the moment, there is a lack of statistical information on this country. So, it becomes very difficult to draw a comparison between Sudan and South Africa in the field of river transport.

V. The Gambia River;

This river flows from Futa Jalon Mountains in the northwestern direction of Guinea Republic. The main tributary here is Faleme that constitutes the borders between Mali and Senegal, it flows to a south–west direction, crosses Gambia Republic and discharges into the Atlantic Ocean.

VI. The Senegal River;

The total length of this river is approximately 1500 Km., nevertheless it is not mentioned in the Times Atlas of the world. The reason behind this negligence is not known but it may be the same as for not having adequate information on both the Gambia and the Senegal rivers. So, African researchers have to fill in the gab in human knowledge on their continent.

To sum up this chapter, the mode of transport and other relevant concepts have been defined. Every mode of transport consists of the following components, ways, means and terminals. For inland water transport these are, water surfaces, crafts, vessels and harbours.

Through man usage of these components, river transport has been developed at the international level as one of the old modes of transport. Most of the ancient civilizations have centred round riverbanks. As well as early world's explorers, and invaders had used waterways either by sea or inland water surfaces.

The study also shows that river navigation has positive and negative characteristics. The positive ones include that river transport is spacious, safe, secured and suitable for low–valued heavy goods. On the other hand, the negative ones are those; it is a seasonal activity which has slow movements and inelastic in the economic sense.

Water, as part of land, which is an important component of the factors of production, is no longer considered as natural gift, that is to say free off charge. It is quite true that to utilize water surface as a route for transport, is far much cheaper than to construct a railway track or an asphalet road. Water is becoming a precious commodity that wars between nations may take place to obtain it especially during this new century.

Thus, the water surface, as a navigation route, has fixed costs to provide for the needed dredging, navigational signals and other channel improvement equipment, besides the necessary related activities. External help is needed in such tasks especially in the case of underdeveloped nations. The impact, financially, will not be so much as to affect the running expenses of the river transport business.

Water surfaces may be rivers, lakes, gulfs or seas, which are suitable to obtain a navigation route. The term "river route" is defined as a way taken or planned from one place to another. The term stretch is used to mean a route and sometimes the term "region" is used to mean an administrative unit.

The term" river crafts" means all ships, boats, push-tugs, ferries and barges, both dump and automobile ones. At another level, the term "river vessels" means big ships.

Harbours are classified into five types; river-junction harbours, river – railway, river- sea, regional and local harbours. A distinction is made between the usuage of harbour and port is that, harbour is a place where ships shelter and a port is a town with a harbour.

A global coverage of inland water surfaces has been made for each continent separately. A selection and brief description of the navigable routes have been stated showing its importance in the socio–economic life in the respective regions. The European experience shows that river transport plays significant roles in connecting different countries and nations. As the Danube River connects eight countries together, as well as the Germans and French people have joint experiences through rivers.

This survey has shown that the longest rivers in the world are; the Nile River of Africa, the Amazon of South America and the Yangtze of Asia. The total length of these rivers are; 6695 Km., 6570 Km. And 6380 Km. Respectively

It is clear that the longest rivers are found in Africa, South America and Asia. This is to say that these are the least developed continents of the world. This survey has shown that although the natural resources of these continents are rich, it is not sufficiently utilized due to the inadequate transport facilities, especially inland water, transport. In Africa, the information, on some countries, is rare. This necessitates that much effort has to be done by African researchers to fill in the gab in human knowledge on their continent.

River transport in Africa is an old human activity. It needs to be developed so as to sustain better standards of the demanded socio-economic growth for its nations. Rivers are important links between many countries in Africa, as the Gambia, Senegal, Niger, Zambezi, the Congo and the Nile River which links nine African countries, as will be detailed later in this study. The total number of African countries, which can be linked through river transport, is about twenty-two.

The recent advancements in technology, which have covered the fields of ship-building and the high standards of technical specifications achieved at the international levels should be utilized, through appropriate policies, in the African river transportation. Similar efforts have to cater for channel improvements and ports' constructions. Finally, suitable policy making measures, at the African governments level, should be planned and carefully executed.

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CHAPTER SEVEN

SUDAN'S INLAND WATERWAYS

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SUDAN'S INLAND WATERWAYS

The proceeding chapters shall concentrate on the recent history, present position and the expected future of river transport business in Sudan. Economically, emphasis is drawn on investment, pricing and monopoly as important factors in the process of policy – making. The provision of these economic elements is expected to facilitate adequate grounds for the socio – economic appraisal.

This chapter, in particular, discusses the navigation routes in Sudan, existing hazards to navigation, river – crossing ferries in operation and finally it draws an outline for a proposed National Water Policy. These points are important components for the analysis of inland water system.

7–1 Navigation Routes In Sudan:

Early attempts made to utilize Sudan's inland waterways can be found in the writings of Page (1918 and 1919). In the year 1918, he wrote, in "Sudan Notes and Records", on "the Possibilities of Navigation on the River Rahad". (1) The Rahad is a tributary of the Blue Nile. The attempts were carried in three stages; in the year 1904, and 1917. The work was attended by such difficulty and risk of damage to craft, especially on the return journey, "that it was doubtful wheather the game was worth the candle" the danger and difficulty were due to a combination of rapid current, innumberable sharp bends, hidden rocks in the river bed and the presence, throughout the entire journey, of trees not only overhanging the river but also growing in the river bed. (2)

In 1916, a report was written showing that "...It (was) obvious that if the river was to be navigated successfully and as a commercial proposition, a considerable amount of clearing was inevitable wherever trees occurred in the bed of the river at bends and in narrow parts or where they overhung the fair way form the banks." (3)

However, "the country served by the Rahad is so fertile and rich in possibilities and land transport is so costly and inadequate that, it seemed worth while to persevere with the problem of transport by

river". The result of this work was that " work was hampered and curtailed by scarcity of water" which was not enough to supply the workmen and transport animals

During the flood 1917, Page wrote, "I decided to investigate conditions on the spot to test the value of the work already done, ascertain what remained to be done and review the possibilities of the river as a whole." The review ran as follows " one of the crying needs of these rich upper reaches of the Rahad is population to make the most of its agricultural possibilities and, once that is found, cheap transport for the produce. The former can only be induced to remain there if an adequate water supply is secured in the dry season, the latter I am convinced can be provided, partly by the evolution of river craft specially adapted to the conditions of navigation and partly by the more complete clearance of obstructions and dangers to navigation from the channel, or, were the means available, by the construction of a series of dams and locks which would serve the double purpose of providing a permanent waterway and a permanent water supply."
The obstructions and solutions can be summarized as follows:

a) Shalllow water can be solved by dredging " but any increase in the section of a river with so steep a slope as that of the Rahad, would increase the outflow and shorten the period, already all too short, during which there is sufficient water to render navigation possible."[4]
b) Rocks can be removed.
c) Obstructing trees can be cleared.

This was the situation on the Rahad during the first two decades of the twentieth century. In 1978, the Rahad Agricultural Scheme sharted to produce. It is irrigated through a siphone pump from the Blue Nile passing the Dinder River and flows into the Rahad, making a continuous water supply all over the year. The problem of population is solved as well as the permanent water supply. Nevertheless, the river is not used for navigation. Although the Rahad Agricultural Scheme as well as the Gezira Scheme, and the other similar Schemes produce cotton, wheat, dura and other important cash crops. That are suitable for transportation by inland waterways, the constructed canals are not considered in the provision of transportation in Sudan. The history of Great Britain shows that many canals were basically constructed for transportation [5] regardless the recent developments in river craft industry. It is hoped that the irrigation canals could be used for power generation and transportation. Suitable crafts can be designed and produced locally

making use of the experience of River Transport Corporation. The canal routes can be useful in transporting agricultural produce from farm to factory, to local markets or, in case of export products, as feeder channels to Sudan Railways. This step may be the most possible way to reduce transport costs, which shall contribute in lowering the total cost of agricultural products. It also works in avoiding damage caused to built roads by considerable reductions in the number of trucks. This attempt shall result in many indirect economic benefits to the country as a whole, reduction in truck purchase, spare parts, fuel and lubricants consumption, besides accidents and environmental pollution. In addition to social benefits as a result of devoting roads for passenger transport.

The second Issue of "Sudan Notes and Records" contained an article written by Page " Inland Water Navigation of the Sudan"

It provided a comprehensive description and analysis of river navigation in the country. It covers the following areas: [6]

a) There are some 3000 miles of river on which steamers run at some period of time each year. Navigation may be considered permanently possible on 1217 miles, as Page argues.
b) It discusses some obstacles to cheap water transport in Sudan among which we find; shallow water, shortness of flood period, absence of cheap fuel, the nature of shipments and the sailing traffic is not very favourable.
c) It provides detailed information on working river sections.

The following lines shall give brief accounts of points (a) and (b) above, while the last point is to be discussed in a coming chapter.

The Navigable river routes are:

1. Khartoum–Rejaf	1100 Miles
2. Lake No–Meshra el Rek–Wau	0165
3. Taufikia–Gambela	0350
4. The Pibor and Akobo Rivers	0182
5. Khartoum–Roseires	0402
6. The Rahad	0165
7. The Dinder	0075
8. Khartoum–Berber	0225
9. Atabara–Goz Regeb	0159
10. Karima–Kerma	0209
11. Wadi Halfa–Shellal (Egypt)	0210

At present, the total length of navigable waterways in Sudan is about 3242 miles (5187 Km.). Navigation may be considered permanently possible on 1783 miles (2853 Km.) as between Khartoum – Rejaf, lake No. Meshra el Rek, Wad Hamid–Atbara, Karima–Dongola and Wadi Halfa–Shellal, as the records of R.T.C show.

Abrief analysis is presented for each of the river sections provided above (see Map No. 7-1)

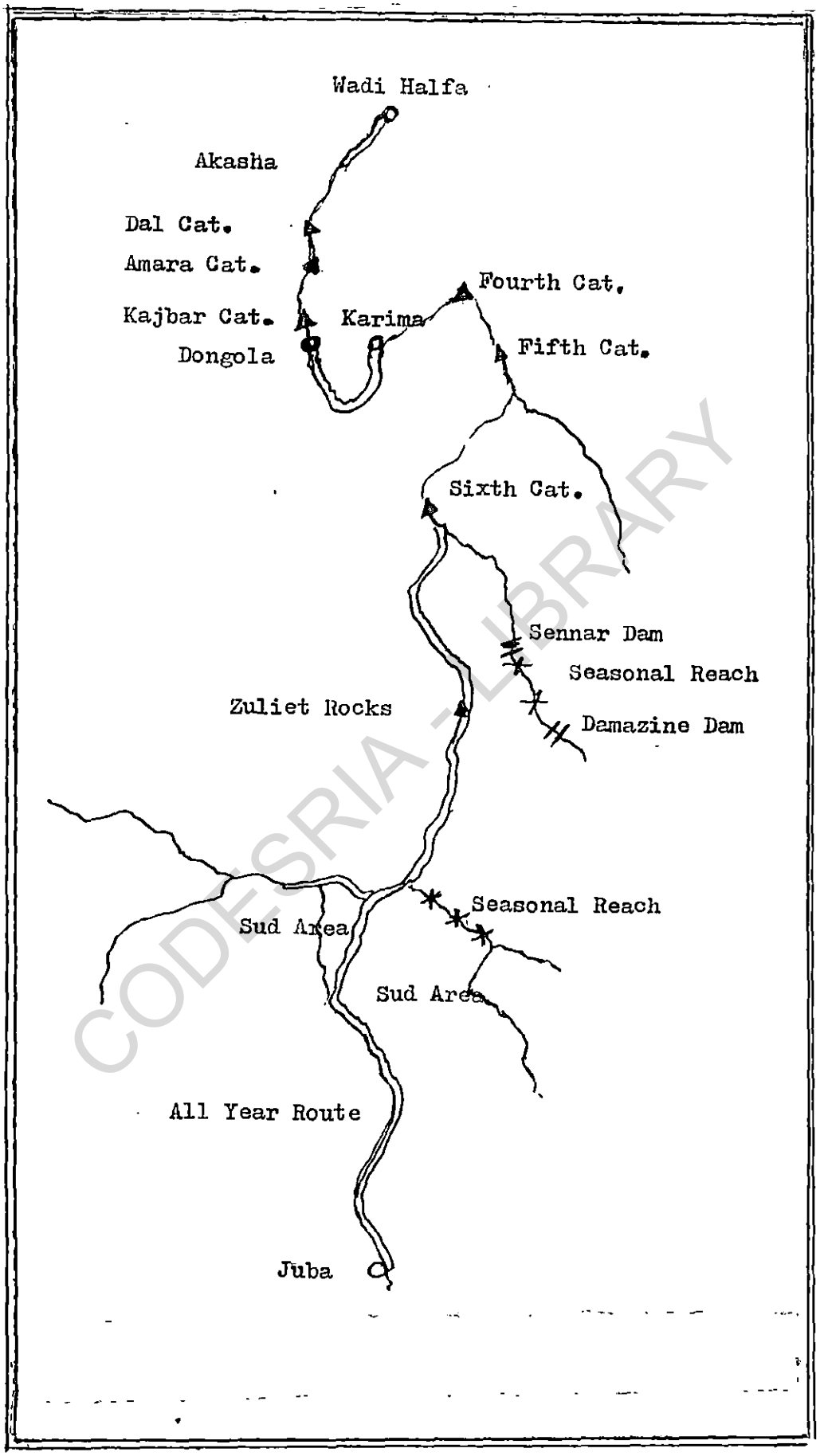
7-1-1 Khartoum–Rejaf, via, the Jebel or the Zeraf 1100 miles, (1760 Km):

No serious difficulties are found on this reach. There are several rocks, which are all well known and most of which are marked. The channel at Abu Zeid and at Zuliet is very shallow during the dry season and as they have rocky bottoms navigation through them requires considerable care. South of Taufikia the river is generally of good depth and comparatively straight as far as Kenisa, but movements of suds have occasionally blocked the channel, though of recent years there has been no serious interference with the traffic. South of Kenisa the channel for some miles is very narrow having extreme tortuous with rapid current, which makes navigation, especially down stream, very trying. Even with the greatest navigation skill it is impossible to avoid colliding with the banks. On this part steamers, which are powerful when going astern, are necessary to negotiate the acute bends, which are the result of the erosive action of the wash from the stern wheels. "As the river south to Rejaf is shallow and rocky and as it is not navigable for any distance beyond any station (to act as a port) should be made down stream ... to ...obviate the risk of damage in passing this area." Thus, Juba harbour was erected on the same basis.

The Zeraf route to Mongalla is from 80 to 100 miles shorter than the White Nile via Tonga, and as there is nothing on that part of the Jebel which would be cut by using the Zeraf, while there is a developing trade on the latter river, it would be very advantageous to have this river improved to enable it to be used at all times. This would only necessitate dredging and banking to prevent influx of floating suds. Fortunately the White Nile and its tributaries for many miles from their confluences are very flat, and great improvement is possible on these rivers by simple dredging.

This river section is still working between Khartoum North and Juba with a total length of 1748 Km. The Zeraf course had been silted, and a new stream emerged. At the moment steamers take

Map No. 7-1: Existing Navigation Routes and Constraints



El Bahr El Gadid, i.e. " The new river" as a main navigation route. If Jongolei cannal is constructed, the new river shall act as an alternative route.

7-1-2 Lake No. Meshra El Rek–Wau:

There is little trade on the Bahr El Ghazal as Page states, "but Meshra, which is on the extreme end of a back water of Lake Amadi, is the port for Wau and the interior of the province, during the dry weather when the Jur River is closed, steamers can usually get to Meshra at all seasons, but in exceptionally dry seasons they can not get far past the open waters of the Lake or 20 to 30 miles distance. Sud blocks ... have, at times, caused very serious trouble in this river... the river has greatly improved since there has been regular service of steamers over it, the action of the wash having knocked off the " corners" and made the channel much wider it is now possible for the largest steamers with as many as six barges to navigate it freely, whereas a few years ago it was difficult for small steamers to do so with a single barge in tow."

The Jur, which joins the Ghazal in the lake, is only navigable for a very short period in each year. It is very shallow and is frequently closed by movements of large blocks of sud, or floating grass, which is caused by the wind. The open part of the Jur has a steep slope especially near Wau and consequently becomes almost dry for some months in each year, ie. it is closed in the dry season.

Dredging and banking the channel as far as the open water would not be difficult and would enable the steamers to get very much nearer to Wau at all seasons and to sail there directly for a very much longer period during the flood. If a receiving station was made at which goods could be stored until the river was favourite to transport, a very much more satisfactory service could be worked.

"Before the resources of this province can be properly developed it will be necessary to provide a cheap transport route, which will no doubt be found by canalizing the Jur. It runs through well-defined banks, it is not very wide, and is capable of improvement at no great expense, especially as materials can be found on the banks."

There are several other rivers in this region, such as the Arab and the Lol, the outlets of most of these rivers are not known.

7-1-3- Taufikia to Gambela (560 Km.):

The Sobat and Baro are navigable as far as Gambela from about the middle of June to early in November and for a very much longer

Trade with Gambela was the most extensive of any place south of Khartoum if permanent communications were possible, trade with Ethiopia would undoubtedly increase. River transport, when was operating, had full cargoes on all steamers in both directions and for the whole distance, it could be made more satisfactory by using crafts suitable for the local conditions. Sudan has stopped this river service in the year 1964.

Rivers here could be improved by building a series of locks and weirs to make permanent navigation possible. This requires bilateral agreement and joint efforts between Sudan and Ethiopia.

7-1-4- The Pibor and Akobo: (291 Km.):

The Akobo joins the former at Akobo village and runs to the Sobat near Nasir. These rivers have so far been used only by local authorities for the purpose of administration and patrol duties. If peace is attained, this area would be developed considerably since its flat valleys and rivers can easily be improved by dredging.

It is worth noting that the White Nile and its tributaries have complete absence of local sailing crafts. There are a few built in and trading from Khartoum. Dug–out canoes are numerous and also some are built of ambach.

7-1-5- Khartoum–Roseires (643 Km.):

This reach was only navigable from about the end of June to the beginning of November as far as Roseires. A very considerable amount of grain was brought down by both steamers and sailing craft, "but as the railway runs through the grain producing areas and parallel to the river, it is not be expected that very much produce for direct export would be water–borne for the short distance from north of Sennar to Khartoum for transshipping to the railway there." Page argues; "The propsed dam across the Blue Nile at Sennar should greatly improve the river upstream of that town, but apparently little water-borne traffic is expected on that reach as no provision for passing vessels through the dam is contemplated. Another effect of this dam may have on the Blue Nile will be to shorten the navigable period down stream of it."

This section is obstructed by the construction of Sennar Dam in 1925. The river service is located between Suki and Roseires on seasonal basis. Recently, a bridge has been built at Singa, it does not

handicap navigation but shallow water and the irregularity of production are main reasons for seasonality of river transportation. This region is rich in agricultural production, what is needed is adequacy of water supply and efficient transport network.

The Khartoum–Sennar section has no river service now. It could be improved through dredging, where it is needed and used in river transport especially for the produce of the Gezira and Gunied Schemes. It can be used for local transport as well as for export. If navigation is possible north of Khartoum, then Atbara could be an important rail-river station.

7-1-6 The Rahad (264 km)

The Rahad flows through a very rich valley. It is rather narrow and of unusually constant width and depth. It would be quite a simple engineering fate to canalize it. The Rahad is navigable for a few months; during the flood only. In 1917 steps were taken to remove navigation obstructions and the movement had been easier.

There are no sailing or other native boat of any description on this river only a few rafts, made of gourds and bamboes with straw spread over the top, on which everything from goats to camels are crossed. Steamers operations had stopped since the 1920's.

7-1-7 The Dinder (120 Km.):

This River is navigable for some distance from its junction with the Blue Nile. There has not, hitherto, been any trading steamer traffic on this River, but steamers do occasionally go up on inspection duty, etc. "The produce grown in this valley is not ready for export until the river has fallen, and it is therefore taken to the Blue Nile by animal transport." This is Page argument.

This reach is not used for transport at the present time. It runs through rich savanna zone, that makes land transport during the rain's season very difficult if not an impossible task. The Dinder can be operated, using river crafts, for administrative, commercial and tourism especially with the presence of the Dinder Zoological Protecterate.

Except the short route Suki- Roseires, the Blue Nile and its main tributaries, the Rahad and Dinder, are not used as inland waterways in Sudan.

7-1-8 The Khartoum–Berber (360):

This reach is only open during the flood and is afterwards reduced to Wad Hamid – Atabara since the railway reached Khartoum it has been used very little for commercial traffic but province and other departmental steamers use it constantly.

At the present time, river steamers can navigate between Khartoum and Atbara during flood times. It was tried, in the 1970s, to transport cement from Masbio Factory, at Atbara, to Khartoum. No traffic was attracted to the downstream journey, and for this reason it was stopped. If the route, Khartoum–Karima is made navigable, after the construction of the Hamdab Dam, this section might increase in traffic for both journeys.

7-1-9. Atbara–Goz Regeb (255 Km.):

Steamers going as far as Goz Regeb have used this River occasionally, but it is a difficult river to navigate. As the steamers cannot get through the Atbara Bridge, they must pass under before the water rises too high and must remain on the wrong side until it falls again, a period usually twice a long as the river is navigable for any useful distance. This and the shortage of suitable craft have prevented any attempt at a regular service on this river. There is no immediate prospect of any imports or exports to, or from the regions on the banks of the Atbara River, which would justify any improvement works on it.

This River is the only considerable tributary, that discharges into the Nile River, after the confluence of the Blue and White Niles at Khartoum, that constitute the main Nile River. The establishments of Khashim El Girba Agricultural Scheme, for the resettlement of the Nubians on the area, are important factors that have contributed a lot in the socio–economic development of the region; so, it is becoming rich in agricultural production which necessitates the possibility of having the river to be navigable.

7–1–10 Karima–Kerma (330 Km.):

This reach is served by sternwheelers and nuggers, the latter being mostly privately owned. It is a difficult and expensive one to run. The river, for a great part of the year, is very shallow and in several places the bed is very rocky, especially at the north end. There

a long distance runs south. In some seasons the steamers cannot go further down stream than Dongola, thus reducing the distance from Karima to 270 Km. (See Fig. 7-1).

In the year 1897 the riverbed was cleared in the shallow water near the north end of Argo Island and immense quantityof large rubble and loose stones had been removed, to enable the large fleet of steamers and sailing craft to sail to railhead then at Kerma without delay or damage.

The output of the province is so small that any extensive improvement of the channel of this reach would not be justified. Economy should be looked for in some cheaper form of propulsive power. The produce to be expected from this province has to be taken upstream to the railhead now at Karima, which is the only outlet from the province.

Sailing craft cannot be used very economically on this reach. The loaded boats going upstream can not sail against both wind and current and therefore have to be towed by manual labour, a very slow, laborious and costly procedure, which would be prohibitive if cash wages were paid to the crews, or if time was any object. The boats generally have to return downstream empty."

At present, Karima–Dongola is the main river route that provides local transport services in north Sudan. After 1993 the services of this sector had been deteriorating as a result of being splitted from the headquarters in Khartoum North. Its administration has been allocated to the Northern State, which failed to operate it as will be discussed in the coming chapters.

