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MANAGEMENT PROFILE AND TRAINING NEEDS
FOR MARINE RESOURCES DEVELOPMENT

By

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C.O. Okidi

ABSTRACT

The long history of evolution of the Law of the Sea through State practice as well as codification and progressive development, culminated in the Law of the Sea Convention signed, under auspices of the United Nations, at Montego Bay, Jamaica, on 10 December 1982. One of the principal features of the Convention is the area of the Sea which it brings under the two legal regimes of the Exclusive Economic Zone and the Continental Shelf. Under these two regimes considerable areas of the Sea are brought under national jurisdiction for purposes of exploration, control, conservation and exploitation of marine natural resources. The regimes also define the zones with the highest probability of the attractive natural resources, notably fisheries and hydro-carbon.

It is estimated, for instance that Kenya and Tanzania would each acquire a new zone of between 20,000 and 200,000 nautical square miles over which they have exclusive jurisdiction and sovereign rights for purposes of exploration, exploitation and conservation of natural resources.

This paper, which focuses only on hydro-carbon, argues that in order for the respective coastal states, such as Kenya to benefit in a meaningful way, from the natural resources newly brought under its jurisdiction, it must acquire requisite technology and manpower to explore, exploit, transport, process and market the hydro-carbon and its other products.

Accordingly, the paper outlines an analytic profile of basic and broad management needs. Thereby, it suggests the specific training needs required to meet the needs suggested by the management profile. In conclusion, the paper suggests some broad frameworks for developing manpower to meet these development needs.

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I INTRODUCTION

This paper focuses on the imperatives of marine resources management; therefore a proportionally large part of it sets out, in a broad way, the activities and operations which constitute the management of offshore resources. That outline of activities will at once suggest the training and manpower needs required for accomplishment of the corresponding management goals. They are, however, juxtaposed against a subsequent section which looks at the scope of training and research work currently done in Africa as an example of the average situation in the developing countries. The subsequent part outlines certain schemes of training for the management needs.

All aspects of the management of marine resources have evolved at the national level largely as a result of the interaction between national economic and social needs, on the one hand, and on the other, the development of the expertise and technology for the exploitation of such resources. The corpus of international legal regime has also changed and evolved correspondingly, trailing after the foregoing imperatives. The latest state is the Third United Nation Conference on the Law of the Sea which concluded the convention signed at Montego Bay, Jamaica on December 10, 1982.¹ That Convention stipulates legal regimes for the various zones of the ocean, viz: the territorial sea (Articles 2-32); Contiguous Zone (Articles 33-45); Archipelagic States (Articles 46-54); Exclusive Economic Zone (Articles 55 to 75); Continental Shelf (Articles 76 to 85); High Seas (Articles 86 to 115); Islands (Articles 121); Enclosed and Semi-Enclosed Seas (Articles 122 and 123); and the Seabed or Area beyond national jurisdiction (Articles 133 to 191). There are also provisions relating to functional questions such as protection of marine environment; scientific research; regional cooperation; transfer of technology; and rights of access for land-locked states.

1. The final document adopted as convention was referenced A/CONF.62/122 of 7 October 1982-United Nations Convention on the Law of the Sea.

Evidently, management profiles for all these subject areas is too large for this discussion paper. Therefore, for its purposes the paper will confine itself only to management of a specific natural resource sector, namely, hydrocarbons which are obtainable from the Continental Shelf and the Exclusive Economic Zone. Thus, the purpose is not to analyse the legal regime of these marine zones; rather we will directly and broadly outline requisites of management of petroleum and oil resources, and thereby to suggest the corresponding training needs.