7-1-11 Wadi Halfa–Shellal (336 Km.):

This is a regional route that connects Sudan with Egypt. River transport is a joint venture between the two Governments. In 1919 Page wrote, " Navigation over this stretch, with the exception of a short period during the flood, is limited to vessels having a maximum three feet draft of water and even with this shallow depth only comparatively small steamers are, at times, able to get through the narrow and tortuous channels between the sand banks. At times of very low water barges and gyassas have been sunk at the worst places to cause the current to scour out the channels, but this is, of course, only a very temporary measure. No steps have been taken of recent years to make any permanent improvement. It is not to be expected

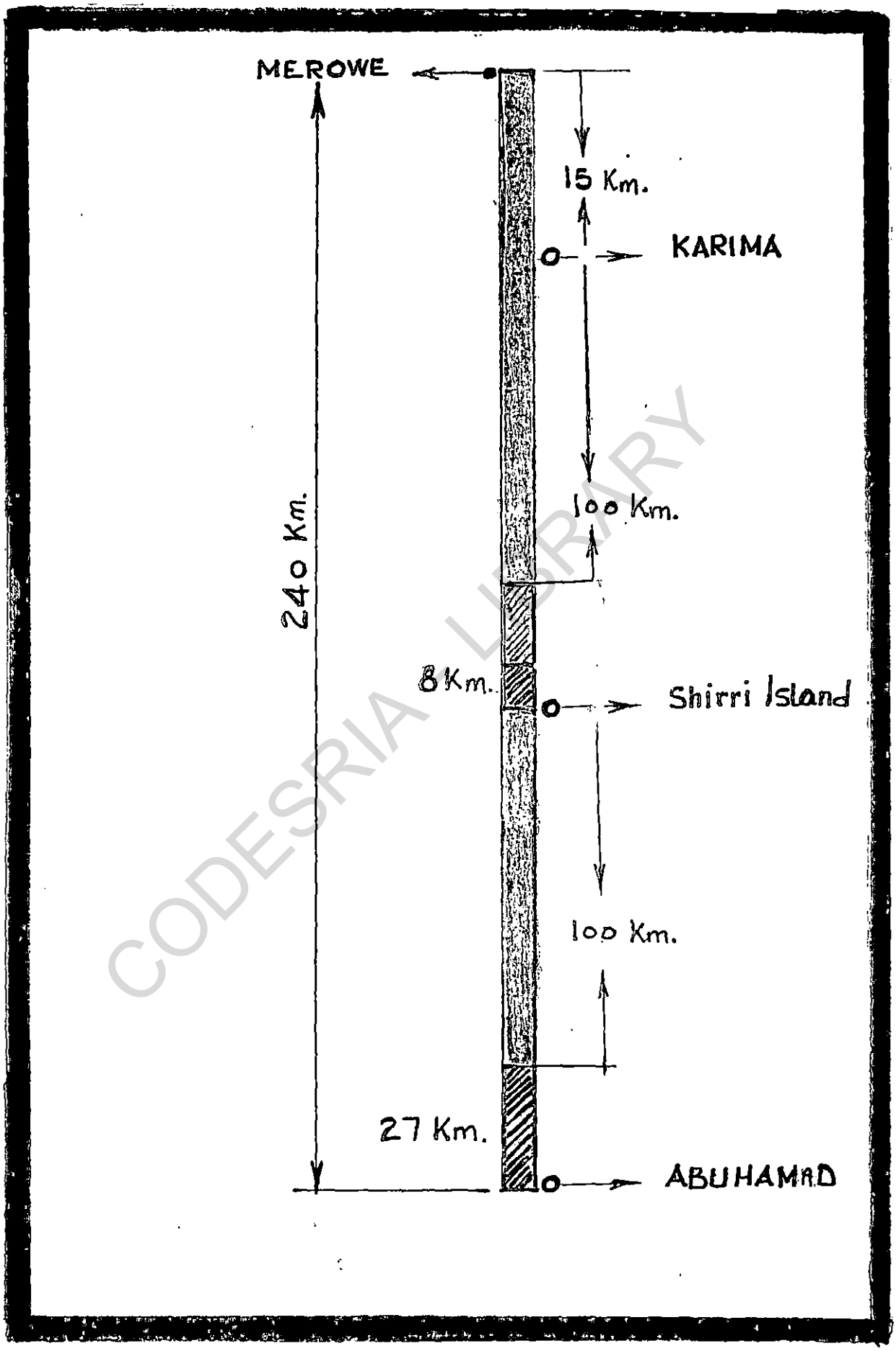
that any expensive works to improve this channel will now be undertaken. The railway will, no doubt, be extended from Halfa to Shellal in the near future and the expense and loss of time now incurred in transshipping goods etc. at Halfa and Shellal would easily cover the difference in freight between water and rail transport over so short a distance. The mail and passenger services on this reach, as well as part of the cattle and goods traffic, are served by the sternwheelers belonging to the Government. There are several private companies running various craft including auxiliary steam sailing barges. Some of these sail from Alexandria and Cairo. Egyptian gyassas and locally built nuggers are also used, but not to any great extent. These latter are very like those built in the Dongola and Khartoum provinces, but have less beam, a greater moulded depth, a harder bilge stem and are rigged with lateen–sails, they are not nearly such good sailors as those of the south. A large number of quarter-decked sailing boats of a new design from the native craft have been put on this reach during the last few years. They are of great beam and are rigged with a very large balanced lug sail, they are fast and safe sailors, are built very cheaply and as they carry a large cargo on a shallow draft they are rapidly custing the old native design of craft. They are usually used for local passengers and freights, but occasionally make long distance journeys."

We sum up the above extract into five points;

a) The low draft used by that time
b) The river route was described as "narrow and tortuous channels between sand banks.
c) The colonial policy was not in favour to improve or extend river navigation in the area,
d) The Wadi Halfa – Shellal railway, and
e) The "good" boat – building in Northern Sudan.

Both points (a) and (b) are solved after the construction of the High Dam at Aswan. While point number (d) is not yet materialized. The remaining two points will be discussed when dealing with the future of inland water navigation in Northern Sudan.

Fig No. 7-1: Cataracts Between Abu Hamad And Merowe



Page argues that there are specific factors hindering cheap and efficient river transport networks in Sudan; these are:

a) Shallow Water; Page says, "Nowhere in the country can boats exceeding three feet draft be used excepting for short periods during the floods, and even with this shallow draft numerous delays occur."

   Recent experience of River Transport Corporation shows that boats with five feet draft are introduced into service in both the Southern and Northern Reaches. In these reaches two distinct fleet devices were used; quarter–wheeler and modern–electrified push-tugs. The advantage of the wheeler ships is that, when frequently used, it makes natural dredging by stirring silt. Frequency of river operations is impossible, at the present political conditions; in the north due to management problems and civil war in the south. Dredging is expensive and even it will be valueless if the traffic is infrequent. Small draft, of three feet, is still used in case of river crossing ferries. Great efforts should be undertaken in this regard possibly by the construction of dams and locks.

b) Shortness of flood period; Page argues that "As rivers on which most of the traffic is carried out are only navigable for four to five months annually, a large fleet is necessary during those months but is largely idle, and an unnecessary expense, during the greater part of year." This argument was true according to the experience of River Transport Corporation, which had a new fleet in 1983. The best outcome of procured barges according to RTC'S statistical reports did not exceed two round trips during the whole year.

c) Absence of cheap fuel; Although Page's argument was based on the consumption of wood fuel but it is true for gas oil as well. He says, "I am of the opinion that the proper solution is to be found in internal combustion engines for propulsion and that they will eventually replace steam, and it is quite possible that local products may be found for supplying the necessary gas."

   Steamboats are no longer in operation; gas oil fuel engines had replaced them. Many recent reports of RTC have shown that the Corporation was unable to get the sufficient quantities of demanded gas oil as a result of the difficulties that had faced Sudan economy during early the 1980s. This difficulty is most

likely to be solved if the national oil resources are economically utilized.

d) The nature of the traffic: Page argument is that "... the consignments of native produce are small, the distances are short and the cargo, which is carried, is practically all in one direction .... large consignments going long distances are very few. The traffic between Khartoum and Gambela is the one exception."

   This argument is true for baggage and personal effect consignments. The situation is changed now as a consequence of the growth in markets and consumption centres. The development projects established in many various parts of the country have expanded the range of demand for transporting consignments in bulk. For example, grain produced in Renk area is estimated at 100000 Tons every year.

e) The sailing traffic: Page argues that sailing traffic is not possible to any great extent. He says " The prevailing wind, generally from north to south is not very favourable ...the boats are not designed to sail against the wind, neither are they sufficiently well built to do so especially when fully loaded. "

At present, this argument is not correct for many reasons. First, the wind blows, in Sudan from north to south during winter season, which is a very short period, about three months, December to Feburary. Second, most of the traffic, especially in the southern reach, goes upstream, i.e. from the north to south. Third, the experience of RTC shows that, the downstream journey is shorter in time than the upstream one, although the boat speed per hour is higher in the latter journey. Fourth, modern fleets are designed to sail irrespective of the wind direction and are sufficiently built to sail under different environmental conditions when fully loaded.

7–2 Hazards To Navigation:

Hazards to navigation can be grouped under two headings; natural and man-made constraints. The natural hazards are those found in the nature obstructing the river course causing difficulties in passing – through. Such as the presence of rocks, sands, suds, trees, grasses, changes in riverbed and high precipitation.

On the other hand, man- made hazards are those constructs, and similar acts performed by man. Such as construction of dams, reservoirs, bridges, canals and the water hyacinth.

The following account is devoted to provide a brief description of the existing constraints in Sudan.

7–2-1. Man –Made Hazards:

Man, in his day- to- day adaptation to enviroment, constructs and takes many actions to develop the water sources around him. So, for several developmental purposes he erects dams, reserviours, weirs, locks and bridges to derive the maximum benefits of rivers. Sometimes, for unknown reasons, he may harm these water sources such as in case of planting water hyacinth. These two types are found in Sudan.

Dams, erected or planned to be, are present on the main Nile River and its tributaries. In Sudan, and on the Blue Nile, there are Sennar (1925) and Damazine (1966) dams, which are established for irrigation purposes and electercity generation. The Sennar Dam, as has been shown in 7-1-5, is a serious consraint to navigation between Khartoum and the southern parts of the Blue Nile Province. It does not allow ships to pass through. On the other hand, the Damazine Dam is not constructed to pass steamers. It is found upstream Sennar Dam. The area between the two dams (350 Km.) is supposed to provide high water level that can make navigation take place all the year but unfortunately it is only seasonal.

On the White Nile, there is Jebel Aulia Dam (1937). It has a lock that permits boats to pass through the dam. The main purpose of this dam is to protect the Nile River from water hyacinth not to pass through the dam. It also works regulating the White Nile current. It closes when the Blue Nile is flooding. The Jebel Aulia Dam is constructed some fourty miles upstream of Khartoum. (7)

On the Atbara River, a seasonal tributary of the Nile River, there is Khashim El Girba Dam (1962). This dam is constructed to provide permanent irrigation water for Khashim El Girba Agricultural Scheme, for the resttlement of the people of Wadi Halfa after the construction of the High Dam at Aswan, in Egypt. Since the Atbara River is not utilized as a route for transport at the time being, hence it constitutes no navigation obstruction.

On the Nile River a dam is proposed to be constructed on the position of the Fourth Cataract at El Hamdab area. It has been studied

for so many years ago but its execution depends on the relationship between both Sudan and Egypt Governments. Its original map-plan permits the passage of boats. A weir is planned to be erected on the remaining rocks of the third cataract at Kajbar. Both of the dam and the weir are intended to facilitate irrigation water and power generation without obstructing sailing boats.

The first bridge was constructed at the Atbara River, near Atbara, in 1900. It was not designed to allow ships to pass. The second was erected on the Blue Nile to connect Khartoum North with Khartoum, mainly through railway line, in the year 1909. It was designed to permit ships to pass but, at present, it does not.

The next one was constructed near Kosti town to make both trains and boats pass. It was constructed in the year 1910. The White Nile Bridge, which connects Omdurman and Khartoum, was constructed in the year 1928. This bridge and that of Kosti are difficult to operate. Now they are getting mechanical deficiency that makes the passage of ships a risk. El Butana Bridge was constructed on the Atbara River, to make the railway runs over the River. It was constructed in the year 1927. All these bridges, except the White Nile one on Omdurman, are built by Sudan Railways. [8]

On the Blue Nile, a bridge was constructed, adjacent to the Damazine Dam, on the downstream direction, in 1967, on half the distance between Sennar and Damazine. Another one was constructed at Singa, in the year 1992. Hantoob Bridge was constructed in the year 1976 as an extension of Khartoum–Gedaref road. Burri bridge (1971) was constructed to release traffic congestion, on the old Blue Nile Bridge, between Khartoum and Khartoum North. Further, there are two planned bridges, on the Blue Nile. The first to connect Ruffaa with Hasahiesa, the second to connect Gurief East with the Western part of it. All the Blue Nile bridges are designed not to obstruct river navigation.

On the White Nile, there is the Jur Bridge constructed in the year 1974. This bridge lies south of Juba town, which is the destination for sailing boats from Khartoum. Thus, it does not represent an obstruction for river transportation. Next we have new Kosti bridge (1980). Jebel Aluia Bridge, over the dam, and the Fiteehab bridge (1999) all these bridges are designed to allow ships pass under them. A bridge is suggested to connect El Duiem with Khartoum-Rabak road. Its design must permit ships' passage.

So far, on the Nile River there is only one bridge in Sudan that is Shambat Bridge connecting Omdurman with Khartoum North. This

bridge was completed in the year 1965. Other bridges are suggested on the following positions, Shendi, Merowe, Dongola, and Atbara. It is expected that these bridges shall allow boats to pass. [9]

The water hyacinth and other aquatic vegetations, such as papyrus, threaten the smooth running of the river services throughout the year. Water hyacinth causes barges to slow down and often damage the propellers when it accumulates around them.[10] These problems are particularly acute during the flood season when carpets of vegetation drift downstream and can completely block the channel.[11]

Water hyacinth is recently introduced in the Nile River. It was not known, in the southern part of Sudan, during the first half of the twentieth century.

Finally, man-made navigation constraints could be found in two cases:

a) The imperfect competition between different modes of transport, and
b) The absence of proper policy frame works at the national economy as general and in preserving water resources in particular.

7–2–2: Natural Navigation Hazards:

Natural hazards depend on the water flow. If the current discharges swiftly no serious rocks, cataracts, falls are found on a river course. [12] So, natural hazards may be:

a) Low or swift current.
b) Sharp bends.
c) Precipitation of silt.
d) Changes in riverbed.
e) Aequatic plants: suds and marches, and
f) Cataracts, falls, rocks, fords and sands. All these hazards are found in Sudan.

I. In the upper reaches of the Nile River water current is swift especially on the Bahr El Jebel before Juba harbour, on the Sobat River before the Nasir town and on the Ghazal before lake No. Low water current is one of the characteristics of the Nile River down streaming its confluence at Khartoum. As a

result of this feature we find the six cataracts and the long sweep in the river course at the Northern State. [13]

II. Sharp bends occur as a result of the current speed. They are found, in the upper part of the river, at the Jebel, Sobat and Ghazal tributaries. These bends constitute navigation difficulties since many towed barges cannot sail together and manoeuvering becomes a necessity. [14]

III. When the current speed slows down precipitation of silt occur. On the Nile River this takes place at the upper reaches as well as in the Northern State as a result of the High Dam. In upper Nile the traditional navigation route, on the Ghazal, had become innavigable due to precipitation of slit, which results in changes in riverbed.

IV. Change in riverbed, consequently the river changes its course in another direction [15]. In Sudan, such a new stream is known as El Bahr El Gadid ie the New River. This area is full with sud and marches that reduces water current and result in precipitation of silt.

V. The equatorial zone is famous for its thick vegetation, among these acquatic plants are at the lead. Swamps, suds and marches are well known plant families in the upper Nile in Sudan. Besides, the water hyacinth is said to have been planted for the first time there and hence continued to spread on down stream direction.

VI. The last category of navigation hazards is what is known as the cataracts. It is the most characterizing feature of the Nile River from Khartoum to Aswan. A detailed account of these cataracts is presented.

Rocks On The White Nile:

The White and Blue Niles, the main water channels connecting Juba and Damazine with Khartoum, are free from cataracts and dangerous rocks. However, some of the sections in Blue Nile, White Nile and their tributaries do present problems of low water levels during certain months of the year. [16]

The section Khartoum – Kosti, of the White Nile, is very well suited for river operations throughout the year. This is a result of the studies, undertaken for River Transport Corporation, by Romanian and German consultants. [17]

The Kosti–Malakal rocks are found at the following locations:

Abu Zeid Ford, Zuliet Rocks, Dinka Ford of El Makhada, Nabaqaya and Gisr El Dom.

Abu Zeid ford " is located 16 Km. upstream of the highway and railroad bridges at Kosti. It is very similar to the Makhada area in that it appears to be a long flat "S" shaped curve. The first bend, downstream, is to the right and the second to the left. The shallow area is located in the wide straight reach, or crossing, between the bends. This reach is shallow during low water and is also identified as a ford on the river maps." The total length of the ford is three Km. [19]

Zuleit Rocks. At this location, which is about 25 Km. downstream of El Jebelein, several rocks are to be found at the bottom of the river. During low season below the water surface, the width between rocks is only about 40 meters, which is safe for a tow of two barges during low water. Thus, it is a hazard to navigation. [20]

El Makhada Ford is located about 15 Km. upstream of El Renk town. The width of the navigation channel ranges between 25 – 40 Meters, while the depth is about O. 9 and 3.7 meters during low and high water levels. Flow velocities are very low.

The Nabagaya shallows during low water. Its length is about one to one and a half Km. during the dry season depth, would be less than 1.5 meters. Velocities are very low and are estimated to be on the order of 0.3 to 0.4 meters per second.

In the Abuzeid Ford, Zulliet–rocks and the Dinka Ford (EL Makhada) the two convoys crossing is forbidden. The minimum draught condition prevails mostly between April and July each year.[21]

Cataracts In North Sudan:

In his discussion of the development of Sudan Communications, Morrice (1949) argues that, " It is difficult to suggest how (economic bottlenecks) can be remedied unless cheaper transport is provided, and cheap transport over hundreds of miles means in practice water transport." If it were possible to develop the Nile River between Khartoum and Wadi Halfa as a continuously navigable waterway, the problem would be solved. [22]

Abrief account of the principal obstacles to navigation on the Nile River between Khartoum and Wadi Halfa as described by Morrice "It is a customary to refer to six numbered cataracts on the Nile River north of Khartoum, but it must not be therefore supposed that no others exist. This nomenclature is, in fact, confusing, and

would be better avoided if not sanctioned by long–established custom." [23] The foregoing description is believed to be substantially correct, but absolute accuracy of detail is not possible. The reason is that the points where cataracts begin and end are not sharply defined; hence their individual length and drops are liable to vary according to the observer, sometimes by quite considerable amounts. The lack of more recent authorities is in itself an indication of the little interest taken in the subject during recent years. [24]

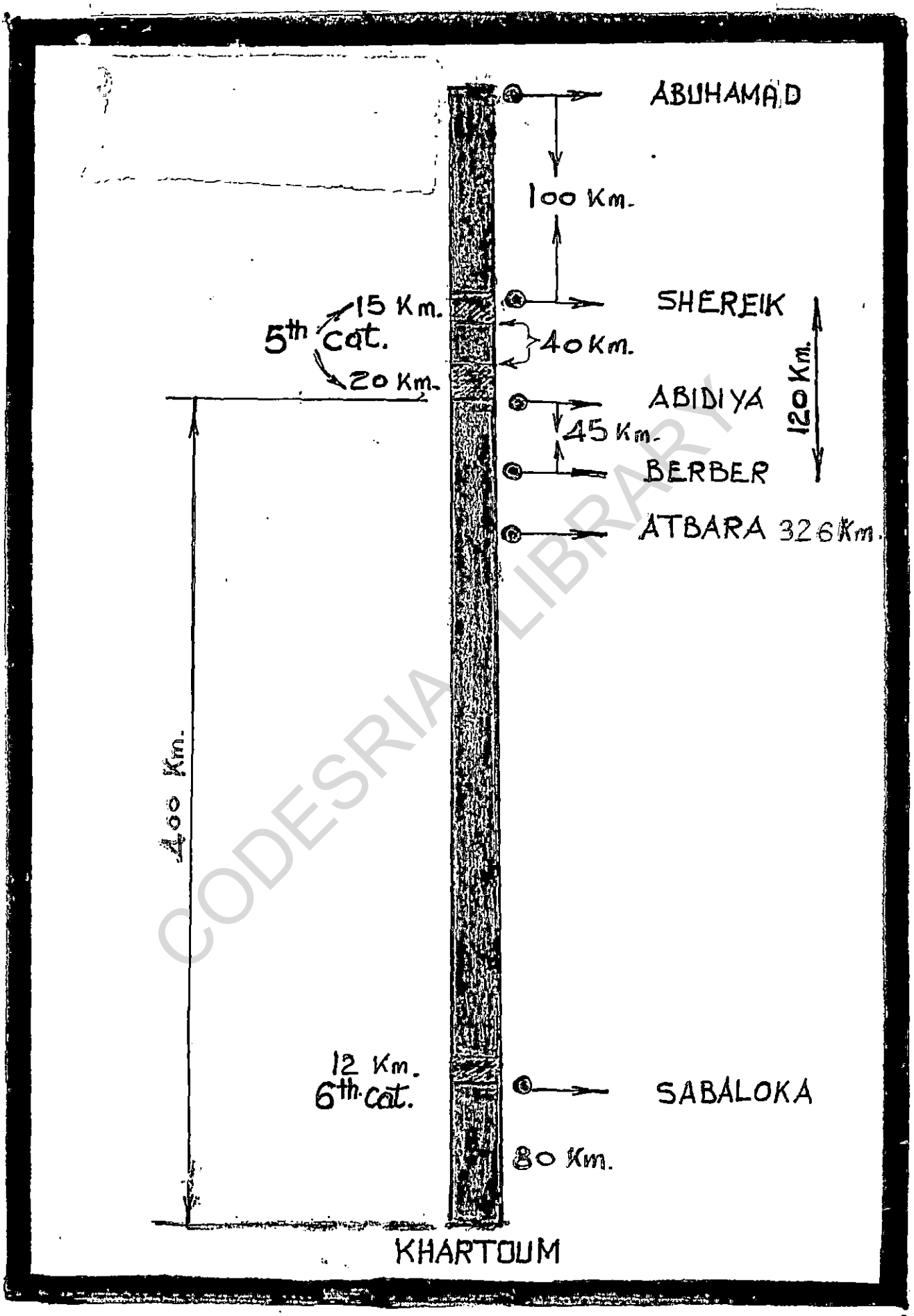
The first obstacle north of Khartoum occurs at the Sabaloka Gorge, often called the Sixth Cataract. The Gorge starts about 80 Km. North of the capital and is approximately 12 Km. long whith an average width of 300 meters or so. It is however, so deep that the slope at low water is only 6 cms/Km; but when the flood comes down the slope increases considerably and a strong current races through the gorge. Owing to the innumberable islands navigation is not possible at low water. "Sabaloka is definitely a gorge rather than a cataract and should preferably be so described; it is cut through felsite and the geological formation is remarkable". (See Fig. No. 7-2)

The second obstacle begins below Abidiya about 45 Km. north of Berber or just over 400 Km. from Khartoum it is known as the Fifth Cataract. In the next 20 Km, the river drops about 8 meters with a slope of approximately 40 cms/Km, and is quite unnavigable at low water.

After some 40 Km. of open water there is another rapid about 15 Km, long, which ends near Shereik, roughly 120 Km. by river from Berber and 480 from Khartoum. This rapid is navigable at high level. There is an open water from Shereik to Abu Hamad, a distance of a bout 100 Km. Between Khartoum and Abu Hamad the Nile River drops approximately 65meters in 580 Km.; of this fall 30 meters occur between Khartoum and the Atbara confluence, a distance of 326 Km, and 25 between Berber and Shereik.

At Abu Hamad the Nile River is divided into two parts by the island of Mograt, which is about 30 Km. Long and 5 broad. The rapids here are some 27Km. long and involve a drop of about 18 meters; navigation is impossible at low water but possible with some difficulty when the Nile River is in flood." It will be noticed that this cataract, though unnumbered, is at least as serious an obstacle as the Fifth Cataract. There follw 100 Km. of open water to Shirri Island, where the rapids start again and continue for a further 100 Km. to end just above Karima about 805 Km. from Khartoum. The total fall in this series of rapids is 33 meters; of these 14 are concentrated in the Fourth

Fig No. 7-2: Cataracts Between Khartoum And Abu Hamad



Cataract which begins about 750 Km from Khartoum and is approximately 8 Km. long. The Fourth Cataract shares with the Second the distinction of being the most serious obstacle to navigation north of Khartoum.

There is enough water for vessels to pass only when the Nile River is high, and then the current is so strong that they cannot ascend under their own power. For the ordinary purposes of commerce the Fourth Cataract is certainly not navigable.

Between Khartoum and Merowe, a distance of about 820 Km., the Nile River drops approximately 130 meters; half of this drops occurs in the 240 Km. which separate Merowe from Abu Hamad. Below Merowe there is no serious obstacle to navigation for about 330 Km., until Jebel Abu Fatima marks the start of the third cataract 1150 Km. from Khartoum. This reach is navigated regulary for (270 Km.) to the town of Dongola, and during about seven months of the year for some 60 Km. further to Kerma. The total drop between Merowe and the head of the third cataract is about 27 meters. When the Nile River is low shifting sand banks often make navigation difficult; when it is in flood care must be taken to avoid isolated rocks. (See Map No.7-2).

The third, or Hannek, Cataract is rather over 20 Km. long with a total drop at low water of about 11 meters. The first 5 Km. constitute the most serious obstacle and make the cataract impassable at low water; at high level, however, vessels can ascend without much difficulty under their own power. In the 200 Kms, below Abu Fatima there are only two other cataracts, and both are easily navigated at high water level. The first is Kajbar Cataract, which consists of a single granite dike about 400 meters wide and is thus the shortest constraint between Khartoum and Wadi Halfa. At low water it acts as a dam and produces an afflux of about three meters; the site is about 20 Km. south of Delgo just below the point where the Nile changes its course from east to north. After 100 Kms. of open water comes the Amara Cataract near Abri; though nearly 10 Km. long, it is not a serious obstacle, for the total fall at low water is barely three meters. (See Map No. 7 –4)

Two hundred Km below Jebel Abu Fatima and 1350 from Khartoum, we reach Kosha near the head of the Dal Cataract; it drops 12 meters in about 24 Km. It is divided into two parts and Akasha lies near the head of the second. The Tanjur Cataract starts about 100 Km. above Wadi Halfa and is approximately 12 Km., long; the drop is nearly 10 meters overall and 7 in the last fifteen Km. downstream, the

Ambigol Cataract has practically the same dimensions as Tanjur. The rapids of Semna gorge are 65 km from Wadi Halfa and about three km long. At Kajinera Island, 55 km from Wadi Halfa, there is a small rapid with a drop of nearly five meters, and then we reach the head of the Second Cataract.

The construction of the High Dam, on the First Cataract, has solved some of the navigational problems on the Second and Third Cataracts. In Sudan, River Transport Corporation has operated river service between Wadi Halfa and Akasha town. It was all – year round. It stopped recently when the authorities in Karima had withdrawn the push tug that was working on the region. In the year 1986/1987 a "Technical Study of the Navigability of River Stretches Wadi Halfa – Akasha – Dongola" [25] was conducted by British and Sudanese consultants. The objective of this study is to extend river navigation between Karima and Wadi Halfa in Sudan, so as to be linked with the existing route Wadi Halfa – Aswan in Egypt. By that time, as well, another study was carried out to build Wadi Halfa river harbour. The port study was conducted by German consultants for both Sudan and Egypt Governments [26]

The Kajbar is the only remaining part of the Third Cataract which constraints navigation, when the Nile River is low. The construction of a weir on it, for power generation, might help improving navigation conditions.

7–3 River–Crossing Ferries:

In the year 1991, a study was carried out under the title "Working Ferries in Sudan." The study report is written in Arabic. The Cabinet of Ministers financed it. Ferries in Sudan are under the administration of the local authorities, River Transport Corporation used to design, assemble and provide technical and maintenance services on demand. [27]

This study considers ferry activities as important operations on inland water navigation. Since such ferries connect many population settings on riverbanks, it contribute a great deal to the social welfare of populations. Traditional river crossing-boats, wood sailing, are dangerous when used by so many people and may result in passengers' deaths. For this reason a brief description of the numbers and locations of these ferries is presented in this work.

On the Blue Nile there are 31 ferries that work between Roseries and Tuti Island. The total number of cities and villages served with these ferries is more than 40 locations. This service is highly intensive, since we find a ferry every 18 Km, an aspect which is not found on other rivers in Sudan. There are ten ferries working between the Damazine and Sennar dams. On the other hand, there are 21 ferries that work downstream of Sennar Dam up to Tuti Island on the confluence of the Blue and White Nile rivers.

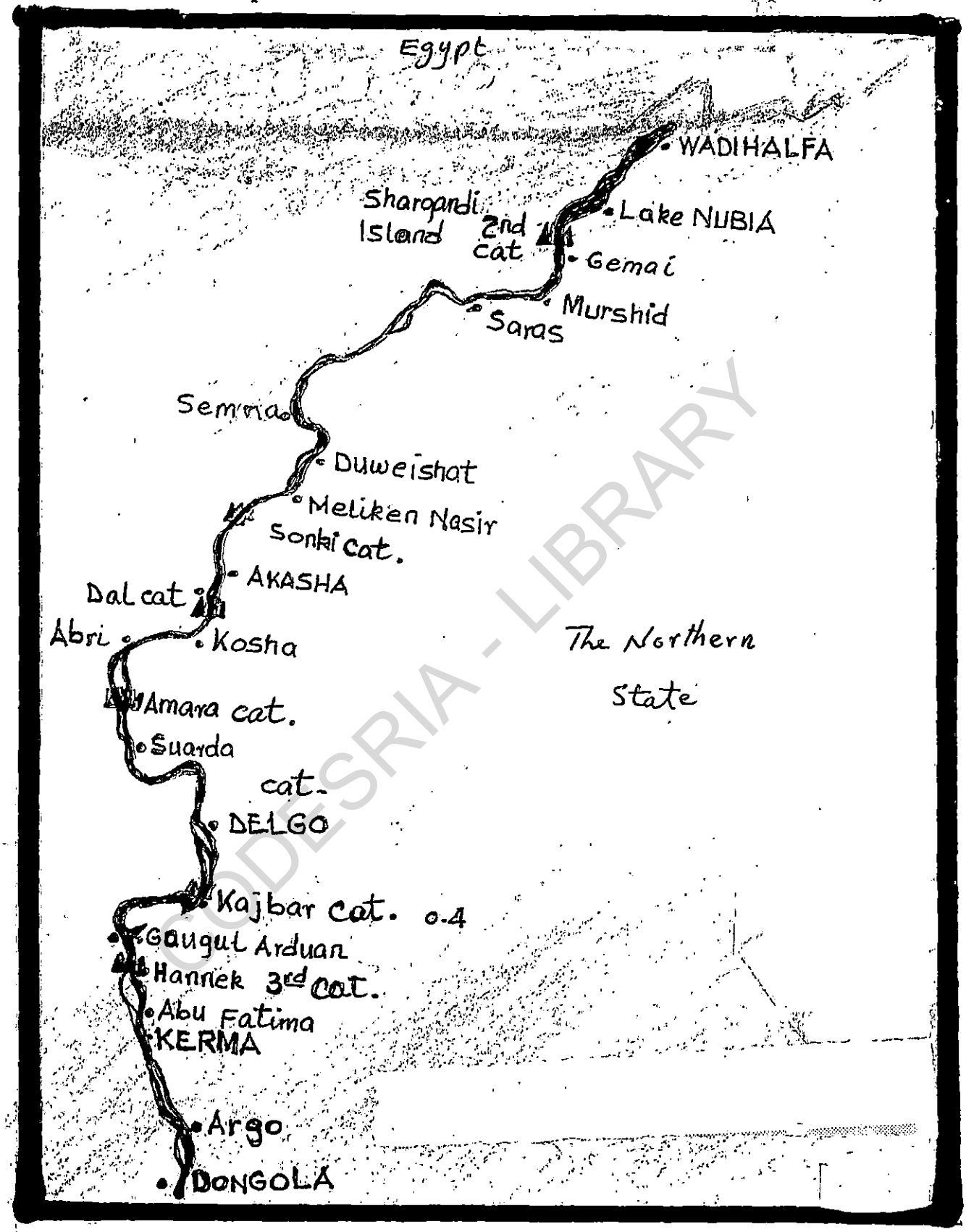
On the White Nile the research team could not reach far than El Jebelein due to the War in the south. So, the studied area lies between El Jebelein and Gutaina towns.

The total number of ferries is about 14, working in nine river-crossing berths. Thus, the total number of population settings covered by this service is about 18 centres. The density of service is one ferry for each 33 Km.

On the main Nile River, there are more than 44 ferries connecting about 70 population centres. The density of service is one ferry for 25 Km. This region lies below the Sixth Cataract; Wad Hamid, and above the Second Cataract, Abri area. As it is mentioned in 7–1–1 that this area is known for its history in boat building. But crossing on wood sailing boat is not always secured. The local boats building has developed in recent years through the use of out board engines attached to boats made of old barrels, which are not considered, technically, secured or safe for passenger traffic.

This study recommends that a central national firm should be established to cater for the proper technical specifications, import of suitable engines, assembly and/ or the construction of ferries, and finally the provision of on–the spot repairs and maintenance needed for this essential business. Rules and regulations should be set out to eliminate those boats, which are not designed in accordance with the technical specifications. Licensing procedures, for both boats and captains, should be assigned to such suggested firm. This firm should be authorized for frequent inspection of river crossing ferries.

Map No. 7-2: Cataracts In The Northern State



7–4 Toward A National Water Policy:

The previous chapters have analysed the importance of water in all agricultural activities, animal husbandry, hydroelectric power, industry, household consumption, drinking and in navigation. But, is our knowledge of water sufficient? The answer to this question is provided by Alfred Stefferud " Most of us are conscious nearly all the time of the importance of water in our lives, but actually our knowledge of it is pretty skimpy." [28]

Water is considered, by some scientists as a gift of nature just as is land. Others consider it as a factor of production, the sixth factor actually. While recently it is considered as a precious commodity that war between nations can be a result for obtaining it.[29]

In May 1997 an international agreement was signed in the United Nations, which considers the non- navigation activities of the international water channel networks. It includes items, which are to be discussed by interested scientists in the field of "international law". But the concern of this study, focuses on the ideas which are supported by UNISECO that water can has an economic value i.e. it is a commodity that can be bought and sold by those who can afford its price. On the other hand, the World Bank, is considering water as a commodity that can be subject to local and international exchange transactions since it has an international price. This may lead some to violate the existing laws so as to obtain fresh water and they may forbid other countries that have natural access to such waters. This brings us to a situation, which necessitates looking at our historical rights. We should look for both regional and international support to draw a National Water Policy. [30]

Hence, "The realization of (our) ignorance is the beginning of wisdom. The statement of a problem is the first step in its solution. It is a duty to discover facts in a true scientific, unbiased, unselfish spirit." As stefferud has stated.

In Sudan, the recent history shows some serious social problems as a result of lack of water as the famine, drought and desertification of the year 1984. At other times; there are problems of much waters as the result of heavy rains and floods as it happened in 1998. Ezra T. Benson states the same situation in the United States of America; "Nearly everyone in this country in the past few years has experienced

some problem caused by too much water when we do not want it or too little water when we do want it." (31)

Early in the 1970s, Sudan Government has declared a "Thirst Campaign" in which international aid was needed. A neighbouring country had responded positively and it granted Sudan certain amounts of money. Few months later, the political relations between the two countries had deteriorated, and the neighbouring country demanded repayment of the grant. The president of Sudan issued a Decree under the title "Gerish ELKarama" {A piaster for National Dignity} by which every working employee has to pay a piaster so as to refund the grant.

These examples show our need to know more about flood control, early warning systems, rational use of water and to develop underground water resources for future consumption. Because, as population increases more demands are being made on our water resources. So, as Alfred argues "The effective use and conservation of water will become increasingly important."

African experiences show that wars may take place between tribes, and in some cases between States, struggling over water resources. Coalition between individuals and State may occur for better utilization and protection of these resources. So, such conflicts over water use should have to be solved through proper water policy to be adopted by the concerned Governments.

As it is known the Nile River basin passes through nine African States. Egypt, Sudan, Ethiopia, Uganda, Kenya, Ruanda, Borondi, Tanzania and the Congo. Sudan government has to maintain good relations with all these States, for the sake of better planning and utilization of water resources. (32) Coordination and planning for future water uses must be considered more seriously than we have ever done before. The Nile Water Agreement, 1959, concluded between Sudan and Egypt must effectively be revised especially on the part of channel improvement and the historical rights of Sudan's nation.

An American scientist has concluded what is needed, "Five developments since 1940 have made us realize that we must take immediate steps to increase the conservation, improve utilization, and expand the administration of our water resources. These are, the Second World War, increases in population, production expansion, shifts in industry, and pollution of streams and lakes." (33). So, for Sudan, it has to take the same policy measures.

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CHAPTER EIGHT

RIVER TRANSPORT CORPORATION IN SUDAN 1973-1999

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RIVER TRANSPORT CORPORATION IN SUDAN (1973-1999)

This chapter analyses the performance of River Transport Corporation, (RTC) as a main operator in inland water navigation in Sudan. It considers its social, political and economic experiences during the period 1973-1993 and since then up to the year 1999. Special points such as: administrative organization, activities, responsibilities and economic performance are chosen to facilitate anlysis.

8-1. Background:

By the end of the year 1960 the river transport services were limited to Khartoum-Juba, Karima-Dongola, as all year routes, and Elsuki-Roseriers, a seasonal stretch, with a total length of about 2180 km. Although the field of river operations has decreased, successful social settings were created where river ports were founded, such as those of Karima in the north, Kosti in the centre and Malakal, with other small berths, in the south. These towns have provided many work chances and supported the social being of many families. Schools were provided up to the eighth grade. Health services were provided in addition to housing and other social services. Khartoum North is an ideal port in this regard. Workers and employees trade unions are organized and played significant roles in the socio-political life on these urban settings.

Politically, the period between the years 1973-1993 was rich in Sudan's recent history. The May era 1969-1985 was very important in the political history of Sudan. During the period May 1969- July 1971; socialist parties supported the regime. The period 1971-1975 witnessed a great political turn and the oppression of socialism. The Government, then, created a one party rule, the Sudanese Socialist Union, against the national opposition outside the Sudan. The political opposition, formed the National Front composed of the Umma Party, the Muslim Brothers and the Democratic Union Party, excluding the Communist party. In the year 1976, the Government made a political coalition with the National Front. Few months later, the Umma and the Democratic Union Parties went off the political coalition. The

Muslim Brothers Party continued with the government till it was overthrown by a popular uprising in April 1985. The period 1985-1989 was characterized by a democratic rule, which was ended by, an army coup in June 1989 this regime was superseded by the leadership of the Islamic National Front Party, which was the Muslim Brothers Party during the May Rule. Late in 1999 the name has become the National Conference (N.C). By "May 2000, a sharp dispute has resulted between the coup leader, who is the President of the Republic and the Political leader of I.N.F this has resulted in freezing the N.C.

The above account shows the political developments, at the national level, that has taken place during the last thirty years. It shows that the political regime is instable and it fluctuated from the extreme left to the extreme right that is to say, from the doctrine of Marxism to the doctrine of Islam.

The political instability, together with the changing ruling doctrine, has serious consequence on the socio-economic life of Sudan as a whole. It was known that; for example, the Communist Party was behind the Peace Agreement, which was concluded in 1972 between Sudan Government and the Southern Opposition at that time. Also it was in support to the labour movement and encouraged the development of trade unions, on the other hand, the Islamic Front is on a complete opposition to the above issues and has its alternative measures and positions.

River transport workers, as well as other workers, are greatly affected by these changing doctrines, as part of the Sudan social structure in general.

8–2. River Transport Corporation:

Administrative Organization:

On the first day of July 1972, the Streamer Administration was separated from Sudan Railways Department. [1] It was given the title of a full department, the River Transport Department. On the 11th of July1973 the President of the Republic has issued the Act No 37, which established an independent and a legal public entity i.e. River Transport Corporation. (RTC)

Similar Acts are issued for other organizations as well. That seemed to be a political action, for the sake of creating public units so as to be entitled for foreign finance. On the other hand, for River

Transport-Corporation, the rehabilitation and development of Southern Sudan was a recognized reason.

The salient points of the Act, 1973,are as follows:[2]

a) It provided full monopoly to River Transport Corporation, over the ownership of crafts, harbours and workshops in addition to other premises as offices and houses. The monopoly of transporting passengers, luggage, commodities, mail and animals has been assigned to it.
b) It is implied, in the Act, that River Transport Corporation has to reflect the government sovereignty. Since it is stated that the corporation is obliged to provide its services, for national economic interests, irrespective of the incurred costs. In such cases, the corporation has the right to submit a case for subsidy to be paid by the government.

The General organizational structure and activities of the corporation are as follows:

a) The Parliament should be reported occasionally on the different activities performed, or to be performed by the corporation.
b) The Minister of Transport supervises works of the Board of Directors, negotiates with the Minister of Finance the annual and development budgets, tariff approval, demands subsidy and other needed credits from local or foreign sources. The Transport Minister delivers operational reports to the Parliament.
c) An eleven member Board of Directors has the authority to legislate the general policies of the corporation. It spells out the national economic interests into applied forms. It has the responsibility of passing, to the Minister of Transport, annual reports and development budgets, required finance and other amendments in the tariff structure. It has the right to conclude foreign finance agreements and approves revenue generating and expenditure absorbing activities. Its members are not allowed, themselves or any member of their families, to benefit or participate in any competitive activity against the corporation.
d) The executive administration is composed of a General Manager and four advisory departments i.e. The Planning, Research and Statistics Department, The Police Department, The Legal Advisor and The Social Services Department. Besides, The Technical, The Traffic, The Accounts, The

Personnel, The Supply and Stores, The Training, Civil Construction and The Auditing Departments.

The total number of employees was about 5000 in 1985. At present it is estimated at 1400 employees. During the period 1990-1995 more than 4000 employees were dismissed for political reasons. The Northern reach was spiltted in 1993 and transferred to the Northern State. The working staff is highly qualified, trained and experienced. Among them are navy-engineers, economists, administrators and classified skilled labourers. By June 1994 all the top-management staff were dismissed an aspect that is considered as great loss of human assets, which is very difficult to compensate at the prevailing political conditions.

During the period 1980-1985, some foreign consultants claimed the overstaffing of the corporation. This might be true since by the time, about 75% of the provided supply was not fully utilized, in the South, due to the civil war between North and South Sudan. Other government officials, supported by some known merchants and some foreign agencies, claimed that the management was inefficient. Interviews held with some previously staff members for the purpose of this study, have shown that both arguments, stated above, are incorrect. Because, on the first level, the working staff members are usually recruited into service according to specific tasks to be performed, given that scheduled trips should be in operation. The actual navigation frequency was to find one steamer-navigating daily on the Southern River Stretch, which means that about 30 steamers are supposed to be in work during every month. If this level of output is decreased to one steamer per month, or even less than this level, it is quite logical to say that RTC is overstaffed. The respondents argued that, if peace were maintained in the South, RTC would not be able to staff the required crew for steamers to sail. For the second claim, inefficiency of management, the following reasoning is found justifiable; the management was composed of graduates of well known universities and polytechnics, at local and abroad levels, high secondary and intermediate technical school graduates and finally on-the-job trained workers, which were undertaken at local as well as at European firms. Surely, it is difficult to say that such a staff is not well qualified or inefficient. The problem really lies on the lack of confidence for political reasons only.

Inefficiency of management was one point among a series of similar criticisms which were properly phased during the period that

started in the year 1978 and ended in 1993.Other points raised against RTC include the following:

a) Monopoly should be released and a policy of free entry should be adopted.
b) Complete withdrawal of subsidy;
c) The private sector is ready to enter the river transport market.
d) Split of traffic operations from other infrastructural components, and
e) It is a loosing corporation.

Each of these points will be discussed thoroughly, where it is relevant, in this chapter.

8-3. Studies For The Development of RTC:

8-3-1ADAR Study:

The establishment of the corporation came as a result of a general study conducted by ADAR. [3] This study is considered as a base for planning transport networks in the country. It is based on macro-economic analysis of Sudan economy. It emphasizes the importance of river transport at the national level.

8-3-2. Contransimex Study: 1973[4]

Contransimex is a Romanian consultancy firm that was assigned the job for undertaking a study on the topic "Study Concerning Possible Improvements of Navigation Conditions on The Nile, The Khartoum-Juba Sector". The final Report dates March 1973. The study has become a base line for the projects implemented in the years 1976 and 1982. It is a recognizable effort determining the navigation channel between Khartoum North and Juba. It stresses the feasibility of the stretch. The main report also suggests some locations as landmarks to help and direct navigation. The most important contribution of the study is the specification of the demanded fleet, workshop equipment and docking facilities, which can be used in the future.

The Study is composed of a main report and so many appendices; it is so large and comprehensive. Reading and following its different particulars is not an easy job. Besides, that the determined channel does not include any measurement of depths or widths which are very important to make sailing easy, safe and secured when navigating above hidden hazards on the river-bed.

In addition to this study, Romania has contributed significantly in the development of river navigation in Sudan. It trained many secondary school graduates in different trades and specializations. Some are taught at university level, on economics, social sciences in addition to many branches on navy engineering. Others are trained as captains, for the first and, unfortunately, for the last time in the history of river navigation in Sudan. The chief navigators, in RTC, are "Reis", captains, most of whom are illiterate and old aged. For their very long years in work, they sail according to their experience and knowledge of the navigational hazards and conditions on the different navigable river routes in the country.

8-3-3. RODECO Study: 1974[5]

RODECO is a German Consultancy, which has prepared a study titled "Reorganization of The Traffic Department and Dockyards, River Transport Corporation, Southern reach". The German Agency For Technical Cooperation (G.T.Z.) financed the study.

The final report appeared in the year 1976. The study main concern was the reorganization of the Traffic Department, in an attempt to distinguish clearly engineering and administrative responsibilities. That is to say, a distinction should be made between "Traffic" and the "Commercial" sub-departments in River Transport Corporation. It also suggests new administrative organization for the dockyards in Southern Sudan in addition to other proposals for betterment of docking facilities.

The study is not fully utilized, may be because its basic concern is the Traffic Department and dockyards in the Southern part of the Sudan.

The study has opened opportunities for further technical cooperation between Sudan and West Germany, then, that has provided many training chances for top management and skilled workers. It sometimes also contributed indirectly, in the provision of push-tug engines, and directly through the supply of tools and machinery for dockyards and workshops.

8-3-4. The U.S.A. study-report "Improving Navigation On the White Nile River." September 1990: [6]

The study team was composed of three persons from the U.S.A. Army Corps of Engineers, Middle-East Division. The fieldwork has been conducted during the period 18th July to the 1st of August 1980. The study was made in response to a request from RTC for assistance in improving navigation of the White Nile River.

The final report contains; an introduction, River Navigation Constraints, River characteristics and observation, Availability of data, Recommendations, Corps of Engineers technical Assistance and conclusions. In addition to 23 plates and appendices composed of six titles.

The study is based on information obtained from the Contransimex and RODECO reports, mentioned above, and the study outlined R.R.I., GOPA, L and P forthcoming. The study team consulted many officials in Sudan and was counter parted by RTC General Manager, Southern Regional Manager, and River Agent at Juba, and the District Traffic Manager at Malakal.