The Convention referred to above was the end - product of the Third United Nations Conference on the Law of the Sea. Although the conference was formally convened for its first substantive session in Caracas, Venezuela in June 1974 the preparatory work actually started in 1969, and from then it engaged the attention of member states of the United Nations ^{with} formal and inter-sessional negotiations ^{until} its conclusion. It therefore qualifies for the longest and most protracted negotiation in history of multilateral diplomacy. But there are three other explicit and implicit aspects of this long negotiation. First, it has been an expensive undertaking for member states who had to send people on an average of four months of negotiation away from their countries every year. Secondly, it engage important manpower from these countries. Thirdly, the negotiations implicitly suggested that there would be concrete economic benefits accruing to the states from marine resources. Therefore, the negotiations and the eventual convention raised hopes in the member states that the participating states will derive wealth from marine areas especially the zones of the sea that are immediately contiguous to the land territory.

This paper suggests that even if the benefits exist in fact, they will not automatically accrue to the States. In fact there is a presupposition that the states had commenced the preparation of high - level training of manpower to manage the resources of such marine zones and to ensure the concrete economic benefits.

II BACKGROUND

Early Developments

Throughout all history nations, particularly coastal communities, have utilized certain marine resources for consumptive purposes. In this context fisheries and associated resources, such as crab, oysters, pearl shell, coral and sponge were so dominant that they formed part of the basis

for national jurisdictional assertion recognized even before the emergence of modern concepts of high seas or territorial seas.²

Among the consumptive uses of marine resources, fishing was a principal occupation of the coastal communities for two major reasons: Firstly, it provided excellent food required for nutrition. Secondly, it was an occupation.

Therefore, essentially fishing met what might be characterized as the development needs of that time and over time. It was an activity carried out with the simple technology that was obtainable at the time. The training for handling of the technology was done by the societies that were rather simple in their range of activities. But it was the expansion and sophistication of the technology in that historical perspective that forced nation states also to consider the extent of their national jurisdiction over marine area for fishery purposes. Thus, we find that at the turn of the present century an illustration that the British Government were still divided within themselves as to how far out to sea they should claim jurisdiction over fishing activities.³ But for the society, the youths in the fishing communities gained the knowledge of the art as part of their basic socialization.

In the more recent times the complexity of the societies, wrought by industrialization and increasing population led to higher demand for resources obtainable from the sea. Concomitantly, there was increasing sophistication of the technology for exploitation of those resources and this, coupled with industrialization and population increase, enhanced the fear that access to the resources should be protected by some established territorial claims. Like industrialization, the evolution of the technology has favoured certain areas of the world,

2. Hurst, "Whose is the Bed of the Sea, _____ sedentary Fisheries Outside the Three-Mile Limit" in British Year Book of International Law Vol. 4, (1923-24) pp. 34-43.

3. Mortensen V. Peters in Great Britain, High Court of Justiciary of Scotland, 1906 summarized in Briggs, The Law of Nations: Cases Documents and Notes (N.Y.: Appleton-Century-Croft, 1952) pp. 52-57.

so that industrialized countries are also the technologically more advanced and at the same time, have the largest pool of trained manpower to further utilize and develop the technology. So the demand for the natural resources to feed the industries as well as practices in consumption have been more conspicuous and lavish in the same countries.

Ordinarily, economists would have us believe that demand as such has a major role in the development of the economy because it will provide impetus to the entrepreneurs. But recent trends in the developing countries would confirm that demand, which is glaring in those countries is hardly enough. The real essentials and prerequisites are expertise and technology which must augment entrepreneurship. This combination can, in fact, lead to the discovery of new sources of natural resources previously unknown, and ways of using such resources to enhance development.

In the context of development with marine resources the dominant role of national expertise in manpower and technology was well articulated in the epochal proclamation enunciated by President Harry Truman of the United States on 28th September 1945.⁴ The proclamation, often considered as the starting point of positive law on the subject of jurisdiction over continental shelf and seabed, asserted the jurisdiction of the United States over the resources of the continental shelf adjacent to that country's coast. What is strikingly important for the present discussion is how Truman proclamation expressed the role played by the national "competent experts" with "modern technological process /whose/ utilization is already practicable or will become so at an early date" to discover and make available new natural resources such as hydrocarbon and other mineral resources from the continental shelf of the U.S. coast, and for the development of the U.S. economy.