The study recommendations are;

a) RTC should consider acquisition of a dredge machine and its support facilities.
b) Aerial photographs of the entire river are needed for preparation of a series of mosaic maps.
c) Data should be collected from the various sources, including all hydrographic and hydrologic data, soils and bed material analysis, maps, aerial photographs, etc. this historical data is essential for all ongoing studies to improve navigation of river.
d) Hydrographic surveys of the problem areas between Khartoum and Juba are needed.
e) One or two small reconnaissance boats equipped with a continuous reading depth sounder are needed.
f) RTC has to develop and maintain a staff of complete engineers and technicians for the future.
g) A navigation channel-marking programme is needed.
h) It is obvious that the water hyacinth will continue to create problems. Aquatic plant harvesting equipment could be used at the Jebel Aulia Dam to keep the water hyacinth from building up near the lock and delaying the movement of boats.
i) Daily river stages for the various locations along the river should be routinely obtained from The Nile Water Department.
j) Further improvement in radio communication is needed. Power suppliers for existing radios on the boats should be tied to the

vessel's electrical system instead of using batteries, which run down and do not provide adequate signed strength.

The study report is an appreciated work, which has been followed, few years later, by practical steps in improving the channel between Kosti and Bentiu.

8-3-5. RODECO and GOPA Study 1983: [7]

The title of this study is "Dockyard Relocation Study". The main theme of this study is to estimate and suggest possible locations, on the White Nile River, to relocate the existing ship-dockyard at Khartoum North. The decision was political i.e. it was originated from the Government which wanted to sell the shore-land where RTC headquarters and the dockyards were constructed.

The consultants were German firms who are able to examine the possible locations between Khartoum North and AbuZeid Ford. The possible locations are found to be at a) The existing dockyard at El Shajra South of Khartoum town, b) Few Kilometers up stream Jebel Aulia Dam, c) Existing Kosti Dockyard, and a few Kilometers up stream Kosti bridge on the problem area of Abu Zeid.

The costs of the new constructions in addition to that of removing the existing machinery were found to be very high. It could not be compensated by selling land or any investment on it. So, the project had been postponed.

8-3-6. R.R.I, G.O.P.A. and L. and P.:

This is a "Study of River Transport in the Sudan" it was undertaken by German consultants and financed by the European Economic Community. The final report appeared in the year 1984.

The study evaluates the present role of river transport in the Sudan, evaluates present requirements and recommends short term measures to allow the Government make best use of services provided by RTC. The study prepares a master development plan for river transport in the Sudan. It is composed of two volumes and appendices.

Part one includes short term development, it discusses the following topics, traffic analysis and short term forecast, inventory of existing facilities, operation and management, financial situation and finally it draws recommendations on these topics.

Part two includes chapters on; traffic projections for the whole Nile River, inventory of existing transport capacity, scenarios for future river traffic development, economic costs of alternative transport modes, investment plan, organization and management, financial analysis, economic cost and benefits; lastly, it recommends a phased development plan.

In April 1985 the Government was overthrown by a popular uprising then came a democratic rule which was ended in 1989 by a military coup, as had been mentioned earlier, and it seems that the whole issue has been forgotten.

8-3-7. Livesey and Henderson, Binne and Partners, and, Doshi Borgan and Partners Study:

The first two are consulting engineers from Britain while the third is a Sudanese consulting engineers and planners. The Study title is "Technical Navigatibility of River Stretches Wadi Halfa-Akasha-Dongola". The final report is printed in 1987. [9] The main contents of this study are: Chapter one is an introduction within which it is found that the terms of reference for the study are; a) to survey and prepare charts of the river stretches between the location of the study area; b) to assess the need for improvement works to the navigation channel, and ports and landings; and c) to formulate specific projects to implement the improvement, boards and landings indicating the approximate costs of these projects. Chapter two provides research summary. The third chapter presents the survey conducted. In Chapter Four the aerial photography and mapping activities are presented. The Navigatibility of river stretches is maintained in Chapter Five. While Chapter Six is devoted to transport economics. Studies of existing river services, in Sudan and Egypt, vessels and facilities are focused on another chapter. Potential transport systems and infrastructure are discussed in Chapters Eight and Nine. Finally, the last chapter indicates preliminary observations on projects for implementation.

The study contains four appendices. Among which number three is the most important one; it includes the results of the survey in the form of mosaic maps and charts. According to this study, the river length between Dongola and Wadi Halfa consists of three distinct types of water;

a) Broad, open, relatively slow moving stretches prone to sedimentation and the development of shoals: Dongola to Kerma; Delgo to Kosha

b. Fast moving turbulent stretches through areas of Cataract, Third cataract, Tumbus and Kabodi, Kajbar and Dal.
c. Still water stretch on the upper reach of lake of Nubia, downstream of the Dal Cataract.
d. The lengths of the problem areas are:

Tumbus/Kabodi	21.5 Km
Kajbar	0.7 Km
Delgo	3.0 Km
Attab	6.5 Km
Kosha/ Firka/ Dal	22.0 Km

The study suggests that, during low water level time, a combined river, road transport system can be used; through a roll-on/ roll-off system using suitably modified existing barges to transport trucks. These trucks would be loaded athwart ships and would traverse the non-navigable section by road.

8-3-8. Management Development Centre Consultancy Report.[10]

A Sudanese consulting firm prepared this report. The final report came out in late 1991.The terms of reference for this study include:

i) To propose new management structure to meet the expected separation of river infrastructure activities and the set up of a commercial company, which can operate the existing fleet.
ii) To up-grade the posts structure in the way that it can encourage employees to continue into service.
iii) Establishment of new consultancy posts instead of the single post of "Deputy General Manager".
iv) To eradicate duplication and contradiction between regional and headquarters administrative posts.
v) Establishment of well-defined job description to specify the needed academic qualifications and on-the-job experience to fill in every post. In addition to vertical and horizontal relationships between all posts in the new structure.
vi) To provide "job structures" to absorb all human cadres to be promoted, irrespective of other structures, and to determine time limits for every post.
vii) To reconsider job-titles in accordance with the proposed management structure.

The final report is written in Arabic, it consists of five chapters; the first is an introductory, the second deals with the developments

that have taken place on the administrative structure and the shortcomings of the existing one. The third chapter presents the objectives, reasons and the alternatives of the proposed structure. The fourth chapter specifies the job-description for the different suggested new departments. The final chapter is devoted to the proposed job structure.

In addition to these studies, RTC was able to conduct, through the Planning, Research and Statistics Department, many specialized studies in the field of river navigation in Sudan. This department has played a significant role in all the above studies in association with the Ministry of Transport and the Ministry of National Planning.

There are other studies, written on navigating the Nile River, which are not reviewed in this study. Foreign companies, whose work is associated with river transport, as the French, C.C.I. and the Chevron companies, when they were working on the Jongolei Canal and oil exploration in Southern Sudan, usually undertake such studies. Also the T.E.N.C.O. Company, which was working in Northern Sudan, prepared a study under the title "The Nile Barge System."[11]

There are other studies related to the topic of Transport Policy, which are to be outlined and analysed when this topic is discussed. These studies include; two prepared by the Ministry of National Planning, one by O.I.L.S., a Norwegian firm, and finally a study sponsored by the USAID and prepared by the Ministry of Transport, Ministry of National Planning and RTC.

8-4. River Transport Corporation Development Projects:

In the Establishment Act 1973, RTC was assigned the following national activities:

a) The responsibility of development and maintenance of waterways and the extension of services in new routes,
b) It owns the dockyards, slipways and workshops, on which crafts are assembled and maintained,
c) It owns and operates the commercial fleet for cargo and passenger traffic.
d) To issue licences, for private river operators working on river navigation. Mainly for local administrative purposes.
e) It represents Sudan in the "Nile Valley Navigation Corporation", that is a joint venture company between Sudan and Egypt.

f) Assembly and maintenance of local government river-crossing ferries.

8-4-1. The first Development Project (Jongolei Type):

During the first five years, after its establishment as a public corporation, RTC was able to get two important development loans. The first development loan included the following project; [12]

a) Purchase and assembly of six push-tugs, 2000-ton towing capacity each.
b) 28 barges, 500-ton capacity each.
c) Four passenger steamers, 233 beds – capacity each.
d) Seven river buses, 160 seat each.
e) Two sucking dredgers
f) Conversion of four barges into oil Barges, besides, the conversion of ten barges into self – propelled launches
g) Maintenance of many passenger steamers.
h) Workshop's tools and crafts' spare parts.
i) Purchase of equipment for two slipways.

The above-described project was assembled in the RTC shipyard at Khartoum North and was put into service before the end of the year 1977. The management was still demanding further economic development projects, in the different fields of activities as was assigned to it. Here is a summary of projects prepared by RTC and submitted to the government for finance.

I. Name of the project: [13]

Study to improve the navigation conditions between Sudan and Ethiopia on Gambela and Malakal reach.

The estimated cost of the project is US $100000. The project is to be located on the Sobat River, which runs through the two countries. The major components of the project include;

a) Exact definition of the navigable route and the determination of ports' locations,
b) Installment of navigation equipment such as kilo-posts' signals etc,
c) To specify the amount of dredging required to improve navigation so as to maintain at least 3 meters water depth to operate vessels of 1.8 meters draft, and

d) To determine the socio-economic and political benefits of the route.

The project is justified as it provides linkage between the two countries. It is supposed to ease the problems of communication in both countries as well as increasing the economic, cultural and social interaction between the regions it serve. As for Sudan, the Sobat area is rich, highly productive, with fertile soils capable of growing any tropical crops as well as being an area of high mineral and pastoral potentials. To develop such natural resources a reliable and adequate transport system should be established. The area is very swampy and it would be expensive for rail or road transport networks. So, river navigation will be the cheapest, vast, safe and the most practical mode of transport.

It worth stating that, steamers' services used to link Khartoum with Gambela since early during the twentieth century, but it stopped in the mid of 1960s. The type of crafts used, on Sobat River had a very small draught (1.2 meters), and a barge capacity of 80 tones. The round-trip between ElNasir-Malakal-ElNasir takes the double average time for such a distance due to the natural obstacles as water hyacinth, shallow draught, bends and lack of proper signaling. The main commodities transported are foodstuffs, salt, sorghum and petroleum products.

II. Name of the Project:
Improvement and development of river transport between Sudan and Egypt (The Nile Valley River Navigation Corporation).

The estimated cost is U.S. $ 15 million. The location of the project includes: a) between Wadi Halfa and Aswan, b) between Wadi Halfa Akasha and c) between Akasha and Dongola. The components of the project include: a) Signaling equipments, kilo-posts, buoys etc, b) development of Wadi Halfa port, c) opening of a route between Wadi Halfa and Akasha with the construction of intermediate ports necessary for operating the route, and d) study and implementation of projects to encounter navigation hazards enroute and hence makes continuous navigation between Wadi Halfa and Dongola the year round.

River navigation is found most feasible compared with railway and road transport. It is possible to link the two countries for political, social and economical reasons.

Ten years, after this plan, in 1987 the following parts have been undertaken:

a) The technical feasibility study of the stretches Dongola-Akasha-Wadi Halfa as is shown in 8/3/7 above.
b) A study to develop Wadi Halfa port, by German consultants, which is undertaken for the Egyptian side of the NVRNC. [14]
c) A navigation route has been opened connecting Wadi Halfa with Akasha.

It is hopped that the political relations between Sudan and Egypt would come to good terms so that this project could continue to the benefit of people in the area.

III. Name of the Project:

Top management development training programmes

So as to increase the managerial knowledge and skills in fields of modern administration and technology. The estimated cost is U.S. $ 450000. Such training could be maintained in Sudan or abroad. The project components include:

a) On-the-job training,
b) International seminars and
c) Short-term training and study courses for not more than six months. The project is described as follows:
    i. Training of top managerial echelon and intermediate cadres, both locally and universally by ways of seminars and short-term courses in appropriate institutions to make use of modern developments in the administration of inland waterways. Special emphasis has to be made on areas like shipping trade, tariffs, supplies and storage, stewing, handling, transport economics, development, research and planning methods, dock programming, computer science and quality control.
    ii. Utilization of highly specialized experts in inland water transport to help in setting an organizational chart for RTC with the purpose of eradicating bottlenecks and constraints and the introduction of new methods of management science. The nature of such a project is long lasting.

Chances for training should be opened for all employed staff, at the local levels as well as universal.

IV. Name of the project:
Study to construct a port at Jebel Aulia.

Estimated cost of the project is U.S.$ 350,000 for the study, and an amount of U.S. $ 180 million for implementation. The project is to be located upstream the Dam.

The components of the project are:

a) Traffic forecast.
b) The number and technical size of crafts to be used, as there are occasional strong currents and huge waves south of the Dam.
c) Construction of goods and passengers sheds, offices and personnel houses.
d) Handling facilities.
e) Hydrological survey to decide the amount of dredging and filling needed.

The project is justified as follows: -

The importance of the project stem from the fact that there is an urgent need to connect the Southern Region with other African countries, like Uganda and Ethiopia. Secondly, to link Khartoum with Atbara, in the North, aiming to release the railway bottlenecks and facilitate services between Port Sudan and the rest of the country through which rivers flow. Traffic towards Port Sudan is expected to increase as exports and imports are. Thus, Atbara could be an important terminal port. River navigation could be extended further north, to the existing Karima-Dongola reach, and possibly to Aswan.

V. Name of The Project:
Purchase of new crafts:

The estimated cost is U.S.$ 31 million, to be delivered at Khartoum North, the headquarters of RTC, its main shipyard.

The project is composed of the following units:

a) Six passenger boats; four for Kosti, two for Karima.
b) Six 300-ton each, oil barges for Kosti reach
c) Four 200-ton each, oil barges for Karima reach
d) Four 200-ton each, dry cargo barges for Karima
e) One floating dock 500-ton capacity
f) Six river buses.

g) Two inspection launches; for Khartoum North and Karima
h) Six 500-ton each, self–propelled barges.

This project is supported by the following facts:

a) More than 60% of the existing fleet has long passed its economic life. It has been working for more than 50 years all such fleet should immediately be replaced.
b) There is a tremendous increase in demand for river services as a consequence of "increases in the rate of growth of the economy, specially in agricultural produce, and due to the recent political stability in the south where 70% of traffic volume is achieved". RODECO report, stated in 8/3/3 above, estimates demand for river services in the south to be four times the existing level. For future demand estimates see Annex No. 12. The sailing units in stock are 20 tugs and 150 barges, the percentage available for monthly navigation is only 50% due to lack of spare parts and maintenance facilities. Nevertheless, RTC performance during the last three years is as follows: -

Table No. 8–1 Freight and Traffic By Reach (in 000)

	Southern Reach				Northern Reach			
Year	Pass	Pas/km	Tons	T/km	Pass	Pas/km	Tons	T/km
1975-76	216	76194	74	72938	91	11523	23	08777
1976-77	142	55158	70	73818	91	13557	31	12706
1977-78	171	101513	7 0	64503	84	12974	37	09200

Source: Planning, Research and Statistics Dept, The Annual Report 1976/1977, RTC, Khartoum North.

VI. Name of the project:
Purchase of Navigation Aids:

Purchase of river crafts for navigation improvements. The cost is estimated at U.S $ 300000. The project is to be located at Khartoum North.

The project components and description: -

A purchase of two signaling launches which should be equipped with modern equipment to enable RTC to study the hydrological features of the waterways with the ultimate objective of deciding the depths of river–beds, the contour lines and the relative distances of the

might be hidden obstacles from fixed land–marks and thus compiling the appropriate navigation charts for the piloting of crafts. One of these crafts is to be used in all reaches south of Khartoum while the second is to be used on the Nile River, northwards.

Improvement of navigation conditions is one of the most important development projects of river transport services. The introduction of new crafts and the improvement of ports, are, by necessity, demanding developed means of navigation control among, which signaling has top priority. See studies No. 8/3/2 and No. 8/3/4 above.

VII. Name of the project:
Purchase of Dredging Equipment:

Purchase of bucket dredger and other equipment for maintenance of river channel. The estimated cost is US $ 1.9 million. The project is to be located at Khartoum North.

The above amount is estimated for the purchase of two dredgers in semi-assembled condition so as to be completed on the shipyard at Khartoum North.

The purpose of acquiring these two dredgers is to improve navigation conditions by dredging the river beds, where necessary, to a depth of four meters at least, so as to allow ships of 1.8 meter draught, and those with more draught, to be used in the future all-through waterways the year round.

The dredgers are also to be used to harness some river courses by removing sharp bends and preventing precipitation of silt, thus, allowing the use of longer barge-trains, and eventually to lead to bigger towing loads.

The project is seen as a complementary project to the previous project (No. VI) As the signal launch will determine the location and places to be dredged.

VIII. Name of the project:
Construction of Ports Facilities:

Improvement and construction of new ports' facilities. The estimated cost is U.S. $ 2.75 million. It is designed to improve; Kosti, Malakal and Juba existing ports in Southern Sudan. In addition to the establishment of new harbours at; Dongola and Wadi Halfa in the north and at Renk, Shambi, Bor and Shajara in the Southern reach.

The components of these projects are: -

a) Improvement of existing ports: -

Kosti: To extend the existing quay walls, tarmarcing the port, to construct three good –sheds of 20X50 meters, a passenger platform, a dolphin and oil jetty of 1200 tons. Adding more cranes, lifts and belt-conveyers to enhance easy loading and off-loading.

Malakal: To extend the quay walls, tarmarcing the port, construction of goods and baggage shed of 20X50 meters, an oil shed of 15X30 meters, two 15 tons deck side.

Juba: To extend the quay walls, tarmarcing the port, building one 20X50 meters goods shed, additional two deck side rail cranes of 30 tonnes capacity and an oil jetty.

b) Construction of New Ports

Wadi Halfa: What is needed here is a complete harbour facilities including ship-berth, administration buildings, weighing, warehousing and stevedoring facilities and an oil jetty of 1200 tons.

Dongola: New complete harbour is required including a quay of 200X300 meters, one goods shed 30X15 meters, an oil shed 6X4 meters, archive 4X4 meters, offices with a total area of 120m^2,Staff houses of 900m^2 and an oil jetty of 1200 tons.

Renk: New harbour consisting a quay wall, two-deck side rail-cranes 15 tonnes each, two goods sheds of 40X50 meters, offices with a total area of 84m^2 and houses with a total area of 220m^2.

Shajara: Extension of the existing quay walls, tarmarcing, two 15 tonnes capacity deckside rail-cranes.

Bor: To include a quay wall, tarmarcing the port, station building and two 15-ton deckside rail cranes. (See studies8/3/2 and 8/3/3 above).

IX. Name of the project:

Study for the standardization of the design of river crafts. Estimated cost is U.S. $200000. This project is composed of the following:

a) To study the design of existing ships
b) Study and determination of the expected navigation conditions in the future.
c) To determine standard reaches with the purpose of minimizing the types of designs.

d) Setting up a more competent design office by promoting the skills of working staff and introducing experts in the different aspects of ship design and naval architecture.

It is important here that the Sudan is, most likely, to be linked with two interregional routes; between Sudan and Ethiopia, and between Sudan and Egypt. Thus, standardization of river crafts becomes a necessity.

X. Name of the project:
Establishment of Training School:

Study of the need for River Navigation Training School. To be located at Khartoum North. The estimated cost is U.S. $ 100,000.

This school is suggested to be a training centre, which covers all specializations, performed by RTC. The study shall include, the buildings needed, equipment and navigation instruments, modes, navigation charts and staff required.

The need for this school is dictated by the demand to have a well-educated and trained staff that can better utilize the corporation assets.

XI. Name of the project:
Top Management Training Centre:

A study to establish a training centre. The estimated cost is U.S $ one million. It is suggested to be located at Khartoum North.

The project is to include the following components:

a) Setting up of the following departments; navigation, mechanical engineering, civil engineering, economic and shipping departments.
b) To conduct a study to determine the following; buildings, number and qualifications of staff, the possibility of making use of the existing training facilities, and the equipment and instruments required, in addition to the needed modes, charts, maps and visual aids for the training programmers.

The above-discussed projects are still required to develop river services in Sudan. They have been an outcome of the newly established management encouraged by the implementation of the first development project, discussed in 8/4 above, and the promoting results obtained during the period 1973-1978.

8-4-2. Economic analysis:

The Annual Report of RTC for the year 1976/1977, shows that both the total tons transported and the ton/Km had increased as compared with the previous year 1975/1976. [15] The tons transported were 100405 while the ton/Km was 86.5 million for 1975/1976.

The passenger traffic had shown a declining trend during 1976/1977. The number transported was 233440 persons compared with 307185 persons transported in the year 1975/1976. The pas/Km had shown a decline as well, it was 88 million pass/Km in 1975/1976 declined to 76.2 million pass/Km in 1976/1977.

The operational revenue had increased by 11%, while expenditure had also increased by 1% in comparison with the registered figures in 75/76.

For the Southern Reach the tons hauled showed a decline by 5015 tons, while the ton/Km had shown a slight increase to reach 73.8 million compared with 72.9 for the previous year, 1975/1976. This means that the distance traveled is a bit longer during 1976/1977. The baggage and parcels had decreased to 5713 tons in 1976/1977 compared with 11731 for 1975/1976, while the ton/Km was 7.4 million ton/Km during 1976/1977 compared with 6 million ton /Km for the year 1975/1976.

The passenger traveled, in the South, was 142211 persons compared with 216264 persons transported in 1975/1976. The pass/km was 62.7 million in 1976/1977 compared with 76 million in 1975/1976.

In the Northern Reach, the total tons increased to 30655 tons in 1976/1977 compared with 23219 tons in 1975/1976. The ton/km. in 1976/77 was 12.7 million while it was 8.7 million in 1975/1976.

The total number of passengers increased to 91229 in 1976/1977 while it was 90921 in 1975/1976.

The decline, in the South, was due to decreased number of scheduled trips because of lack of fuel and machine-failures an aspect, which had led to announce two trips instead of four per month between Kosti and Juba. As well as the stoppage of Kosti-Malakal steamer due to health reasons.

While the increase in the tonnage transported, in the North, was attributed to the celebrations of the Independence Day at Dongola town.

8-4-3. The Norwegian Fleet:

The Peace Agreement, which was concluded in 1972 together with the encouraging performance of RTC during the first five years, had resulted in a more detailed development plans set out by RTC administration to further develop the river services in Sudan, as it is stated in 8/4/2 above. The Government agreed on a loan from Norway for the supply of river crafts. The delivery of this fleet started in 1979 and continued up to 1982. It was known, locally, as the Norwegian fleet; its components were:

1. 16 push tugs 2000-ton capacity each.
2. 50 dry cargo barges, 500-ton each.
3. 08 flat deck 500-ton barges.
4. 06 oil barges 300-ton capacity each
5. 02 floating cranes, 45-ton each
6. Spare parts, workshop tools, handling equipment.

The period 1978-1983, the second five years after the establishment of RTC, was very important because of the following reasons. First, it was the era of the Norwegian fleet. It also included the first amendment, release of monopoly of the RTC Establishment Act. On a third level, it witnessed a change in government policy towards the transport sector, in particular, and the economy in general, since the Government started to commercialize most of the public sector organizations. The impact of government policy is, on RTC, to be discussed in a coming section. What is important at this stage is the negative impact of the rumors spread on the production process in RTC.

It was expected that the operation of the Norwegian fleet could solve many of the difficulties confronting RTC, but as the Statistical report for the year 1982/1983 shows, it did not. This might be attributed to the above reasons in addition to the instability, insecurity and the beginning of the civil war in the South. [16]

The Statistical Report 1982/1983 shows that the total tons transported had shown a slight decrease, while the ton/Km almost remained the same in comparison with the year 1981/82. The supply capacity provided, for dry cargo and petroleum products, was estimated at 233040 tonnes, while the actual demand was found to be on the level of 64.5% of the capacity provided. On the other hand, the total number of passenger traveled was 87631 and 76379 for the years 1982/1983 and 1981/1982 respectively, while the pass/Km was 59

million pass/Km and 56 million for the same periods (see table No. 8-2)

Table No. 8-2: Freight and Passenger Traffic (in000) For The year 1981/82 and 1982/83:

Year	1982/1983	1981/1982
Description		
Dry Cargo:		
Tonnes	000115	000112
Ton-km.	083200	083000
Petroleum Products:		
Tonnes	000018	000025
Ton-km.	011100	013000
Baggage Parcels:		
Tonnes	000005	000004
Ton-km.	005900	004200
Total:		
Tonnes	000138	000141
Ton-km.	100200	100200
Passengers:		
Number	000088	000076
Pass-km.	059000	056000

Source: Research, Planning and Statistics dept.
Statistical Report 1982/1983, RTC

The total average revenue per one ton/Km was 64.7 mms. In the Southern region it was 61.8 mms while in the Northern region it was 16.8 mms. While the pass/Km recorded 10.6 mm in total; it was 10.7 mms in the South and 10.2 mms in the North.

For freight-traffic the Southern reach scored 92% of goods and 64% of the passenger traffic. While the Northern reach contributed 8% of goods hauled and 36% of the passengers transported by RTC.

On the end, the Statistical Report is analysing and commenting on the operational statistics according to RTC performance during the year 1982/1983, as follows:

a) It compares the revenue per one ton/Km, as calculated in the report, with the average revenue according to the traffic fares, which was 19mms per ton/Km, while the former was 64.7mms. It questions the great difference, in the absence of the operational expenditure, which was not yet finalized, it concludes that:

i. There is an exceptionally high increase in the total costs, or

ii. There is no traffic differential between the Southern and Northern reaches, as it should be.

It is worth mentioning that the absence of the expenditure accounts was mysterious and unusual act. The previous accounts, for the years 1977/78, 78/79 and 79/80 had shown an increasing cost/revenue ratio as follows 150%, 160% and 200% for the three years respectively. On the other hand, the operational statistics for the same period had stated that the average net return per ton/Km for goods traffic was 13.9mms, 21.69mms and 20.14mms respectively. This return does not include the government subsidy. The total return for the three years constituted an accumulated loss of L.S. 4.5 million, this derived situation deserves serious managerial consideration; it should be studied and questioned.

This study suggests that the expenditure accounts, if it is taken for granted, include other items than the mere aspect of transportation. Surely, it does not go for development or any other infrastructure business.

b) According to the navigation time-schedule the ratio of tug/trip was estimated to be 1104 tug/trip, what had been achieved was only 213 tug/trip, i.e. only operational ratio of 19%. The Statistical report put five reasons for this low performance:

I. Demand was far less than supply

ii. Shortages in fuel supply; RTC was able to get 37.5% out of its demand for petroleum products. Consequently, the same ratio should have been reflected on the operational level instead of the documented ratio 19%.

iii. Navigational constraints, especially on the area between Bor and Mongola, had an impact on increasing the vessels-turn round duration more than scheduled.

iv. Lack of spare parts for the old fleet and the continued occupancy of dockyards and slipways by the assembling of the Norwegian fleet.

v. Poor handling operations increase the barge turn-round duration. Beside, the big barge capacity, except for sorghum, leads to barge/trip delays because goods are not found in 500 tonnes weight in all ports during all times.

CHAPTER EIGHT: END NOTES

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CHAPTER NINE

FREE ENTERY IN RIVER NAVIGATION

CHAPTER NINE

FREE ENTERY IN RIVER NAVIGATION

The present analysis focuses on the new organizational structures formulated by Sudan Government in an attempt to improve the performance of river business. These changes, as argued by the Government officials, are meant to apply a free market economy. Hence, such concepts as, release of monopoly, privatization and liberalization were said to be governing the above changes.

The newly established organizations are; The River Transport Corporation, The River Transport Public Corporation of Northern Sudan, the Inland Navigation Department and the River Transport Company of the Peace and Development Corporation.

The Establishment Acts of these Organizations are analysed together with an evaluation of their performance. The evaluation is closely related to the prevailing political conditions in Sudan since the year 1980 up to the present time. This period has witnessed the political domination of the Islamic National Front whose doctrine has greatly affected the transport policy and hence, it has a direct relationship with the new set- up of these organizations.

The main characteristics of this period can be summed up in the following points:-

1. The inauguration of the River Marines Fleet (1996).
2. Conduct of many studies concerning the development of inland water navigation. (1987).
3. Consideration of RTC a loosing corporation and the transference of the Northern Reach (1993).
4. Establishment of a parallel river firms (1992).
5. Dismissal of all top management and intermediate cadres, in addition to so many labourers for political reasons (1330 employees during the period 1990-1999) in the River Transport Corporation.
6. River transport business is reorganized in the following form:-

i) River Transport Corporation (RTC).
ii) Inland River Navigation Department. (IRND).
iii) River Transport Company (RTCo).
iv) River Transport Public Corporation (RTPC).

9-1 River Transport Corporation.

After the transfer of the Northern Reach in 1993, (RTC) activities are limited to navigate on the White Nile River and El Suki-Roseries service on the Blue Nile, which was rented to a private operator. RTC is still responsible for the dockyards, slipways, workshops and the other port facilities at Khartoum North, Kosti, Malakal and Juba port. RTC, in 1990, had the following units :-

Table No (9-1): River Transport Corporation Physical Inventory in 1990.

Description	Southern Reach	Northern Reach
Old Fleet: Tugs	049	08
Jongloei Type	006	--
Hashaba Type	017	--
Passenger Boats	018	04
River Buses	007	--
Launches	010	--
Total	107	12
Dry Cargo Barges	106	08
Oil Barges	033	03
Flat Top Barges	012	--
Passenger barges	074	16
Total	225	27

Source:- Planning, Research and Statistics Department, RTC.

The above table shows that the total number of motorized crafts owned by RTC, in 1990, was 119 units in both reaches. On the other hand, the total number of barges, designed for all purposes, was 252 units.

Table No. (9-2), shows the remaining crafts at the disposal of RTC after the reorganization. It is noticeable that the Jongloei -Type Tugs and sixteen barges, which constituted the first development project of RTC as is shown in 8-4-2 above, are no longer considered as property of RTC. The whole fleet, premises, shipyard and workshops of the Northern Reach are also out of the ownership of the RTC.

It is clear that RTC is left with only seventeen tugs in work at the present time, which are not enough to make two convoys and the required emergency coverage.

The problem of lack of spare parts is becoming very acute, since the regular flow of spare parts had stopped for about ten years. This is because of the international sanctions against Sudan Government. The economic siege has strong impact on the bilateral agreements signed between Sudan Government and many West European countries in addition to the United States Government. Consequently, the flow of spare parts, workshop's tools and machinery and the supply of all docking facilities have stopped partially, with the exception of spare parts flow provided by the World Food Programme (WFP). So, to make any repair or maintenance for the old fleet, which is becoming obsolete, is almost impossible, at least for the time being. Studies for improving inland water navigation, which were conducted for RTC, are becoming dispersed among different governmental offices and due to the rapid human turn-over, it might be very difficult to find any body who can know anything done ten years back. So, for some of the newly established units, it may be difficult to know anything about the history of such development projects.

Table No(9-2) :RTC Physical Inventory as in 1999.

Description	No in Stock	No. Available
Old fleet Tugs	049	04
Hashaba Tugs Type	017	08
Passenger Boats	004	01
River Buses	007	05
Launches	010	04
Total	087	22
Barges Type 200	028	--
Barges Type 300	013	04
Barges Type 400	009	04
Barges Type 500	011	02
Barges Type 600	060	54
Barges Type 700	010	10
Barges Type 800	008	08
Passenger Barges	054	05
Total	193	87

Source, Planning, Research and Statistics Department, RTC.

Table No. (9---3), shows the tons and passenger transported by river transport during the last fifty years in Sudan. It is clear that the period 1956—1986 had the highest scores. On the other hand, the last

fifteen years are the lowest in the transportation of commodities, petroleum products, mail and animals.

Records for passenger transport are not available for the first ten years (1951—1961). The period (1961/1962—1980/1981), had the highest score in passenger transportation. The outbreak of the second civil war, in the South in 1983, has a negative impact that contributed in the low records. So, many of the citizens in the South, have migrated their homelands, return visits even are not made frequently. In fact many of the national institutions; such as universities, health services and many other public units, have deserted the South.

Low performance of RTC, especially in the South is a result of many factors; the War, technical difficulties and the Government transport policy. The Government has favoured road transport more than river and rail transport networks. Sometimes it is felt that the Government policy is against river transport, as a matter of fact its unannounced policies have created a lot of inconveniences even among the top management staff of RTC. When the policy was declared in public, the corporation was already emptied from its influential management and labour cadres. It has been stated in the beginning of this chapter that the unclear Government policy has an indirect impact on the work process of RTC. This means that low productivity which is a direct consequence of the employees feeling that they are not needed because there are other people who are more efficient and could stand as alternatives for them.

Table No (9—3) RTC Fright and Passenger Traffic For The Period 1951—1999. A fife Year Average. In (000).

Period	Tons	Passengers
1951/52 – 1955/56	087	N.A
1956/57 – 1960/61	110	N.A
1961/62 – 1965/66	133	104
1966/67 – 1970/71	128	255
1971/72 – 1975/76	108	204
1976/77 – 1980/81	096	109
1981/82 – 1985/86	103	049
1986/87 – 1990/91	055	010
1991/92 – 1995/96	060	011
1996/97 – Aug. 1999	042	014

Source: Computed from Documents of:
(a)Ministry of National Planning.
(b) Ministry of Finance (c) RTC.

9—2 The River Transport Public Corporation:

This is the new name for the previous River Transport Corporation, the Northern Reach. Early in 1993, the Government has decided to get rid of the economically loosing public corporations. The decision was to sell the Northern Reach to the Red Sea State for a sum of Ls 100 million. Few months later, another decision was taken to transfer it to the Northern State without value. So, the River Transport Public Corporation has officially come into existence since 16th July, 1993.

In the following lines, a brief analysis is given; showing the establishment and the recent history of freight traffic and, finally, the present situation in the North.

"Karima, which stands on the right bank of the Nile at the head of the navigable Dongola reach was connected with the Desert Railway some sixteen miles north of Abu Hamad by means of a branch line 138 miles long which was opened in 1906" as Morrice, 1949, states[1].

The Northern State is the net importer of basic consumer goods, construction material, petroleum products and it's self sufficient in dates and beans production.

The freight traffic from other parts of Sudan to the Northern State, the down stream traffic, is largely consisted of sorghum, salt, sugar, cement and petroleum products. These items constituted nearly 50% of the traffic. The other 50% included in the following items; wheat flour, onions, household effects, textiles and some construction material and equipment. On the other hand, the up stream traffic included the following goods; dates and beans, which constituted 87% of traffic and, various other items. [2]

The Northern State has a direct trade relation with Egypt; as a consumption and production centre, and as a pass-way for other exports and imports between the two countries. This trade volume is likely to increase, as population and agricultural production increase. The northern parts of Sudan are, connected with other parts of the country, with river and rail networks. River services were actively operated between Karima and Dongola, with Karima as a rail terminal. The distance between the two towns is approximately 287 kilometers. There is a regular air service between Khartoum and Dongola, largely caters for passenger movement. Dongola is also

connected with Omdurman by a road transport, which is still under construction.

River and rail systems in Northern Sudan complement rather than compete with each other. The rail freight traffic did decline over the past years and so was the river freight traffic (see table No. 9-4).

The separation of cargo and passenger fares between River and Rail systems, which was in effect since 1972, has its serious impact on the traffic flow between the two systems. Consignees had the right to transship cargo, say from Port Sudan to Dongola, through one procedure. After the separation this was impossible. Instead, they have to come to Karima to reship their consignments. This means that consignees are no longer attracted to ship cargo in this joint service. So, the main principle of complementarily of tariff structure is distorted. This is an administrative obstacle, which can be solved.

Table No (9—4) shows that the freight traffic moved by river during the period 1952—1971 was increasing in average. After the year 1972, the decline in tonnage started till it reached insignificant quantities during the last two years (1998—1999).

Table No (9—4) Freight traffic in the Northern Reach a five year average for the period (1951—1996).

Period	Tons
1951/52-1955/56	22134
1956/57-1960/61	28572
1961/62-1965/66	33734
1966/67-1970/71	38911
1971/72-1975/76	26412
1976/77-1980/81	26000
1981/82-1985/86	09770
1986/87-1990/91	03400
1991/92-1995/96	05000

Source:-Planning Research and Statistics Department, RTC.

The river fleet in Karima reach is composed of the following units:-

a. Push –tugs; (working) are; Jela and Karbakan, while the Zahra and Uttarid are not working. In addition to four scrapped units; Fashoda, Areal, Abu Tileih and Sanjack.
b. Launches are; the Barkal, Kurru and, during the 1980s, the Khartoum and Maridi had been added to the fleet. Khartoum was sent to work on Akasha – Wadi Halfa reach. At present its engines

were used in a ferry, which is supposed to be working in Dongola. These launches are in fact self –propelled barges with a towing capacity of extra two barges with a total carrying capacity of 450 ton.

c. Barges; there are five passenger/goods, compound barges, with 80 ton and 150 persons capacity each. Three-eighty ton oil barges, two one hundred twenty-ton, two one hundred fifty-ton and four two hundred- ton cargo barges. In addition to five compound barges, which have been lately sold; three were transferred to the Urban Water Corporation, while two were sunk.

On 12th March, 1996, a report was written and submitted to the Regional Minister of Engineering Affairs. (3) In the report, the General Manager of River Transport Public Corporation (RTPC), had declared that, due to lack of demand and the unfavourable navigation conditions, the situation is beyond the financial capabilities of the Northern State Government. He gave reasons for returning to the Mother Corporation (RTC). Few months later, this manager terminated his secondment to the Northern State and returned to RTC. His successor also had deserted RTPC and went back to Sudan Railways. By the end of the year 1999, most of the fleet units were sold, houses were rented, and so there is no river transport service in operation in the north. The administration of RTPC is looking at the present moment for a partner to operate the remaining units in the south. This destructive situation is a direct consequence of the Government Policy, which extended for not more than 30 months.

In the following lines, a discussion of the two reasons presented in the above-mentioned report is analysed.

First, historically, it is known that navigation conditions are difficult. And the produce is insufficient to encourage economical transportation as Page (1918, 1919) argues. (4)

" The navigable waterways that do exist are in their natural condition not suited for the carriage of large quantities of grain and other low valued products as cheaply as one would wish or as is desirable, in the development of a new(area)".(5) This was the case in northern Sudan in the year 1919. The High Dam (1964) is the first man- made construction, which can be considered as a change in the "natural condition ". As a result, the first, second and many parts of the third cataracts are made navigable. This means that the water level is higher than before till the fourth cataract. An aspect that can permit, comparatively, smooth navigation between Abu Hamad and Wadi Halfa. More efforts can make the rest "difficulty-- areas " open for all

– year sailing. In 1949, Morrice wrote " recent surveys have disclosed two possible sites for storage dams, one at the foot of the Fourth Cataract and another near the Dal Cataract." [6] These are the Hamdab reservoir and the Kajbar weir. It is very important to construct these two constructions so as to provide irrigation water, power generation, flood protection and transportation for the whole country. [7] Egypt can make use of these constructions especially in the future, in the provision of more stored water.

In 1919, Page wrote, concerning the demand side, " the output of the (northern) province is so small that any extensive improvement of the channel of this reach would not be justified. Economy should be looked for in some cheaper forms of propulsive power". It is true the output up to the year 1965 was so small, but after that date, rapid developments have taken place in agriculture, through the use of diesel pumps instead of the traditional means; the sagia and the shadoof. The output now is much more than in the year 1919, and it would be far more in the near future, provided that suitable transportation is rendered possible. The population of the area is also increasing; it is becoming a centre for population resettlement and growth. Improvement of the channel could be seen, at present, as justified. Propulsive power could be maintained through the use of advanced technology and cheap fuel, as a main power input, if local oil is produced.

What is happening to river transport in the north indicates that the Government has decided to withdraw itself out of the economic situation of the State. Historically, this State is known to be the most self – Reliance State in Sudan. But in comparison with the colonial rule, i.e. after ninety years (1906-1996), the picture seems to be unbelievable and shocking. The analogy between " before this region could be developed it will be necessary to provide a cheap transport route ", and the existing blind economic policy which proved to be a big failure, is surprisingly a pity.

The Northern State total area is 236480 square kilometers, constituting 9.5 % of Sudan's total area. [8] It borders Egypt, on an 800 Km. boundary, starting from Awienat Mountain and goes eastwards. The boundaries between Sudan and Libya extend in 224 Km starting from Awienat Mountain and southwards. The vegetation has been described above.

The State constitutes the main parts of the Nubians homeland, which contains the ancient civilizations of Kerma and Merowe. The Nubians are found in many other parts in both Sudan and Egypt. The

State total population is 566209 persons. The population density, of 204 persons /Km^2, is very low. This is because of the social movements that had taken a place in forms of voluntary migration, for the attainment of educational chances or in search of a better –living standard. (9)

The North is inhabited, mainly, by Nubians : Halfawein, Mahas and Danagla tribes. Minor population groupings, who have immigrated since long times, include; the Falallih (peasants), the Arab and Nilotic tribes. Involuntary immigration was imposed on the people of Wadi Halfa district, during the period 1962-1965, when the High Dam was constructed, which have flooded their towns and villages. The main reasons for population migration are lack of government development projects and inadequate infrastructure; basically absence of reliable and safe means of transport.

The social services, in the State, consist of the following units: 25 hospitals, 65 medical centres, 143 clinics and 92 other health centres. The total number of available physicians is 52 out of which 15 are specialists. The fertility rate is 4.8% and the natural rate of population growth is 1.9%.

Water and electricity are insufficiently provided, with irregular supplies. Electricity is generated from thermodynamic stations, regardless the presence of many cataracts, which constitute natural water falls, an aspect that can help in generating hydro-electricity with stable current and supply.

There are 447 "basic schools" with a total number of students 102588. The secondary schools are 75 having 12562-student seat capacity. In addition to Dongola University which is composed of the following faculties; Agricultural Sciences, Medicine, Mining, Arts and Human Studies, Sharia and Law, and Education.

Agriculture is a private ownership of individual, co-operatives or companies. The main crop sown are: wheat, beans, sorghum onions and pepper. The major horticultural products are; dates, mango, lemon, orange and grapefruit. Productivity per feddan is as follows:- 1.2 tons for wheat, 1 for beans and 0.8 for sorghum. On the other hand, grapes productivity per feddan is eight tons, six for lemon and eight for orange.

The livestock wealth is composed of the following heads; cattle 157565, sheep, 809958, goats 636157 and camels 40609.

Production relations in agriculture have been discussed in the chapter of Sudan Economy.

Except the vegetable and fishing canning, manufacturing plants in Karima and Wadi Halfa, there is no other unit to be considered in the Industrial Sector of the whole State. The State has great potential in mining, fishing and electricity generation if the Hamdab and Kajbar projects are materialized.

From the above analysis, it can be concluded that developing river transport costs a large sum of money. Perhaps the government can not yet afford it, but one thing is certain; we no longer have the shadow of an excuse for failing to investigate the new possibilities that are opening temptingly before us.

9-3 The Sudanese River Transport Company (RTCO)

Late in the year 1992, Sudan Government had decided to withdraw the Jongloei fleet from RTC so as to be given to the Peace and Development Corporation (PDC). In the next year (PDC), became a partner with the Marine Force, which owns the River Army Fleet. In the year 1994, the Sudanese River Transport Company was established within the PDC. In 1997, a partnership between the PDC and the Arm Forces instead of the Marine Forces was concluded. Thus, the RTCo is a partnership between the PDC the Arm Forces and Dan Fodio enterprises.

RTCo is a public unit responsible for the provision of cargo carriage on the White Nile River. It is directed by an engineer who was the senior army officer in command of the River Marines Force Fleet, which was inaugurated in the year 1986. RTCo operates services between Nassir, Bentiu, Malakal and Rabak.

The establishment of this company seems to be as a substitute for the Norwegian Company, which had applied in 1983 to run a joint-venture river business with RTC, but few months later, it regretted the application. This is so felt from the suggested contract between the Company and Sudan Government, which, was submitted, in March 1983, to RTC for comments.

RTCo was given all the push- tugs of Jongloei type in addition to 16-500 ton capacity dry cargo barges, which were owned by RTC. Still RTCo demands more crafts from RTC. Nevertheless, it started to build some river units. Other crafts, of the previous French company CCI, were added to RTCo fleet.

Since the Company is a new public unit, in the field of river navigation, it recruited most of its staff from RTC or those who were trained in it. The total number of employees is 147 persons.

RTCo has constructed two berths; one in Rabak and the other is in Bentiu. It plans to construct new harbours at Renk, Bentiu, Nassir, Shambi and Bor. The total estimated cost is about US $ 22 million. RTCo is planning to modernize Malakal and Juba ports with an estimated cost of US$ 6 million and US $ 20 million for the two ports respectively.

The company is also planning to improve navigation on the Ghazal, Sobat and the White Nile Rivers. It needs four dredgers with a total cost of US $ 6 million, while the cost of the technical survey and the dredging works is about US$10.24 million.

RTCo is able to transport the following:

Year	Tons
1998	20545
1999	10303

The above figures do not include other dry cargo than the crude oil, which is transported from Melut to Rabak. Since the year 1996, the company was able to transport about 40170 tons of crude oil.

The major constrains facing the company can be summarized as follows:-

i. lack of adequate finances especially that of foreign currencies.
ii. Burden of repaying credits to local financing agencies.
iii. Lack of sufficient number of barges.
iv. Absence of proper ports, berths and navigational aids.
v. Shortages in specialized barges for oil transport.

The above information has been extracted from two reports, which were submitted, with great thanks, by the General Manager of the company.

9-4 The Inland Navigation Department:- (IND)

An Act was issued in 24th Jan., 1980 (to regulate Inland Water Navigation) in Sudan. [10] Accordingly a department was established under the umbrella of the Ministry of Transport and Communication. The establishment of this department came as a result of the recommendation set by the economic conferences [11], which had been materialized in (the River Transport Policy Study, 1980). Recommendation No (3) states that (a public authority should be

created to take the full responsibility of construction and maintenance of fixed river transport facilities). On the other hand, recommendation No(4) reads as follows; (a separate public body should be assigned the responsibility of river craft registration and licensing on the lines as being done in case of road transport).[12]

The same policy- trend was repeated in the (Transport Policy Framework, 1982) which states that " the construction and maintenance of fixed facilities should be handled by a separate public sector agency, other than the RTC. This is essential to maintain parity in the application of regulation policies between private and public agencies ".[13]

The main points included in the 1980's Act are that the Department is responsible for registration, licensing and inspection of all inland water navigable crafts in Sudan. Twelve years later, in 23.11. 1992, a first amendment was made to the Act. This amendment was necessitated by many practical difficulties, which had faced the Department in the performance of the assigned tasks. The main objective of the amendment was to clarify and add newly missed concepts in the previous Act. A distinction has been made between privately owned river crafts and those owned and operated by the Arm Forces, Police and security agencies. The latter crafts have been excluded from the routine work of the department.

Recently, the Management is visualizing the importance of the Department. Keen efforts are undertaken to up-grade the work performance. It tries to attract the previous experts who were fired off or considered as abundant by RTC, to be staff members in the Department.

A second amendment has been submitted for approval by the concerned authorities. The main points raised in the new suggestion include; to develop the Department into a full Public Corporation, it highlights public safety, caters for prevention of water pollution and environment protection and, it limits the manufacturing of river crafts to standardized safety control and technical measures.

Some of the recent achievements of the department are as follows:-

a. In the field of registration, 14 units are registered.
b. In the field of provision of licences, 20 units are licensed. Only one of these units is working in long haulage.
c. In the field of inspection, 143 units are inspected.

As far as ports administration, dockyards ownership and operation are concerned, still, the Department is struggling with RTC

over the ownership of the existing ports and docking facilities, which are owned by RTC. Nevertheless, the development of new Wadi Halfa port is the prime responsibility of the Department. It is up-dating the previous pre-feasiblity study conducted in the year 1985, for the construction of the port. [14]

During his visit to Cairo, in November 1999, the Manager of the Department, succeeded to get some help from the Egyptian authorities in the form of provision of some navigational aid equipment, which is hoped to be put into effect soon.