Essentially, the latch for the policy decision was a combination of national expertise and their technological sophistication in time perspectives. In fact, over time the two factors changed the landscape in the relationship between the coastal state to their marine resources as well as between and among coastal states. Thus, several years after two of the arms of British Government, the Judiciary and Foreign Office (Executive) agreed to resolve the Mortensen V. Peters dispute, partly to

4. The text of the proclamation is reprinted in Lay, Churchill and Norquist (Eds) New Directions in the Law of the Sea Vol. 1 (Dobbs Ferry, N.Y. Oceana Publications 1973) pp. 106-109.

avoid Norwegian displeasure, another issue came. This time it was on the criteria for drawing appropriate baseline in the Norwegian coast and thus to determine the extent of their internal, as distinct from international waters for purposes of control over fishery resources. The dispute was the Anglo-Norwegian Fisheries Case decided by the ICJ in 1951.⁵ That decision only determined the baseline from whence the outer limit might be measured once the extent of that limit was agreed upon. Recall now that the Truman Proclamation did not give the outer limit of their continental shelf either. It simply referred to "continental shelf beneath the high seas contiguous to the coasts of the United States".

In fact, upto 1958 when the first United Nations Conference on the Law of the Sea adopted, among others, the Convention on the Continental Shelf, there was a belief that available technology could exploit only certain limited areas "adjacent" to the coast. For that reason Article 1 of that Convention defined the Continental Shelf to mean (a) "..... the seabed and subsoil of the submarine areas adjacent to the coast but outside the area of the territorial sea, to a depth of 200 metres or, beyond that limit, to where the depth of the superjacent waters admits of exploitation of the natural resources of the said area; (b) to the seabed and subsoil of similar areas to the coasts of island."

However, within less than a decade there was a call for another United Nations conference on the law of the sea. Initially, the main reason was to agree on the outer limit of coastal state jurisdiction over the submarine areas. It was clear that technological sophistication and national expertise were so advanced and progress so rapid that man could exploit the entire geological continental shelf as well as most of the seabed. Immediately, scholarly suggestions were being advanced for ways of revising the 1958 Geneva Convention on the Continental Shelf, especially the question of outer limit of the continental shelf, since the definition based on exploitability had ceased to have the clear juridical sense.⁶

5. "Fisheries Case" (United Kingdom v Norway) [1951] ICJ Reports, p. 116.

6. See for instance, Oda, "Proposals for Revising the Convention on the Continental Shelf" in Columbia Journal of Transnational Law Vol. 7 (1968) pp. 1-31.

The trend that had been set by the United States was overtaken by the advancement of technology and expertise. Recall now that an explanatory release appended to the Truman Proclamation had specified that the U.S. experts had determined that the claim would "make possible the orderly development of an underwater area 750,000 square miles in extent". That area, they pointed out, included sub-surface structures associated with oil deposits in the Gulf, off the coast of Texas and off the coast of California. The goal was to maximize the U.S. national interests, according to the technology of the time.

So some Latin American coastal states on the west, where there was no continental shelf to speak of, decided that they should protect their offshore fisheries interests. Because they would not rely on the geological and geographical notions of continental shelf they sought other criteria which might be a match for the Truman Proclamation. This is when German Fisher, a Chilean Lawyer cautious to find a legal precedent for whatever they would claim, misread the U.S. President F.D. Roosevelt's map contained in security zone Declaration of Panama and thought the limit of that zone extended to 200 nautical miles.