CHAPTER NINE: END NOTES

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CHAPTER TEN

TRANSPORT POLICY AND PRICING

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TRANSPORT POLICY AND PRICING

This chapter analyses the rationale of Government intervention, the importance of drawing a transport policy and pricing system in Sudan. Thus, the main objectives of it are to judge the efficacy of our transport policy on theoretical and practical levels. Hence, the basic principles are provided and compared with the current practices.

10-1 Government Intervention in the Transport Sector:

Stubbs, Tyson and Dalvi (1980) argue that " In an ideal world there might be no need for Government intervention in transport policy. A perfectly functioning market could be left to determine the quantity, quality and price of transport services according to consumer preference and subject to resource constraints. The Governments' role in the transport sector would be confined to that of a producer and a consumer. Such an ideal does not exist, and Government intervention has been necessary in the transport sector" [1] They traced the history of Government intervention since the laissez-faire era during, which transport policy was evolved on an adhoc basis by Parliament, to determine, which of several rival railway to authorise in an area.

There are so many practical problems that rise in the transport sector, which call for Government intervention. In addition to the allocation of service mentioned above, there are problems of safety, over capacity, taxation, allocation of assets and subsidy provision. Such problems compromise direct concern for governments to intervene so as to provide both public and private transport means, to the benefit of all transport users.

Intervention in the transport market is needed in order to achieve optimal traffic flows and modal split, "especially if direct pricing is not feasible". Examples cited from other countries, show that the market in the transport sector is far from perfect allocator, and Governments of most political persuasions have needed a transport policy affecting the control of quantity, quality, organization and fiscal resource allocation of transport modes.

10-2 The Spheres and Effects of Government Transport Policy:

There are four main spheres of influence of government transport policy, the emphasis among them has varied from time to time, from mode to mode and from country to country. There are certain instruments, which are used as part of the policy, as legislative and fiscal powers. These instruments vary as well according to time, mode and country.

The spheres are; control of quality, control of quantity, control of the organization of the transport sector and control of resource allocation.

10-2-1 The Quality Control:

This covers a wide area, although the stress is usually on safety. Controls are both general e.g. speed limits, vehicle safety standard, applying to all traffics whether public or private using a mode, and specific to particular aspects of public transport. Examples of the latter are standards set for the construction of buses, and air crafts, the control of railway- operating practices and standards for transport operations, both for those in charge of vehicles i.e. pilots and drivers, and for managers in charge of businesses.

Quality regulations in Sudan are clearly set on Government – owned transport means such as railways, river navigation, air lines and the Mechanical Transport Department. The major objectives of policy is public safety. It is a legitimate aim of government policy to protect citizens through legislation and licensing in both the passenger and freight traffic. So, complying with safety laws uses scare resources and should be reflected in transport fares. The success of this policy is difficult to quantify because there can be no clear and objective standards by which to judge. Government supervision of the standards of motorized means, crews and operators should be provided.

10-2-2 The Quantity Control:

Quantity regulation usually applies to public transport and, as its name implies, it seeks to limit the quantity of transport services offered. This normally entails a reduction of supply compared to the uncontrolled situation, and some form of licensing generally achieves regulations.

Stubbs, Tyson and Dalvi argue that "there are two possible arguments that an economist could advance infavour of quantity control in transport. First, it can be argued that in some circumstances free competition, particularly freedom of entry into the market will result in overcapacity and that resources will be wasted in consequence. This argument only appears justified where operators are unable for some reason to forecast the future competitive situation and / or , where the expansion of capacity requires expensive infrastructure that cannot easily be put to alternative uses. Second, some form of quantity control may be needed in order to ensure that existing capacity is fully utilized. In both cases, the arguments for quantity control will only be valid in particular circumstances and on economic grounds it is difficult to justify the extensive controls still existing in many parts of the transport sector. In this sphere government policy has been to control the level of service with a view to preventing wasteful competition". (2)

Control, in Britain, has been wide ranging and covered routes, timetables, stopping places and, significantly, fares. The objectives of introducing controls were to protect the railways from unfair competition and to bring order into the bus market, which had suffered from excesses of competition.

The history of quantity regulation in the United Kingdom contains regulations not fully justified by the economic principles set out. Even in the case of the railways, it might have been more efficient overall to expose them to free competition in both the passengers and freight fields. And, if necessary, to pay a temporary subsidy that would have allowed them to price down to short- run marginal costs until the assets used in the sectors of their business, in which they were unable to compete in the long term, had reached the end of their useful lives. This would have avoided much capital expenditure on replacing these assets. In reaching these conclusions, it must be stressed, however, that a comprehensive quantitative study of the impact of quantity regulation had still to be carried out and that circumstances may differ in other countries.

10-2-3 Control of the Organization of the Transport Sector: -

The organization of the transport industry has been a concern, with degrees of reluctance, of Governments in many countries. It is not confined to situations where the Government itself owns part of the industry, but ownership by the state and reorganization by Government policy are highly correlated.

The extend to which Government Transport Policy controls the structure and organization of the transport industry varies considerably from country to country. In the United Kingdom, almost all railways, central or local Government owns 27% of buses. Even in the United States long –distance passenger railways services are operated by a quasi- nationalized agency and privately owned railway systems are the exception rather than the rule in most of the world.

The objectives of the control of organization are as follows; first, it may be necessary in order to promote large undertakings that can exploit scale economies in circumstances when normal economic forces would not bring about a merger. Second, if large-scale subsidization of an operator is necessary for whatever reason, they may be a political case for assuming control in these circumstances. Third, Government control of organization may be needed to promote the co-ordination of services within an area where numerous small operators exist.

Thus, the objectives of the reorganization were, on the one hand, to unify control that was diverse both geographically and among operating agencies and, on the other, to secure scale economies.

This sphere of Government policy has probably been the least successful so far as its influence on transport is concerned. The reason is that many of the difficulties faced by the transport industry have been the result of more fundamental problems than its organization and structure.

10-2-4. The Control of Resource Allocation:

The Government policy seeks to influence the efficiency of resource allocation in the transport sector. Indeed, this can be considered as the ultimate objective of the first three spheres of policy but in more recent times some aspects of Government policy have been directly concerned with resource allocation. Of particular relevance here are the way in which Governments use their fiscal powers in taxing road users and the way in which they use their financial powers by providing assets for the transport sector and subsidizing its operations. Transport policy influences resource allocation and helps to determine how much of each form of transport is used. Two areas of economics are important in this respect; investment and pricing, which have been given increasing interest by Governments.

In investment, the most important area of direct Government control of resource allocation concerns roads, for which Government Policy determines the total capital expenditure, the criteria for investment, the standards of construction and the parts of the network that should be improved.

Investment policy has some weaknesses such as;

i. Little systematic attention has been given to problems of inter-sectoral appraisal because of the enormous problems of comparing investment in different sectors in practice. Political decisions have usually been made with little economic guidance
ii. Within the sector the allocation of investment funds between roads and different public transport agencies has been haphazard.
iii. The interrelationship between pricing and investment and the efforts and the effects of different pricing policies used in the transport sector has been ignored.

For pricing policy, it is found that in some circumstances public transport subsidies, of either a current or a capital nature, could be a partial substitute for marginal social -cost pricing on roads. And that this is one area where Government policy could have a profound influence on resource allocation, as stated by Stubs and others (1980).

If a system of subsidies is needed, it should be integrated with the rest of transport policy. This is to ensure that pricing and investment policies are consistent, that the financial objectives of operators are consistent with the subsidy policy and that the subsidies do not in themselves introduce further bias in resource allocation.

In summary, it can be argued that the purpose behind Government regulation of transport may change from control of monopoly to control of competition. Such change may be attributed to a compound of two trains of thought. The first emphasizes the "Public Service" aspect of transport; the second suggests that some measure of conscious co-ordination of transport facilities would result in increased efficiency in operation and improved services to the public. Both implied that, in the sphere of transport, competition should be limited or controlled. [3]

The above-mentioned four spheres are the main components of every study that attempts to draw transport policy in a country. Given the main characteristics of Sudan's economy and transport networks, it would be easy to choose the best alternatives to draw a transport policy for Sudan.

The coming lines are briefing some of the efforts undertaken to draw a transport policy in Sudan.

10-3 River Transport Policy Studies In Sudan:

10-3-1 River Transport Investment Policy Study (1980): [4]

This study "was designed and supervised by a Transport Adviser, UNDP/IBRD Planning Assistance Project, with the assistance of the Head of the Transport Sector, Ministry of National Planning, has provided a concrete evidence to show the need and the desirability of changes in the pattern of investment and river transport operations for the consideration of all the concerned authorities". As stated in the foreword presented by the Under Secretary, Ministry of National Planning, Feb.1980.

The study falls in nine chapters including the following topics; River Transport Potential, Economics of Inland Water Transport, River Transport Operation Under The Existing Set up, Existing and Projected Volume Of River Freight Traffic, and The Role of Public and Private Investment In River Transport Operations.

This study recommends that:-

a. River transport facilities should be improved and strengthened to make River Transport more competitive with alternate transport modes.
b. River transport competitive strength should lie in lower costs and hence lower tariffs, which can be realized if the river crafts are intensively utilized.
c. The public sector investment in the river transport should give high priority to eradicate navigational constraints, such as water hyacinth, sharp bends, shallow depth, moving sands, etc to improve navigational facilities, and to reduce operating costs.
d. The private sector should be encouraged to participate in river transport line haul operations by lifting the entry control restrictions. The private sector should be given some concessions to attract private capital, managerial ability, and technical skills, similar to the ones given to the road transport agencies.
e. The RTC should strengthen its competitive ability in offering river line haul operations by auctioning redundant craft and capital equipments, drastically reducing the wage bill and

overhead expenses. It should set technical and operational standards for the private sector.

f. The RTC should provide river freight and passenger services in places where such operation may be essential in the national interest but unable to promise adequate returns. Such operations should be identified and studied for obtaining government subsidy to meet the additional costs.
g. The public sector should take the sole responsibility of the maintenance of waterways, improvement of navigational and communicational facilities, up grading and construction of river ports and other fixed facilities. The appropriate institutional arrangements are to be decided by the Ministry of Transport.
h. A public authority should be appointed to take the responsibility of craft registration and licensing.
i. A river transport user charge should be levied to help maintain and improve the basic river infrastructure.
j. The major focus now should be on problem solving feasibility studies, resulting in specific investment proposal in the form of a project for financing and implementation.

Although this study was not initiated by the Ministry of Transport or RTC, it is important to keep the time sequence of relevant studies regarding river navigation and its importance in affecting the transport policy in general and RTC in particular.

Academically, investment means the allocation of a specific fund for the attainment of known or desired output. Normally this is so in new projects or the rehabilitation of existing ones. The term economic policy denotes the presence of an objective, to increase efficiency, quality or quantity through certain measures to be taken either by the Government or market forces, as has been discussed in the chapter that deals with transport policy. If one has to apply the scientific meaning of these two concepts on this study, might be found, to a certain extent, irrelevant, as it does not apply any of the known concepts in investment, in addition to the lack of objective . policy measures.

10-3-2 Proposed Transport Policy Framework (1982): [5]

This is the title of an occasional paper prepared by the Ministry of Finance And Economic Planning, Democratic Republic Of The Sudan. In association of UNDP/IBRD, Planning Assistant And

Training Project .It was circulated in Feb.1982 " to all the agencies concerned with the transport planning and operation in Sudan. The main objective is to initiate comments and discussion on various transports policy views expressed in the report. So that a consensus can be reached for the formulation of a long term transport policy programme for the Sudan" [6].

The report foreword states that "one of the major important functions is to assist the Government of the Democratic Republic of the Sudan in formulating appropriate planning strategies at both the macro- economic and sectoral levels. This assumes special urgency at the present time, when sound economic planning is crucial to the successful solution of Sudan's immediate economic problems. For the past year, the Senior Transport Adviser "Non-Sudanese" and his colleagues in the Ministry of Finance and Economic Planning have been formulating their ideas on what sort of development strategy for the transport sector is required to support Sudan's development objectives. The result is the discussion paper, which sets out comprehensive and integrated proposals for a transport policy framework, covering all modes of transport. Final discussion and policy must of course rest with the country's political leadership. The function of an advisory project is to add as a catalyst in the decision-making process. This is what this paper sets out to do in the hope that it will assist and expedite the emergency of a consensus on transport policies in Sudan ". Wrote the team leader of the project.

On the other hand, the introduction states, "Since the planning process started in the Sudan, the transport problem has been singled out as the most crucial and serious, needing special attention. Initially, the main emphasis was on the improvement and strengthening of rail and river transport systems, but due to the inability of these transport modes to cope with the rapidly changing pattern and demand of transport in Sudan, road transport was encouraged to fill the gap. Since then, transport capacity in Sudan has expanded many folds. But much of the transport supplied is expensive, and the growing intermodal competition is leading to a traffic split, which is increasingly becoming uneconomic and resulting in misallocation of resources.

The private sector, so far, has demonstrated the ability to organize, manage and compete in the provision of the transport services. Such capability seems to be expanding very fast in response to the demand for transport services in the market and encouragement by the public authorities by way of subsidies and special concessions.

To strengthen the technical competitive ability of each transport mode, the disparities in the cost of operations of different transport modes resulting from the pricing, investment and regulation policies of the public authorities needed to be eliminated. This is basic and crucial for the transport users in making a rational choice" [7].

The study is composed of the following chapters; introduction, objectives of transport policy, transport investment criteria, role of private sector, policy framework; road, rail, river, air, ports and shipping, intermodal transport priorities, implementation and follow up.

The river transport policy framework is set as follows:

a. The study outlines that rivers in Sudan seems to have great potential for the movement of goods and passengers. The pattern and volume of freight traffic flows in Sudan is such that the river transport can provide a competitively efficient service to the transport users.
b. Regulation policy; the study argues that the basic economic characteristics of inland water transport are similar to those of the road transport. It suggests that ownership of river crafts can be separated from that of the waterways and terminals; the entry control should be lifted with the introduction of incentives to attract private capital, and "as the provision of waterways, navigational and communication and port handling facilities involve fixed investment of fairly large size, they fall within the purview of a public authority". The study adds that user charges need to be collected from the river transport operators for the maintenance and improvement of fixed facilities. And that RTC should be run as one of the competitors among other operators and later RTC can cover areas where private sector may not be willing to operate river services. It adds that the construction and maintenance of fixed facilities should be handled by a separate public sector agency. This is essential to maintain parity in the application of regulation policies between private and public agencies.
c. Pricing policy: The study suggests that the pricing policy needs to be drawn on the lines, similar to road transport. Once the entry control restrictions are lifted, and prices are left to the open market, the law of supply, demand and price will determine the tariffs of river services.
d. Investment Policy; The study argues that investment should be made on the improvement of river channels, provision of

navigation aids and the modernization and improvement of river ports. While investment on river craft should be left to private investors with the freedom to choose the design, size and technology "which can provide the best result to meet transport demand and permit efficient utilization of craft, and cost effectiveness in a competitive transport system.

10-3-3 Nile Transport Sudan; 1983: [8]

This study was one of the contributions made by the Oil Industry Services, AS, a Norwegian company. It made efforts to run a joint- venture company with RTC, to operate four-push tug and 16 barges between Kosti and Juba. It was the same company that had supplied the 1979-1982 river crafts to RTC. Also it conducted a study for dura storage on the White Nile area. This is an applied study to establish a river transport firm. The main chapters are as follows; Background, project area, river transport sector southern reach, project investment, expenses and revenue, economic evaluation, financing and two appendices; detailed cost information and an intention to set up a joint - venture river transport company.

10-3-4 Study of Private Sector Investment Constraints In River Transport; February 1984: [9]

This study is edited by engineer Ibrahim, A.A. and a transport economist El Khider, M.O.The study work was undertaken by a team from the Ministry of Transport and Communications, Ministry of Finance and Economic Planning and RTC. The United States, AID Programme, provided finance.

The foreword reads as follows; "during the year 1980, The Sudanese People's Assembly passed (The Regulation of Inland River Navigation Bill, 1979) to unify old provisions regulating river navigation, and to enable the private sector to participate in river transport.It includes rules, regulations and procedures for licensing, registration and inspection of crafts. In the past RTC had nearly full monopoly for operating crafts on (all the inland waterways), and by passing such a Bill, that monopoly no longer exists. Since the passage of the Bill, several individual and private companies have indicated some interest in river transport, but up to date, only few have positively responded and acquired licences. This has been the case since there are so many difficulties and constraints confronting private investment. This study aims at finding out these constraints, specifying private firms,which are interested to operate river transport

companies and providing clear technical and economical guidelines for such investors".

The initiative for this study came from the Ministry of Finance and Economic Planning. That was for the sake of implementing the Sudan Government Policy, to help the private sector to participate actively in inland water transportation. The USAID mission when approached, expressed a great interest in this idea and agreed to finance the study from the allocation of wheat proceeds.

The study falls in seven chapters running as follows; Chapter One introduces the study in question, while Chapter Two envisages the anticipated role of river transport activities in Sudan up to the end of the century. A comprehensive investors' market survey has been conducted for this study. The analysis of this survey is shown in Chapter Three. On the other hand, a well-developed investors' profile is worked out in Chapter Six. Chapter Four States clearly the rules and regulations that are essential to apply for, owning and operating a river transport fleet. In Chapter Five useful and practical calculations of investment have been shown so as to give a brief idea for private investors on how to operate economically river transport business. This chapter also shows how such projects would technically and economically is studied. Chapter Seven includes necessary appendices of the study.

10-4 Pricing River Transport Operations:

Prices are very important in resource allocation [10]. They are specifically important in river transport because they constitute an intermediate good used in the production of almost every other commodity in the whole economy. "Pricing is a means to an end, it must be related to an objective. In the elementary theory of the firm, a pricing rule is derived from the profit maximization objective. However, as relatively little transport is provided by private enterprise, with the exceptions of some road haulage, this aim will not suffice for the transport sector, especially in the field of river transport, and because in addition, many if not all, governments play a considerable role in providing transport, a more appropriate objective is one based on the aim of efficient resource allocation, which will be taken as maximizing the benefit to the community derived from the goods and services that transport resources produce. In effect, this means choosing to produce a particular set of commodities, and in this process pricing has a vital role" [11].

10-4-1 Pricing Principles:-

A presentation, of the marginal –cost and the modified pricing principles, as discussed by Stubbs, Tyson and Dalvi (1980), is provided. As well as the provision of principles and methods concerning calculations of Tariffs, as analysed by Matsveko(1982). Finally, the study hopes to draw a tariff scheme for river navigation in Sudan.

Marginal –Cost Pricing Principle: -

Stubbs, Tyson And Dalvi illustrate this concept by the following diagram; in which CD is a demand curve, which can be interpreted as showing how much consumers are willing to be pay for each unit of the commodity. If consumers are assumed to be rational, willingness to pay must equal the benefit derived from each unit; so total benefit is given by an area OCD. EF is the marginal cost curve, the area under which represents total costs. If output is set at OA units, total benefit minus total cost will be maximized, and this output could be brought about in the market by setting price equal to OB (i.e. equal to marginal cost). The pricing principle is therefore that price should equal marginal cost if the efficiency is to be attained. (See Fig. 10-1).

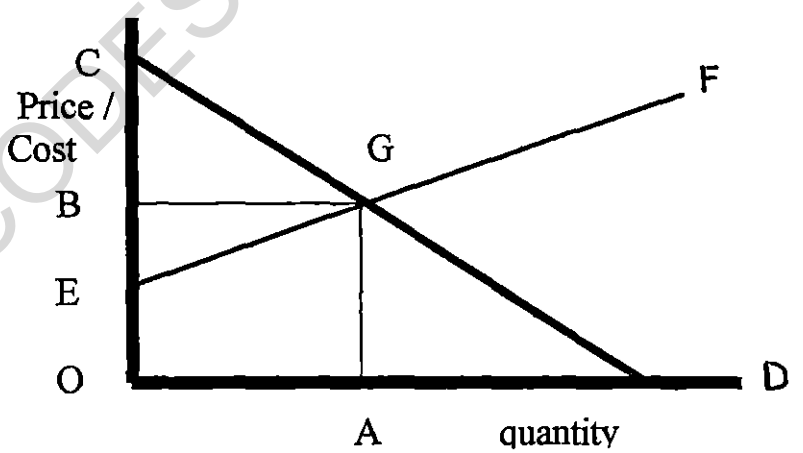

Fig. No.10-1: The Determination of Price

The marginal cost pricing principle rests on many assumptions, not all of which are explicit. The authors present the following

remarks. The first implicit assumption is that the only cost and benefit included are those borne by producers and consumers. In transport this is not true, because transport services impose costs and confer benefits to a third party technically called externalities. As costs and benefits to the whole community are the basis of the pricing principle, such third-party costs and benefits must be included. This is achieved by the principle that price should equal marginal social costs. Social costs are defined as the including of externalities.

A second problem concerns income distribution and arises particularly if one pricing policy is being changed for another, a proposal found frequently in transport, where existing pricing policies do not accord with the principle. This had led to suggestions that prices in the transport sector should not equal marginal social costs. The authors add an alternative view, adverse effects on income distribution should be corrected by other and more efficient means, i.e. as taxation policy.

A third is the problem of what pricing rules to follow in transport if marginal social cost pricing is not applied in other sectors of the economy. In principle marginal social cost pricing will only achieve the objective; if applied everywhere; and if this is not the case, it will not necessarily be correct to apply it only to transport. But the benefits within the transport sector of introducing the principle outweigh potential losses in other sectors.

Fourth is the problem of long- run and short – run marginal costs. In general long - term marginal costs seem more appropriate as a basis for transport prices, because in this way it can be ensured that consumer benefits from expensive long- life assets equal or exceed the value of the resources used in providing them. This is especially relevant when the replacement of an asset or an expansion of the transport network is being considered.

Finally, the pricing principle is complicated by the fact that transport is supplied in larger units than those in which it is demanded. The strict application of the rule would mean that the first passenger on a craft would pay the whole costs of running the craft while everyone else would pay only the costs of printing his own ticket.

ii. The Modified Pricing Principle:-

Prices should be set so that the beneficiaries from a service pay the long –run marginal social costs of providing it and the structure of prices reflects the structure of costs. This modified scheme takes into account the problem of externalities and indivisibility and it means that if costs are related to distance, fares should also be distance based. It means that the long- run marginal costs should be compared with some measure of benefit. This could be marginal revenue from the users of the service, or it could be an assessment of social benefits.

10-4-2. River Transport Tariffs:-

Matsveyko (1982) defines tariffs as "Payments for carrying cargoes, passengers and luggage as well as additional dues for operations connected with their delivery are called transport tariffs. Tariffs are prices of transport output and they are inforce for all individuals and organizations using the transport services". [14]
Tariffs play the following roles:-

a. Promote economically expedient siting of industrial enterprises over the territory of the country in order to cut down the transport expenses of national economy.
b. Help to establish optimum inter- regional and intra- regional links between the points of production and consumption. They rationally distribute carriage among different kinds of transport in compliance with the effective sphere of their use.
c. Stimulate better use of transport means.
d. Provide obtaining of necessary profit by transport enterprises creating conditions for their further development and for improving the economical calculations.
e. Stimulate and attract new kinds of cargoes to the transport sector.

The level of transport tariffs is governed by the carriage cost. In practice, when fixing the level of tariffs, the first cost and profitability are worked out according to the formula:

$$T = S + \phi k$$

Where;

T = tariff rate, cop/ t or cop/ pass.

S = first cost of carriage, cop / t, cop/ pass.
K = coefficient determining profitability.
Φ = specific absorption of funds for carriage defined by dividing the cost of main production funds and standardized turn over means used during carriage by the volume of carriage, cop/ t or co/ pass.

Hence, the tariff amount is based on the carriage first cost and, as a rule, exceeds it. In certain cases, however, it can be equal to the first cost or even lower. For river transport, the general level of tariff is established such, that the income from carriage should compensate the expenses and provide a certain per cent of profitability, usually accounted for 10—14 % of the cost of main production funds and standardized turn over means.