So Chile became the first country to claim 200 nautical miles coastal jurisdiction on June 23, 1947 then followed by other Latin American States.⁷ Peru, one of the countries which followed suit, has since become one of the world's leading fish producers and exporters. During that period there have been several confrontations between these Latin American countries, including Ecuador, with foreign fishing fleets they sought to exclude from the 200 miles zone. Whatever was the nature and gravity of the confrontations, the fortuitous choice of 200 miles zone, to protect coastal marine resources became one of the most powerful concepts in history of the law of the sea.

7. See Holick, "The Origins of 200-Mile Offshore Zones" in American Journal of International Law vol. 71 (1977) pp. 474-500; Garcia-Amador, "The Latin American Contribution to the Development of International Law of the Sea" American Journal of International Law Vol. 68 (1971) p. 33; Okidi, "The Role of the OAU Member States in the Evolution of the Concept of Exclusive Economic Zone in Law of the Sea: The First Phase" Dalhousie Law Journal Vol. 7 (1982) pp. 39, 71.

Meanwhile, the anxiety over the outer limit of the continental shelf persisted. It became increasingly pronounced in the North Sea, which was also to be one of the world's largest oil fields. Eventually, these led to the disputes between West Germany and the Netherlands, and Denmark decided by the ICJ in 1969.⁸ And that was only part of the North Sea resource problems. The fishing disputes were only partly settled in the 1951 Anglo-Norwegian Fisheries Case. Iceland with its rich fishing grounds had similar conflicts particularly with British long distance fleets, leading to the so-called "Cod War" which were eventually referred to the International Courts of Justices and finally resolved by a number of treaties recognizing the Icelandic claim to 200 miles jurisdiction.⁹ In the entire history of the dispute over Icelandic fishing grounds that country pleaded for safeguard of its internal economic interests against foreign fleets with increasingly refined technology.

New Challenges in New Areas of National Jurisdiction

The sophistication of fishing technology and the concomitant increase in the demand for more fishery resources led to intensified exploitation of fish near coasts of various states and this in turn led to widespread, though uncoordinated, decision by coastal states to expand their jurisdiction further outwards. The aim was to protect the resources in the coastal zones by excluding long-distance fleets. By the beginning of the Third U.N. Conference on the Law of the Sea (UNCLOS III) in 1974 there was a general unanimity that there be created a zone, sui generis, called the Exclusive Economic Zone (EEZ) over which the Coastal states would exercise exclusive jurisdiction and sovereign rights for the exploration and exploitation of natural resources. Initially, the move was to enable the developing countries to plan, manage and exploit

8. For a commentary see Jennings, "The limits of Continental Shelf Jurisdiction: Some Implications of the North Sea Case Judgement." International and Comparative Law Quarterly Vol. 18 (1969) pp. 819-832.

9. For background, see Iceland and the Law of the Sea: Fisheries Jurisdiction in Iceland both from Rey Kjavik: Government of Iceland, 1972; ICJ, Application Institution Instituting Proceedings Filed in the Registry of the Court on 14 April, 1972 "Fisheries Jurisdiction Case" (United Kingdom of Great Britain v Iceland). For the final treaties signed on 28, November 1975 - between Iceland and Belgium see International Legal Materials Vol. 15 (1976) p. 1; Iceland and West Germany, p. 43. Treaty between Iceland and Norway signed on 10 March 1976 and with U.K. on June 1976 are both in International Legal Materials Vol. 15 pp. 875 and 878 respectively.

the resources of the Zone which, according to Article 57 of the Convention¹⁰ ".....shall not extend beyond 200 nautical miles from the baseline from which the breadth of the territorial sea is measured." And generally, the proponents of that concept agree that they now have a juridical regime which, by treaty, gives coastal states enough power to control and utilize the natural resources of that coastal zone. Article 56 stipulates, in part, that in the Exclusive Economic Zone, the coastal state has:

"(a) Sovereign rights for the purposes of exploring and exploiting, conserving and managing the natural resources, whether living or non-living, of the sea-bed and subsoil and the superjacent waters, and with regard to other activities for the economic exploitation and exploration of the Zone, such as the production of energy from water, currents and wind;"

The delimitation of the continental shelf, where it extends beyond the 200 miles of the Exclusive Economic Zone is a lot more complex and is outlined in Article 76 of the Convention. But it is certain that the 200 nautical miles of the coastal belt, with its natural resources, becomes subject to the rights of the coastal states as briefly stated above. That limit of the Exclusive Economic Zone alone brings considerable area and resources under the sovereign rights of the coastal state, for purposes of exploration, exploitation, conservation and general management.

In simple terms, the actual area brought under national jurisdiction by the legal regime of the Exclusive Economic Zone is considerable. Of course, by virtue of their geographical location the land-locked countries get nothing. But, Table I below shows that even though the developing countries might not figure prominently among the top-ten states acquiring the largest areas of the sea, as in Table II, they actually are in fairly large numbers among states acquiring over 20,000 square nautical miles beyond 200-metre isobath. Certainly the area as such does not guarantee that there will be the valuable natural resources; however, it is more emphatically certain that without that area at all the chances of the obtaining the resources are correspondingly reduced.

10. The Convention ready for signature of states is referenced U.N. Doc. A/CONF.62/122 dated 7th October, 1982.

Table I

Areas of Sea-Bed Acquired by States, Beyond the 200-Meter Isobath Through the Extension of National Jurisdictional Limits to a Distance 200 Nautical Miles from the Coast

No Gains (50)	0-5,000SNM (10)	5-10,000SNM (4)	10-12,000SNM (6)		20-200,000SNM (53)	Over 200,000SNM (24)
(Land-locked & Shelf-locked states)	Albania Bangladesh Cameroon Congo Gambia Israel Lebanon Romania Syria Yugoslavia	Bulgaria Dahomey Ethiopia Guinea	Iran Malta Thailand Trinidad & Tobago Tunisia Uruguay	Algeria Argentina Barbados Burma China, P.R. China, Rep. of Colombia Costa Rica Cuba Cyprus Dominican Rep. Republic Egypt El Salvador Equatorial Guinea France Gabon Ghana Greece Guatemala Guyana Haiti Honduras Ireland Italy Ivory Coast Jamaica	Kenya Korea (North) Korea (South) Liberia Libya Malaysia Mauritania Morocco Nauru Nicaragua Nigeria Oman Pakistan Panama Saudi Arabia Senegal Sierra Leone Sri Lanka Sudan Tanzania Tonga Turkey United Kingdom Venezuela Vietnam (South) Western Samoa Yemen (Aden) Yemen (San'a)	Australia Brazil Canada Chile Ecuador Fiji Iceland India Indonesia Japan Madagascar Maldives Mauritius Mexico New Zealand Norway Peru Philippines Portugal Somalia South Africa Spain Soviet Union United States

Source: Ocean Development and International Law Journal,
Vol. 1, spring, 1973, p.40.

*SNM - Square Nautical Miles.

Table II

The Outer Edge of the Continental Margin (3,000 metres)	200 Nautical Miles from the Coast
1. Australia (783,800)	United States (1,676,600)
2. New Zealand (500,300)	Australia (1,381,700)
3. Norway (433,700)	New Zealand (1,338,700)
4. Indonesia (420,200)	Japan (985,900)
5. Canada (393,500)	Soviet Union (945,200)
6. Soviet Union (317,200)	Indonesia (767,700)
7. United States (317,200)	Mexico (702,600)
8. Japan (300,800)	Brazil (699,900)
9. Argentina (251,900)	Chile (659,300)
10. Mexico (214,100)	Norway (560,500)

Ranking Order of states Acquiring the Largest Areas of Seabed beyond the 200-meter Isobath through the Adoption of New National Jurisdictional Limits.

Source: Ocean Development and International Law Journal, Vol. 1, No. 1, spring, 1973, p. 42.

Integration into National Economy.