The level of the first cost is unequal in different carriage conditions. Thus, the average first cost is differentiated by a number of indications and it is calculated to develop tariffs for the all kinds of transport. For river transport the level of the first cost is divided according to river firms groups, kinds of carriage, kinds of cargo, consignments, ways and distance of carriage. In this case the first cost of operations when a ship is lying at berth and movement operation is determined separately. The first cost, when a ship is lying at berth compromises expenses during ships' being at berth in the initial and final points, which do not depend upon the distance of carriage. It reflects expenses connected with the carriage of transportation enroute. Its level depends upon the distance of carriage.

The first cost of shipping one ton of cargo (St) and ton- km (St km) is defined according to the following formula:

$$S_t = \sum\alpha + \beta L \qquad \text{cop/ t}$$

$$S_{t\,km} = \frac{\sum\alpha + \beta}{L} \qquad \text{cop / t}$$

Where;

$\sum\alpha$ = first cost at berth cop/t
β = first cost of movement cop/t
L = carriage distance.

Graphically, the first cost change, depending on the distance of

shipping cargo, looks as follows:-(See Fig. 10—2)

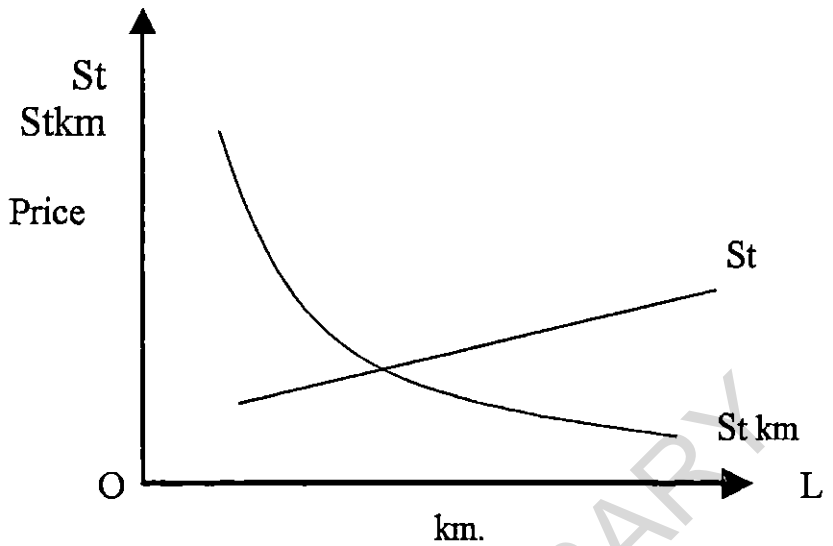

Fig. 10-2. The Dependence of the first cost level upon the Carriage Distance

The diagram shows that with increase of carriage distance the expenses per one ton increase and per ton / km decrease. This concept should be taken into consideration when working out tariffs.(13)

10-4-3 Ways Of Working Out River Transport Tariffs: -

There are three ways of working out river transport tariffs. These ways envisage the differentiation of tariff rates according to distance: -

i. Tariff for carriage is established as the sum of three tariff rates; it is calculated as:

$$T = B_{init} + B_{mov} L + B_{fin.}$$

Where;

B_{init}, B_{fin} = operation rates when ship is lying at berth in initial and final points respectively, cop / t.

B_{mov} = Movement operation rate, cop / t km.

L = Carriage distance, km.

The differentiation of tariff rates into movement operations and those at initial and final ports helps to fix individual prices for carriage of cargoes in separate directions between particular ports.

ii. Tariff for carriage is fixed as one rate for one ton of cargo which is worked out on the two- rate base:

$$T = B_{in.fin} + B_{mov} (L - e).$$

Where;

$B_{in.fin}$ = rate for operation when ship is at initial and final points and for movement operation at minimum carriage distance, cop / t.

B_{mov} = rate for movement operation, cop/ t km.

L = total carriage distance, km.

e = minimum carriage distance, km.

The minimum distances are determined in cargo tariff systems of some kinds of transport. For river transport, this distance is normally taken to be 50 km.

iii. Tariff for carriage is fixed as in the form of one rate for one ton of cargo, it is calculated on a multi- rate base:

$$T = B_{in.fin.} + B_{mov_1} e_1 + B_{mov_2} e_2 + \ldots B_{mov.n} e_n$$

Where;

$B_{mov_1}, B_{mov_2}, \ldots B_{mov.n}$ = rates of movement operation for certain zones of carriage distances, cop /t km

$e_1, e_2, \ldots e_n$, = Zone distances of carriage for which different movement operations rates are fixed, km.

With this way of calculation there is a possibility to change the movement operations rates at different route sections. As a rule, with the increase of distance, the rates decrease, however, for some distance zone, they can remain stable and sometimes increase. It depends upon the tariff policy as upon the carriage conditions at certain distance zones.

Tariff rates for operations when ship is at berth and movement, are fixed according to the general principle on the basis of the first cost, i.e.

$$Bi = Si + kPi$$

Where;

i = kind of operation.
Si = The first cost of i-th operation, cop/t.
P = Specific absorption of funds of the i-th operation, cop / t.

When designing and calculating more convenient tariffs are worked out on the two- rate basis.

10-4-4. Classification Of Tariffs:

Cargo tariffs for inland water transport are classified according to the following indications; kinds of carriage, communication, cargo and consignment.

I. Kinds of carriage; tariffs are subdivided into
   a) Carrying cargoes in bulk and cargoes in packages.
   b) Carrying liquid bulk cargoes in tankers.
   c) Towing ships and other floating objects.

   For groups of steamship companies, tariffs are divided according to the different first cost level in different steamship companies.

   Each group of companies may specialize in the carriage of specific type of cargoes. The first group is having the lowest level of the first cost and, hence, tariffs; while the last group is having the highest first cost and, hence the highest tariff level.

II. Kinds of communication; Tariffs are subdivided according to the means of transportation; river through road, rail through river and river through railways. Carriages in through mixed railway – river transportation is paid according to the railway tariffs, at the railway part of the route and according to river tariffs at the river section. To encourage traffic in mixed communications, some privileges should be given to consignees.

III. Kinds of Cargo; Each kind of cargo presented for carriage is included into a definite section, group and position. Each section includes output of certain large branches of industry (Agricultural, manufacture…) Each group is entered by cargoes having the same purpose in production or consumption

(raw –cotton, seeds, grain, vegetables, ...). Each position compromises cargoes to be carried in approximately equal conditions and with equal labour consumption (grain includes the following positions; wheat, rye, oats, maize, corncobs, rice) [16]

IV. Kinds of consignment; Tariffs are subdivided for ship, combined, small and container consignments.

Field of application:

Tariffs are classified into main, exceptional and local ones. Main tariffs are used when carrying the prevailing parts of cargo along the main lines. Exceptional tariffs are fixed for carrying some kinds of cargo at certain parts of the route and in certain navigation periods. They are used in cases when it is not expedient to use main tariffs for some reason or another. They can be privileged (decreased) and increased. For river transport, decreased exceptional tariffs are mostly used with the purpose of attracting cargoes and eliminating idle runs. Local tariffs are fixed for carrying cargoes along waterways being developed anew along short river reaches or on some tributaries. They are also used for transporting passengers and luggage in local and inter -city traffic.

According to navigation seasons, tariffs are usually increased when navigation conditions and ship operation become more difficult especially during low water level time. [17]

I) According to the internal structure, tariffs can be uniform and differential. Uniform is the tariff whose rate per ton- km, independently upon the carriage distance, remains constant and the amount of carriage payment increases directly proportional to the distance. In differential tariff the ton – km rate varies depending on the carriage distance. This rate normally lowers with the increase of distance, which corresponds to the character of change of the carriage first cost. The amount of carriage payment increases not proportionally to the distance.

II) Finally, according to external structure of tariff, they can be divided into table and scheme. In the table tariff forms there are given distances and ready rates of payment for the carriage of one ton of cargo between given points. It is a simple and convenient model, however, it can be used for few points and one cargo type or a group of cargoes having the same tariff structure. When there are many points of departure and destination, it becomes so bulky and inconvenient. In this case it is advisable to use scheme tariffs. (See Table No, 10-1).

Table No. 10-1; The Table Tariffs Form:

Destination / Origins	A	B	C	D
A	--	T1	T2	T4
B	L1	--	T3	T5
C	L2	L3	--	T6
D	L5	L4	L6	--

L: distance between points
T: Tariff notes for one ton.

In the scheme tariffs form, the rates of payment for one ton are given depending on the number of the tariff scheme and the zones of carriage distance without showing the particular cargo, point of departure and destination. Scheme tariffs form is the main one for river transport since it enables to define the payment for the carriage of any cargo at different distances.(See Table No 10-2).

Table No. 10-2 The Scheme Tariffs Form.

No. of Tar. Schemes	Rate for one ton			
	L1	L2	L3	L4
1	T1	T2	T3	T4
2	T5	T6	T7	T8
3	T9	T10	T11	T12
4	T13	T14	T15	T16

L: length of carriage zone.

10-4-5 Tariffs and Rules for Their Use: -

For the purpose of this part, tariffs are found to be of four types; tariffs for carrying dry cargo, tariffs for carrying cargoes in tankers, tariffs for towing ships and tariffs for carrying passengers and luggage. The first type can be subdivided into three; cargoes in ship, combined and small consignments, carrying sands or gravel –sand mixtures for short distance and, cargoes in containers and on pallets. While the last type can be composed of three tariff kinds; tariffs for carrying passengers in displacement ships, carrying passengers on high speed ships and tariffs for carrying luggage and cargo luggage.

Each of the above sub divisions has specific rules for its use. Here an analysis is provided for the rules of tariffs for carrying dry cargoes only.

Taking into consideration different conditions of operation in different river firms and, hence different first cost levels of cargo delivery, when working out tariffs for carriage of dry cargoes, these firms should be divided into some specific groups. The first group should include those firms with most favourable navigation condition, therefore the tariff level, for this group, is the lowest. The highest tariff level should be fixed for the last group, where there is the most difficult condition of fleet operation.

Tariff level for these groups of firms should be differentiated by means of tariff scheme. The number of this scheme, for carrying dry cargo, should be limited to a specific number (30 schemes for example) and to be ordered from number one up to number (30). Scheme No. (1) has the minimum tariff level. The rates of each following scheme are increased compared to the previous one by say 10 per cent. Hence, the highest rates are in scheme No. (30) (See Table No.10—2).

The number of tariff scheme depending on cargo group and position as well as on the group of operating firms is defined according to special table, placed in a price- list. Cargo group and position should be determined according to the alphabetical index to cargo nomenclature, placed in the same price-list where all the cargoes are given in the alphabetical order. Opposite of each of them there is indicated to which group and position of tariff nomenclature this cargo belongs. The index will be worked out as follows:-

A:	
A -1	641
A -2	582
A -3	391

The first two figures opposite the cargo denomination mean the group of tariff cargo nomenclature; the third one means the position. So, figures 641, for instance means that this cargo belongs to group 64, position 1.

The schemes (1 to 30) and the computation made enable to define the payment for carrying one ton of cargo for any distance. The form of this is shown in table No. (10-3) below. In this table, the payment rates are given according to distance zones.

Table No(10—3). Tariff Scheme Based On Cargo Nomenclature.

Position No.	River Firm Groups	1	2	3	4	5	6
	Group & nomenclature of cargoes	Tariff Schemes					
1	Group (21) Non- Ferrous Metals; Non-Ferrous Metals and their alloys.	15	15	21	20	26	39
2	Rolled non-ferrous metals	15	15	21	20	26	39
3	Non-Ferrous Scrap	03	04	09	08	14	31

Table No. (10—4) Tariff Payments Based On Distance Zones:-

Scheme No.	Initial Final Operations	Rates in Ls and cop. for one ton Total rates for Distance							
		0-50	51-60	61-70	71-80	81-90	91-100	101-120	121-140
1	0- 37	0-43	0-44	0-45	0-46	0-48	0-49	0-51	0-53
2	0- 40	0-47	0-48	0-49	0-51	0-52	0-54	0-56	0-59
3	0- 44	0-52	0-53	0-54	0-56	0-58	0-59	0-61	0-65
--									
20	2- 23	2-63	2-67	2-75	2-83	2-91	2-99	3-11	3-26
--									
50	38- 97	45-38	46-57	47-96	49-35	50-73	52-12	54-20	56-97

With the increase of distance, the carriage first cost had less difference, so the zone distance increases.

The minimum distance for carriage is normally taken to be 50 km. If carriage is carried out for distances less than 50 km, carriage payment should be taken for 50 km. The maximum distance is considered to be 2000 Km., and it should be divided into 56 zones:

0000	-	0050	km	01 zone
0051	-	0100	km	05 zones, 10 km each.
0101	-	0300	km	10 zones, 20 km each
0301	-	0600	km	10 zones, 30 km each.
0601	-	1000	km	10 zones, 40 km each.
1001	-	1500	km	10 zones, 50 km each.
1501	-	2000	km	10 zones 50 km each.

Tariff rates are to be calculated for carriage within the first zone for the final distance, i.e. for 50 km, in all other cases, for the mean zone distance. For instance, for zone 51---60 km distance, 55 km is taken, and for zone 601 –640 the distance 620 is taken as well.

Thus, the calculation of tariff rates, when making the table is carried out according to the following formula: -

$$T = B_{in.fin} + B_{mov} \left\{ L + \frac{Ł_n - 50}{2} \right\}.$$

Where;

$B_{in.fin}$ = the rate for operation when ship is lying at berth in initial and final points, as well as movement operation for minimum distance (50 km).

B_{mov} = movement operation rate cop/ t km.

L = distance up to the zone for which the tariff calculation is carried out, km.

Łn = calculation zone length, km.

When defining the tariff scheme, it is necessary to check the availability of exceptional tariffs for this carriage. They are given under each cargo group (See The Table No. 10-4), and are established as fixed rates per cent increments or rebates as well as by the change of tariff scheme number, i.e., the tariff is reduced.

To simplify the calculations of carriage payments, the cargo weight should be rounded off whole units, short kilogram being considered as the whole one.

CHAPTER TEN: END NOTES

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GENERAL RECOMMENDATIONS

GENERAL RECOMMENDATIONS

For the achievement of efficient and successful inland water navigation system in Sudan, it is suggested that the following points should be considered.

1- Planning of a Transport Policy:

To draw a transport policy for Sudan, the indicators presented in this work should be followed. Specially those of modal share of transport modes. Such a policy has to concentrate on Sudan special experiences and its economic characteristics. The principles of free market economy cannot be applied, as ideally as required, in Sudan's river transport or elsewhere, as has been discussed in this work. The study stresses the importance of monopoly rather than competition. The following points should be put into consideration when formulating the policy;

i. Social benefits of the whole community should be put as a target. Here, special elements have to be materialized. Transport safety, price stabilization, and equal distribution of development chances for all regions. Transport has to be treated as a service, which does not aim at profit maximization for its own sake.

ii. Sudan economy is characterized by bulk low–valued agricultural and industrial products. The adequate means for transporting such products are the railways and river navigation. The productive sectors have to provide accurate statistics for its transport demand.

iii. Government sovereignty, especially in under developed countries, can be achieved, through the control of water channel and some modes of transport as river and rail transport. This implies that State Capitalism should be favoured as an important objective for economic development. So, the planning of the transport sector, tariffing and resource allocation should be undertaken at the national level for the interest of the whole economy.

iv. Free entry for private sector, in the field of river transport, should be left open in specific areas such as tourism, fishing, urban-rural transport, river-crossing ferries and inter-city transportation.

v. River crafts, as civil units, should not be used in local wars especially in the South. Civil river crafts can be used in case of national emergency to help the River Marines Force, if need be.

vi. All water surfaces in Sudan have to be made navigable. These surfaces include permanent and seasonal rivers in addition to the canals of some big agricultural schemes.

vii. Rivers can be used to release transport congestion, especially in the capital towns, through crossing berths to provide short distance traveling services.

viii. This study recommends that a river stretch has to be made connecting Khartoum with Abu Hamad. The existing Northern reach should be expanded in the way that Karima and Aswan become connected with each other. Modern river transport has to cover new activity- areas such as tourism, intra-island and fishing.

2- Pricing Policy:

A pricing policy has to be adopted to provide the followings:

a. Efficient and safe transport services.
b. Cover the marginal social cost of operation.
c. Attain a profit rate of 12- 15%.
d. Stabilize prices of consumer goods at all regions of the country.

Liberalization of tariffs should be the responsibility of each planning and research unit in the different transport systems. Subsidies and privileges can be offered in accordance with the prevailing investment policies and regulations.

If the government wanted to transport specific commodities at rates less than the marginal social cost, it has to compensate such losses in a form of subsidy, in money terms. Tariff structures can be made as has been shown in this study, under the guidance of 1906, 1939, 1952 and the latter amendments that were made on tariff principles and structures.

3- **Restructuring of River Business:**

i. The river transport structures have to be re organized to make efficient resource utilization i.e., to make maximum benefits of the existing infrastructure. The historical activities performed by RTC are the best grounds for this reorganization; it should be strengthened to do the same works as before. River transport, in Sudan, can be reorganized, under the umbrella of RTC, bearing in mind the inter connection of the following activities;

a. Ports and navigation improvement.
b. Shipyard including workshop, docking and berthing facilities.

c. Transportation of cargo and passenger.
d. Spread of technical know- how and knowledge.

Such an effort should avoid miss-allocation of financial resources i.e. the establishment of similar public units with ubiquitous functions.

Channel improvement is a national task its cost should be shared by other river users.

For the spread of transport knowledge, this study suggests that an academy or institute should be established in Sudan. To award high Diplomas and Degrees on the different transport modes. Finally, it is recommended hat further studies, at university level, to be conducted specially on transport economics.

4- Water policy:

A water policy should be worked out taking into account the importance of water as a precious commodity having a price, at the international level. This point necessitates close and intimate relationship with all the neighbouring countries sharing the Nile River with Sudan. Special emphasis has to be given to the Nile Water Agreement between Sudan and Egypt on the part of channel improvement and maintenance. This point should be directed towards dredging, building of weirs, locks and dams which can provide a high water level to permit ships to navigate all through the year. The cost of this work should be shared, at a local level, by the energy, irrigation and drinking water supplying sectors. International help should be attracted to participate in these costs in addition to the provision of up to date technology in the field of river navigation.

APPENDICES

APPENDICES

Annex No. 1: Excerpts From: Nile And Congo: Comparisons in River Transport By: Richard Hill, Editor of The African Society, Vol 35, 1936.

The two great river systems of the Nile and Congo provide the principal means of surface communication between the outer World and the vast territory, loosely called Equatorial Africa, which includes the Southern Sudan, the northeastern Belgian Congo, and a large part of the hinterland of French Equatorial Africa. The two rivers serve other areas, and large tracts of Equatorial Africa are traversed by altemative means of communication....

Here, however, we limit our comparison to the two rivers, the Haut Fleuve of the Congo and the Sudan Nile, as media for long distance inland transport.

The river fleet playing on the Nile between Khartoum and Juba is an important link in the chain of uninterrupted communication by rail, road and river connecting Port Sudan and the ports of Egypt with centres as far distant as Mombassa, Nairobi, Kambala and the towns of the Province Oriental of the Belgian Congo. Throughout the length of the Nile Valley from the Mediterranean to the Great Lakes this composite organization provides regular services throughout the year for passengers, mails and merchandise. Two lines of communication connect Khartoum with the coast. Northward lies the rail and river steamer route to Egypt; eastward, over the Nubian Desert and the Red Sea hills, is the modern harbour of Port Sudan, joined to Khartoum by rail. These two routes from the Mediterranean and The Red Sea converge at a point near Khartoum, whence the river steamer service prolongs the route southward to Juba, a provincial capital within little more than a hundred miles of the borders of Uganda and the Belgian Congo. From Juba arterial roads radiate southward to connect with the railways and steamers of Kenya and Uganda and westward over the Nile-Congo watershed to join the Belgian road system of the Province Oriental...

From these two rivers ports two railways run, roughly parallel, to the West Coast....

Both lines, like the Sudan Railways, are built to the gauge of 3 feet inches, the so-called Colonial standard gauge....

Interesting comparisons may be drawn between the Haut Fleuve of the Congo and the Sudan Nile. They are of about equal length

between their extremities of navigation- 1077 miles from Stanleyville to Leopoldville, 1090 miles from Juba to Khartoum. Between these extremities the Congo drops 426 feet, the Nile 264 feet. Stanleyville, 1509 feet above sea level, stands 18 feet higher than Juba while Leopoldville, 1083 feet in altitude, is lower than Khartoum by 144 feet. The greater drop in the case of the Congo is modified, from the navigational point of view, by the relatively greater width and depth of the riverbed. The Haut Fleuve, emerging from the cataract of Stanley Falls, flows between dense, forest-clad banks for over three-quarters of its way. Finally the river narrows and flows through a defile into the broad expanse of Stanley Pool. The White Nile enters the Sudan over unnavigable rapids, which extend almost to Juba, the present commercial riverhead. Then, after traversing a flat, savanna country, the flows for several hundreds of miles through the swamps of the Sud, emerging at last into the bush country between Malakal and Kosti, and completing the remaining stage through semi-desert plains as it approaches the junction of the Blue and White Niles at Khartoum.

The Haut Fleuve is elaborately charted, buoyed and provided with shore navigation signs throughout its length by the Hydrographic Service of Direction de la Marine....

The Nile, on the other hand, except in the case of permanent obstructions, such as rocks and reefs, is scarcely buoyed or marked at all. Sudanese steersmen whose knowledge of the river is intimate and traditional, and to whom steersmanship is a hereditary fore almost an instinct navigate vessels. On Nile craft there are no other navigating officers; the officer in charge of the ship is the Engineer.

The cargo, again, does not impose upon the ship's designer the same limitations of size and draught, which confront him on the Nile. During certain seasons the Nile shallows make navigation difficult for draughts exceeding 3 feet 6 inches, while vessels of over 6 feet draught ply up and down the Haut Fleuve for the greater part of the year. The conditions of navigation on the Congo make it possible to utilise the craft considerably greater in size than on the Nile and to employ more extended methods of towing barges. The long, deep, and relatively straight stretches on the Haut Fleuve permit the practice of towing barges astern and the use of such devices as stern paddle and tortuous windings of the Upper Nile, barges are normally towed alongside or ahead of the towing unit....

The fleet is composed mainly of stern-wheel cargo carriers with limited but exceptionally comfortable accommodation for passengers.

Their principal trade is in palm kernels and palm oil. UNATRA possesses the larger fleet and operates regular services of passengers, mails and cargo. The river fleet of the Sudan Railways, a department of the Sudan Government, provides the equivalent services of Sudan Nile. Limitations of space compel us to confine comparison to these two fleets.

The UNTRA fleet is composed of express passenger steamers, cargo ships with limited accommodation for passengers, cargo carriers, tugs, barges and special craft....

On the Nile, where different trading and navigating con-ditions are met, considerably smaller sizes in ships and barges prevail. Every passenger steamer of the Sudan Railways fleet is capable of towing, alongside or ahead, a complement of barges varying in number with the capabilities of the towing unit and the conditions of navigation. Even the Khartoum-Juba passengers and mail steamers normally tow to six barges for passengers and goods, while the largest and most powerful type of passenger-carrying vessels are capable of towing a maximum of ten barges on certain stretches of the river. The capacity of barges designed for general cargo has been standardized, generally speaking. First-class passengers are accommodated on the steamer, while special passenger barges carry the second and third classes. The usual passenger amenities found in any modern ship are provided. Without exception the entire passenger-carrying fleet operated by the Sudan Railways on the Khartoum-juba reach is composed of stern-wheelers. Formerly steam was the sole propelling agent, though latterly Diesel-driven craft are also being placed in service.