Proceeding from this last point, then, one must stress that for the respective nations to benefit from the natural resources there are two basic requirements. First, the nations must have the manpower and expertise to explore for, and to extract natural resources as pointed out earlier. That presupposes a significant amount of training in a manner that corresponds to the respective natural resources sectors. Secondly, any newly acquired wealth from that area of the sea must be planned for and managed in a manner that integrates it to the general fabric of national economy, so as to realize the implications of the notion of permanent sovereignty over a natural resource, within the meaning of United Nations General Assembly Resolution 3016 (XXVII) adopted in December 1972.¹¹ As an extension of United Nations General Assembly Resolution 1803 (XVII) the 1972 resolution reaffirmed, under paragraph (1). "The rights of states to the permanent sovereignty over all their natural resources, on land within their national boundaries, as well as those found in the sea-bed and subsoil thereof, within their national jurisdiction and in the super-jacent waters". This provision was clearly drawn up with the legal regime for the Exclusive Economic Zone in mind. Certainly, it adds to the juridical basis for the integration of the natural resources of that zone to the planning and management of national economy.

Integration of the natural resources of these marine areas would entail, inter alia, maintaining the full control over exploration, extraction and utilization of the natural resources. It entails the control by the specific nation over deployment of the nationals in those activities as well as determination of the nature of the technology that will be utilized for exploration and extraction of the resources. That process must also entail the determination of the system of marketing of the products and by-products of the industry. And above all, integration is complete only if the authorities ensure that the proceeds from the sale of the wealth is utilized for national development. Indeed, it

11. Although the U.N. General Assembly has expressed its views on permanent sovereignty over natural resources in a number of resolutions the most important and consolidating antecedent resolution on the subject is the U.N.G.A. Res. 1803 of 14 December 1960. It was that resolution which was elaborated, "recalled" and applied to the present subject of marine resources in U.N.G.A. Res. 3016 (XXVII) on Permanent Sovereignty Over Natural Resources of Developing Countries adopted in December 1972 by 102 Votes in favour, None against and 22 abstentions. See text reprinted in International Legal Materials Vol. 12(1973) pp. 226-227.

is this package which encompasses the concretization of the notion of permanent sovereignty over the natural resources.

Oil production should actually make vast difference in an economy of a country both internally and externally. Generally, it is held that the current serious economic problems of developing countries, manifested by chronic and heavy-indebtedness and foreign exchange shortage started with the so-called oil-crisis of mid-1970's. Thus, it comes as stark irony that major oil producers such as Brazil, Mexico and Nigeria should be classified as debt ridden alongside with the other poor and non-oil producing countries. The hypothesis advanced here is that the countries simply pumped out and exported crude oil, like any other raw materials, and paid heavily for processed commodities at a higher per capita rate than the prices of their crudes. It is a result of failure to industrialize; failure to fully refine the hydrocarbon and to involve in petrochemical industries which can have impact on employment and other sectors of the economy. In other words, they pumped and exported crude oil so wrecklessly that they eventually glutted the market and faced the price drops of 1983 which wreaked further problems to their economies.

Training As a Prerequisite:

To realize these benefits fully, that is, to ensure national control of the natural resources and its integration into the national economy, it is imperative that there be fully trained cadre of nationals and with requisite technology and experience to execute the management. Training is essential to explore for the resources, to extract it, (if it exists), to process and market the products. Within the framework of "processing", the trained people must be able to perceive the industries in the context of national socio-economic activities, thus, to diversify the possible industries and, concurrently, integrate with the general fibre of national economy. Essentially, this rubric of activities underscore the necessity for persons with diverse training. But above all, they must be committed to long-range and long-term service to the country: That can be best obtained only from nationals, rather than foreigners on short-term commitments, however, genuine.