The problem of fuel dominates the choice of propelling machinery. At all points on the Haut Fleuve there is a practically unlimited supply of cheap wood fuel. Hence wood-burning steam engines in Congo craft start with an initial advantage over vessels burning imported coal and fuel oil. Coal is not used on the Congo, while furnace and Diesel oils, in spite of a pipe line to Leopoldville from the coast and a refinery at Leopoldville, are more expensive than wood fuel, and are used only where superior speed and economy of storage space on board are desired. When the advent of the economic crisis brought to the fore the question of economizing craft, it was the Diesel-driven units, which were first laid up. On the Sudan Nile, on the other hand, wood fuel is scarce and relatively dear. Coal is consumed in the Khartoum-Juba passenger and mail steamers, wood and Diesel fuel in the smaller stern-wheel steamers and motor vessels on the secondary reaches. The reaction to the economic crisis in the

Sudan, far from causing the steamer administration to lay up its motor vessels, actually led to their more extended use. One of the disadvantages of wood fuel is the waste of time involved at the refueling stations. Hence it is that the coal-burning steamers employed in the direct Khartoum-Juba service of the Nile route are enabled, in spite of the handicap presented by a tow of barges, to achieve an overall speed between terminal ports equal to that of the express passengers steamers of the Congo, which are encumbered by no tow of barges at all but which are hindered by the necessity of stopping at refueling stations on each night of the voyage.

Among the more specialized cargoes carried on the Nile and Congo an interesting example is petrol in bulk. From an installation at Port Sudan petrol is carried in railway tank wagons to Khartoum, where the fuel is siphoned over the quayside into bulk barges, each of 60 tons capacity, which are then towed in a special dangerous cargo service to Juba. Here the petrol is pumped into a depot, whence tank lorries distribute the spirit to various points in the northeastern Belgian Congo and the south Sudan. After an unhappy experience with a small and unsuitable type of bulk petrol barge, Congo transporters have a bulk barge of 300 tons capacity under construction in the Leopoldville dockyards....

The economic crisis has undoubtedly hit the transport companies of the Congo with great severity, and it is to their credit that in spite of declining traffics they have no respect lowered their standards of efficiency. As on the Nile, one of the first actions of the transporters when faced by declining traffic was lay up the less economical craft and to use the remainder to the greatest operating advantage. In this sense the crisis has actually increased the efficiency of the services by forcing the administrations to husband their resources by reducing operation costs. On the Nile the crisis has, of course, been severely felt, but with a lesser degree of intensity since the Nile serves a relatively poor and more sparsely populated area less endowed with exportable wealth, and therefore less sensitive than highly capitalized Congo to the vagaries of world markets....

The Haut Fleuve, in contrast with the Nile, is a national highway situated off the main trans-African passenger routes. In consequence the Congo River services have not been designed primarily to accommodate tourist traffic. In comparison with the Nile services, those of the Congo are but poorly advertised; what publicity exists is of a primitive nature, doing far less than justice to the quality of the accommodation and catering provided, for example, on the

express steamers of the UNTRA fleet. While it is only fair to admit that the standards of catering and service on the Congo are not called upon to meet the exacting demands imposed by the tourist traffic, those standards are nevertheless very high.... Whether business or pleasure take him on the Congo or the Nile, the passenger is assured of a comfortable and interesting voyage .... He will be able to appreciate something of the problems and the difficulties, which face the river transport administrations in their task of maintaining and developing these two great inland waterways of Africa.

Annex No. 2: The Value of Sudanese Pound Compared To Foreign Currency:

Period	Foreign	Local "Pound"
1959	Sterling	0000.975
1961	Dollar	0000.333
1978	Dollar	0000.400
1983	Dollar	0000.900
1988	Dollar	0004.500
1989	Dollar	0006.500
1990	Dollar	0030.000
1991	Dollar	0100.000
1991	Dollar	0150.000
1992	Dollar	0200.000
1993	Dollar	0237.000
1993	Dollar	0270.000
1993	Dollar	0333.000
1994	Dollar	0404.000
1994	Dollar	0420.000
1995	Dollar	0517.000
1995	Dollar	0810.000
1996	Dollar	1110.000
1996	Dollar	1466.000
1999	Dollar	2580.000
2000	Dollar	2600.000

Source: Bank of Sudan. (different reports).

Note:

1. Before the year 1959 the Sterling Pound was the dominat exchange Currency.
2. During 1960-1975 the Dollar had dominated the exchange prices.
3. In the year 1978 Sudan Economy was restructured.
4. Sudan Economy was liberalized on Feb. 2nd 1992.
5. One Sudanese pound was equal to 100 piasters, 1000 Mms.
6. In the year 1980 the milli-pound became value-less. During the same decade the piaster was rounded to one pound. In Auguest 1999 the Dinar has become the official currency, it equals 100 piasters.

Annex No. 3: Organizations Withdrawn from the Public Sector

Name of the Unit	Action Undertaken	New owner/user
Gezira Tannery	Joint-venture	The Govt./Daewoo Company
Friendship Palace Hotel	Joint-venture	The Govt./Daewoo Company
The Telecommunication	Partnership	The Govt./ Local/ foreign partners
Arosa Tourism Village	Rent	Tommy Company
Some White Nile Agri. Schemes	Partnership	The Govt./ Local/ foreign partners
Aroma Cartoon Factory	Rent	Tommy Company
Niyala Tannery	Joint-venture	White Nile Company another one
Vegetable Canning Karima	Transfer without value	Fed. Associations of New Halfa
Timber Workshop UmHaraz	Transfer without value	Northern State
Nuba Lake Fishery	Transfer without value	Northern State
Livestock Marketing Corpor.	Transfer without value	Estate Bank
Arkweit Rest House	Transfer without value	Northern State
Refreshments and Supplies	Transfer without value	Livestock Bank/ Sudan Railways
Rainbow Factory	Transfer without value	ElShaeid Organization
Wafra Chemicals Company	Transfer without value	ElShaheid Organization
River Transport Karima	Transfer without value	Red Sea State
Rural Water Corporation	Transfer without value	Student Support fund
Urban Water Corporation	Transfer without value	Northern State
Duty-Free Shops	Transfer without value	Different States
Sudan Exihibition Corp.	Transfer without value	Different states
Khartoum Dairy Butana	Transfer without value	Sudanese Free Zones and Markets Corp.
Tokar Agric. Corporation	Transfer without value	Kassala State
Gash Agricultural Corp.	Transfer without value	Kassala State
Northern Agri. Corporation	Transfer without value	Tenants Association
Northern Gezira Dairy	Transfer without value	Peace and Development Corp.
Juba Hotel	Transfer without value	Estate Bank
Sudan Construction Company	Transfer without value	Estate Bank
National Cinema Company	Transfer without value	Estate Bank
National Distillation Comp.	Transfer without value	ElShaheid Organization
Sata Shoe Company	Sale	ElShaheid Organization
Blue Nile Binding Company	Sale	ElShaheid Organization
Central Fodder Factory	Sale	———
White Nile tannery	Sale	———
Angasna Mines	Sale	———
Oypson Khor Ariet	Sale	———
Jypson-AlMaica	Sale	———
Nuba Mountains Corp.	Sale	———
White Nile Agri. Corp.	Sale	———
Blue Nile Agri. Corp.	Dissolution	———
Agri. Machinary Kordofan	Dissolution	———
Mechanized Agri. Corp.	Dissolution	———

Source: The Economic Review, 1996.

Annex No. 4: Public Units Sold (millions)

Unit Sold	Bought By	Value		Debts		Paid		Remained	
		Ls	$	Ls	$	Ls	$	Ls	$
Abu Niama Kenaf	Dali Mazmoum	250	-	-	-	-	-	-	-
White Nile Tannery	Group of Companies	120	04	-	1.2	387.2	0.4	-	-
Blue Nile Printing Press	S. A. C. for Invest. and development	061	05.2	20.6	5.2	040.4	-	-	-
Sata Shoe Company	" " "	12.9	03.8	4.1	3.8	088	-	-	-
Ria Sweets Factory	Samir A. Gasim	39.7	-	-	-	039.7	-	-	-
Kirika Sweets Factory	Samir Ahmed Gasim	55.3	-	-	-	055.3	-	-	-
Port Sudan Weaving	Daewoo	-	30	-	30	-	-	-	-
Khartoum tannery	HejraBlg. & Construction Company	103.6	07	103.6	7	-	-	-	-
Rabak Ginning Factory	White Nile Company	0250	-	-	-	0250	-	-	-
Koko Dairy	The Cooperative Society	1382	-	-	-	1382	-	-	-
Sudan Mining Comp.	Advanced Mining Association	0500	-	-	-	0150	-	350	-
Sudan Hotel		0275	-	-	-	0275	-	-	-
Red Sea Hotel		0110	-	-	-	0110	-	-	-
Atbara Rest House		0005	-	-	-	0005	-	-	-
Kosti Rest House		02.3	-	-	-	0002.3	-	-	-
The Commercial Bank		1200	-	-	-	1200	-	-	-
Sudan Cotton Company		3187	-	-	-	3187	-	-	-
Others		-	-	-	-	303.6	-	-	-

Source: The Economic Review, 1996

Annex No. 5: Gross Domestic Product (1981/1982 Fixed Prices, Ls. Million)

	1990/91	91/92	92/93	93/94	1995
Agricultural sector	1918	2522	3188	3605	4283
Irrigated sector	0686	0939	0861	0996	1102
Mech. Rain-Fed	0100	0361	0389	0207	0273
Trad. Rain-Fed	0125	0189	0329	0373	0666
Livestock	0799	0822	1379	1754	1909
Forests	0208	0210	0230	0275	0333
Industrial Sector	1170	1269	1467	1480	1407
Mining	0006	0006	0012	0012	0013
Light Industry	0627	0716	0851	0794	0653
Elect. And Water	0152	0155	0192	0209	0193
Construction sector	0385	0392	0412	0465	0548
Service Sector	3603	3656	3734	3917	4276
Gout services	0782	0770	0656	0704	0841
Other services	2821	2886	3078	3213	3436
Gross Domestic Prod.	6691	7447	8389	9002	9966
Annual Rate of Change	1.2%	11.3%	12.7%	7.3%	4.5%
Decrease co efficient	2852	5396	10252	19479	41476
GDP of fixed prices	190838	401813	860090	1753563	4133657

Source: Ministry of Finance and Economy

Annex No. 6: Area and Productivity of Cash crops:

	Cotton			Groundnuts		Sesame		Sunflower	
	Long	Med	Short	Irrigd	Trad Rain	Mech. Rain	Trad. Rain	Irrigd	Mech. Rain
1990/1991									
Area	114	13	201	128	403	669	435	-	-
Production	044	3	144	117	21	67	14	-	-
Productivity	02.7	1.5	5.06	917	52	100	33	-	-
1991/92									
Area	162	92	200	141	412	967	313	-	77
Production	107	18	155	127	66	85	12	-	11
Productivity	04.7	1.4	5.5	900	160	88	38	-	143
1992/93									
Area	158	35	163	298	1000	2067	1140	-	221
Production	072	4	94	235	145	204	62	-	40
Productivity	3.5	0.8	4.1	789	145	99	54	-	181
1993/94									
Area	120	12	155	293	1565	1281	1650	26	118
Production	054	4	92	254	174	93	82	9	23
Productivity	03.5	2.4	4.2	867	111	73	50	346	181
1994/95									
Area	130	18	290	299	1814	1534	1672	78	95
Production	067	3	189	262	452	105	65	29	19
Productivity	03.6	1.2	4.6	876	249	68	39	372	200
1995/96									
Area	154	55	182	350	2020	2372	1184	77	82
Production	079	7	221	326	412	263	50	31	16
Productivity	03.6	00.9	8.6	931	204	111	42	403	195
Average									
Area	139.7	037.5	198.5	251.5	1202.3	1481.7	1065.7	159.7	119
Production	071	007	149	220	212	136	48	40	22
Productivity	03.6	01.4	5.3	880	153.5	89.8	42.7	481.7	180

Source: Ministry of Agriculture.

Annex No. 7: Sudan Exports and Imports: (In 000 tons)

Year	Exports	Imports	Local	Total	Exp.%	Imp. %	Local%
1970/71	1123	2073	1077	4273	026.2	48.5	25.2
1971/72	1127	1970	1099	4196	026.9	46.9	26.2
1972/73	1168	1913	0985	4066	028.7	47.0	24.3
1973/74	1040	2026	1138	4204	221.7	84.2	27.1
1974/75	0852	2303	1227	4482	019.0	51.4	29.6
1975/76	1317	2243	1360	4920	026.8	45.6	27.6
1976/77	1363	2379	1267	5109	026.7	48.7	24.8
1977/78	1154	2507	1470	5131	022.5	48.9	28.6
1978/79	1027	2529	1334	4895	021.0	51.7	27.3
1979/80	1260	2823	1070	5153	024.5	54.8	20.7
1980/81	1198	2749	1206	5003	022.5	54.9	24.1
1981/82	1918	2957	1485	5360	018.1	55.2	27.7
1982/83	1366	3388	6985	5829	023.8	59.0	17.2
1983/84	1015	3135	6908	5058	020.1	62.0	17.9
1984/85	0558	3337	0691	4586	012.2	72.8	15.0
1985/86	0534	3826	1390	5750	009.3	66.5	24.2
1986/87	1097	2824	1332	5253	020.9	53.8	23.3
1987/88	1217	3739	0823	5779	021.1	64.7	14.2
1988/89	1085	3421	1845	6351	017.1	53.9	29.0
1989/90	0961	3250	0831	5042	019.1	64.5	16.4
1990/91	0954	4069	0669	5692	016.8	71.5	01.7
1991/92	0648	3542	1183	5373	012.1	65.9	22.0
1992/93	0954	2785	1650	5389	017.7	31.7	30.6
1993/94	1019	3078	1102	5199	019.6	59.2	21.2
1994/95	0567	0896	0642	2107	026.9	42.4	30.7

Source: The National Comprehensive Transport Plan for the period (1993/1994-2013/2014, P. 49.

Annex No. 8: Freight Traffic By Transport Modes (000 tons):

Mode	Railway		Trucks		River Trans.		Air Trans.		Total
Year	Ton	%	Ton	%	Ton	%	Ton	%	Ton
1970/1971	3125	74	0972	22.9	129	3.0	03	0.1	4239
1971/1972	3169	73.2	1027	23.7	139	3.1	01	0.02	4331
1972/1973	3034	723	1152	27.9	011	0.3	02	0.05	4199
1973/1974	2901	65.8	1425	32.2	091	2.1	04	0.1	4421
1974/1975	2684	57.3	1895	40.4	101	2.2	06	0.1	4686
1975/1976	2513	53.8	2043	43.7	100	2.4	05	0.1	4671
1976/1977	2761	52.4	2393	45.4	107	2.0	07	0.9	5268
1977/1978	2602	46.9	2480	51.2	102	1.8	07	0.1	5551
1978/1979	2189	42.8	2817	55.0	106	2.1	06	0.1	5818
1979/1980	1961	39.2	2933	58.7	094	2.0	07	0.1	4994
1980/1981	2120	38.6	3264	59.5	096	1.8	03	0.1	6411
1981/1982	1720	31.6	3620	66.4	106	1.9	03	0.1	5131
1982/1983	1631	25.5	4625	72.1	150	2.3	05	0.1	4761
1983/1984	0909	18.7	4045	79.0	114	2.2	03	0.1	5622
1984/1985	0896	18.8	3813	80.1	049	1.0	03	0.1	5357
1985/1986	0721	12.8	4879	86.6	029	0.5	03	0.1	5760
1986/1987	0839	15.7	4453	83.1	054	1.0	11	0.2	6489
1987/1988	0735	12.7	4972	86.3	050	0.8	03	0.1	5890
1988/1989	0754	11.6	5682	87.5	050	0.8	03	0.1	5890
1989/1990	0570	11.4	4351	87.2	066	1.3	03	0.1	4757
1990/1991	0622	10.5	5199	88.3	060	1.1	03	01	4679
1991/1992	0424	07.9	4262	89.6	067	1.4	04	01	5272
1992/1993	1040	22.2	3579	76.5	056	1.2	04	01	4679
1993/1994	1750	33.2	3462	65.6	056	1.1	04	01	5272

Soucre: National Comprehensive Transport Plan For the Period (1993/1994 – 2013/2014).

Annex No. 9: Passengers Traffic By Mode of Transport (000):

Mode	Railway		Buses		River Trans.		Air Trans.		Total
Year	No.	%	No.	%	No.	%	No	%	
1970/1971	3420	18.6	14041	79.2	262	1.40	137	0.8	18361
1971/1972	3240	17.3	15615	80.0	296	1.60	229	1.1	19515
1972/1973	2810	14.5	16181	83.3	182	0.90	249	1.3	19422
1973/1974	2950	14.6	16856	83.2	229	1.10	225	1.1	20260
1974/1975	3070	14.4	17558	82.0	309	1.50	328	1.5	21265
1975/1976	3850	16.8	18482	80.5	233	1.00	382	1.7	22947
1976/1977	3030	13.0	19558	84.0	255	1.10	344	1.9	23187
1977/1978	2440	10.2	20696	87.2	140	0.60	428	2.0	23734
1978/1979	2330	09.3	21996	88.0	170	0.70	520	2.0	25016
1979/1980	2040	08.1	22676	89.8	079	0.30	467	1.8	25262
1981/1982	2680	10.1	23377	88.1	076	0.30	399	1.5	26532
1982/1983	2210	08.2	24100	90.0	088	0.30	409	1.5	26807
1983/1984	2580	09.3	24850	89.0	047	0.20	433	1.5	27910
1984/1985	2260	08.1	25115	90.2	021	0.10	451	1.6	27842
1985/1986	2020	07.1	25905	91.1	010	0.04	496	1.7	28431
1986/1987	1140	04.0	26615	94.6	010	0.04	370	1.4	28135
1987/1988	0850	03.2	25050	94.6	015	0.10	570	2.1	26485
1988/1989	0730	028	25112	95.4	011	0.04	570	2.2	26423
1989/1990	0850	03.3	24315	94.4	012	0.10	570	2.2	26747
1990/1991	0890	03.4	24531	94.3	008	0.03	583	2.2	26009
1991/1992	0540	02.0	25299	95.7	007	0.03	590	2.2	26936
1992/1993	0540	02.0	25309	95.7	007	0.03	590	2.3	26446
1993/1994	0540	01.6	31655	96.5	007	0.02	590	1.2	32792

Soucre: National Comprehensive Transport Plan For the Period (1993/1994 – 2013/2014).

Annex No. 10: Freight Traffic Performed By RTC during, almost, 50 years. (Tkm. In millions)

Year	South		North		Total		Percent	
	Ton	Tkm.	Ton	Tkm.	Ton	Tkm.	S	N
1951/1952	058091	049	23823	4.8	081914	053.8	71	29
1952/1953	055644	043	22348	4.4	077892	047.4	73	27
1953/1954	063012	053	19478	4.0	082490	057.0	77	23
1954/1955	075237	063	22381	4.4	097618	067.4	76	24
1955/1956	070269	059	22742	4.6	093011	063.6	75	25
1956/1957	063012	053	25799	5.2	088811	058.2	71	29
1957/1958	075474	063	24353	4.8	099827	067.8	75	25
1958/1959	102521	086	31149	6.2	133670	092.2	76	24
1959/1960	080027	068	30712	6.2	110739	074.2	72	28
1960/1961	088132	074	30847	6.2	118979	080.2	74	26
1961/1962	096213	078	31980	6.4	128193	084.4	75	25
1962/1963	100122	084	33813	6.8	133935	090.8	75	25
1963/1964	115039	097	35024	7.0	150063	104.0	77	23
1964/1965	089771	076	32163	6.4	126934	082.4	71	29
1965/1966	092015	078	35691	7.2	127706	082.2	72	28
1966/1967	084321	071	37862	7.6	122183	078.6	69	31
1967/1968	083414	070	40706	8.2	124120	078.2	74	33
1968/1969	106562	090	38362	7.6	144924	097.6	74	26
1969/1970	082450	069	39604	8.0	122054	077.0	67	33
1970/1971	090953	077	38021	7.6	128974	084.6	70	30
1971/1972	094294	079	39694	8.0	133988	087.0	70	30
1972/1973	080141	068	21224	4.2	101365	072.2	79	21
1973/1974	071402	060	27434	5.4	098836	065.4	72	28
1974/1975	087451	073	20491	4.1	107942	077.1	80	20
1975/1976	074313	062	23219	4.6	097563	066.6	76	24
1976/1977	069750	059	30655	6.2	100405	065.2	70	30
1977/1978	065594	056	36788	7.6	102392	063.6	63	35
1978/1979	070800	060	26612	5.2	097411	065.2	73	27
1979/1980	062100	052	21312	4.2	083412	056.2	75	25
1980/1981	076341	064	15123	3.0	091464	063.0	83	17
1981/1982	143200	121	13627	2.8	156827	123.8	91	09
1982/1983	131631	111	15123	2.6	144274	113.6	92	08
1983/1984	105421	087	12643	2.1	115998	089.1	90	10
1984/1985	043000	036	10527	1.4	049816	037.4	86	14
1985/1986	041000	035	06816	1.2	046620	036.2	87	13
1986/1987	051000	043	05620	0.6	054000	043.6	94	06
1987/1988	046000	039	05000	1.0	051000	040.0	90	10
1988/1989	056000	047	02000	0.4	058000	047.4	96	04
1989/1990	055000	046	04000	0.8	059000	046.8	93	07
1990/1991	048000	041	03000	0.6	051000	041.6	94	06
1991/1992	029000	024	06400	1.3	035400	025.3	83	17
1992/1993	054000	046	08000	1.6	062000	043.6	87	13
1993/1994 *	053000	045	07000	1.4	060000	046.4	88	12
1994/1996	076341	064	15123	3.0	091464	063.0	83	17

Source: Computed from different sources especially:

1. **River Transport Investment Policy Study.**
2. **The National Comprehensive Transport Plan for the period (1993/93-2013/14)**

*** In the year 1993 the Northern Reach was no longer part of RTC.**

Annex No. 11: Passengers Transported By RTC.

Year	South		North		Total	
	Pass (000)	Pass km (Million)	Pass (000)	Pass km (Million)	Pass (000)	Pass km (Million)
1970/1971	165	069.0	97	13.0	262	082.0
1971/1972	165	068.0	102	14.0	267	082.0
1972/1973	200	085.0	96	13.0	286	089.0
1973/1974	102	075.0	79	10.0	199	085.0
1974/1975	157	076.0	75	11.0	232	087.0
1975/1976	216	055.0	92	12.0	308	067.0
1976/1977	142	101.0	91	13.0	233	114.0
1977/1978	171	036.0	75	12.0	246	048.0
1978/1979	095	037.0	44	17.0	139	054.0
1979/1980	047	045.0	60	17.0	107	062.0
1980/1981	053	051.0	27	05.0	080	032.0
1981/1982	053	054.0	22	04.0	075	058.0
1982/1983	064	030.0	28	05.0	092	035.0
1983/1984	032	002.0	15	03.0	047	005.0
1984/1985	006	002.0	11	02.0	017	004.0
1985/1986	004	001.5	08	01.5	012	009.5
1986/1987	-	-	10	02.0	010	002.0
1987/1988	-	-	16	03.0	016	003.0
1988/1989	004	002.0	08	01.0	012	003.0
1989/1990	-	-	10	02.0	010	002.0
1990/1991	001	000.6	01	00.2	002	000.8
1991/1992	012	006.0	06	01.0	018	007.0
1992/1993	005	002.0	06	01.0	011	003.0
1993/1994	006	003.0	04	01.0	010	003.0

Source: The National comprehensive Transport Plan for (1993/1994-2013/2014)

Annex No. 12: Traffic Forecast By Mode of Transport In (000 Tons)

Year	Railway	Trucks	River	Air	Total
1994/1995	1997	03794	058	05	05854
— 1999	3492	03865	264	09	07432
2003	4123	05355	332	14	09600
2007	4594	07654	423	18	12401
2013	6156	11806	473	24	18206

Source: National Comprehensive Transport Plan (1993/94-2013/14).

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