A vicious circle might be perceived here. In order to train the complete set of the requisite personnel the country needs to have a complete understanding of the complete profile of operations involved in

marine resources management for national development. It is also important that the country understands the investment sectors related to the natural resources of the marine area. That will enhance the chances of training experts in the complete canvass of functions. Some of the sectors on that terrain of operations and development are outlined below as the illustration of part of the management profile for which the training is required. We argue that a competent and complete training programme can only be derived from a clear understanding of the range of management operations involved and that an outline of the management profile will at once suggest the training needs.

III - A PROFILE OF OPERATIONS AND DEVELOPMENT

Management of marine resources entail certain specific operations as well as development activities. Such operations and activities are very diverse, but also depend on the sector under review. They are also closely interrelated partly because the ocean environment is an ecological unity and partly because the management is expected to integrate the resources of the marine area in question, to the national economy and its infrastructure. Therefore, it makes sense for any outline or analysis of the operations and development activities to examine all the major resource sectors, including, inter alia, petroleum, oil; natural gas; fisheries; salts; and water.

However, giving an outline for the activities associated with all these resources is beyond the scope of this discussion paper. Instead the paper shall focus on petroleum and oil from the Exclusive Economic Zone and the Continental shelf. The forms of development activities will themselves suggest the corresponding training needs and the latter will be examined more broadly in the next section.

(1) Delimitation of the Area

The most important action in management is to define the area of the task, both functionally and geographically, as the case may be. It is pointed out above that the present discussion focuses on petroleum, oil and gas. Certainly, for these the Exclusive Economic Zone generally and the continental shelf, in particular, are the directly relevant marine areas and their precise limits for every coastal state or island should be clearly delineated.

A comprehensive plan of the management of the coastal marine resource requires delimitation of the areas both of the Exclusive Economic Zone and the continental shelf. In the first section of this paper we outlined some of the instances of disputes arising from lack of agreement as to the limits of the jurisdiction of coastal states over coastal marine resources. For two reasons it is important that the actual boundaries between states with adjacent or opposite coastlines be determined well before exploration for resources is commenced. The first reason is that it determines - for the state what area it may operate in, thus it defines the task area. And secondly, once resources are discovered states are likely to be more difficult in boundary negotiation because at that stage their dispositions are influenced by the economically attractive resources. As the Third United Nations Conference on the Law of the Sea crystallized the various provisions for the Convention, now signed, commentators discussed the complex juridical considerations regarding delimitation of the coastal zone in an attempt to prevent some of those difficulties at the time of management.¹² That juridical consideration is only a small part of the task; a major part involves actual hydrographic and geographic implementation of the juridical stipulations.

The task of delimitation in management becomes particularly complex where the mineral resource deposits traverse the boundaries of the continental shelf or the Exclusive Economic Zone of given states. Under this category could be listed the hydrothermal brines under the central rift of the Red Sea.¹³ Shortly after the resources were established to exist in commercially viable quantities the Kingdom of Saudi Arabia issued a decree asserting "ownership" over all the hydrocarbon minerals and all other minerals existing in the seabed adjacent to its continental shelf.¹⁴ That Decree did not take into account the fact that Ethiopia Sudan and, possibly, Egypt might also have legally tenable interests in the same resources. At the same time the accumulation of the hot brines is understood to be increasing steadily. And this also requires a

12. See, for instance, Adede, "Toward the Formulation of the Rule of Delimitation of Sea Boundaries Between States with Adjacent or Opposite Coasts," in Virginia Journal of International Law, Vol. 19 (Winter 1979) pp 207-255 and Blecher, "Equitable Delimitation of Continental Shelf," in American Journal of International Law, Vol. 73 (1979) pp. 60-88.

13. See Ross, "Red Sea Hot Brines Area: Revisited," in Science Vol. 175 (March 1972).

14. Decree No. M-27 dated 7 September 1388 Hegira, (September 7, 1968) reprinted in International Legal Materials Vol. 8 (1969) p. 606.

clear determination of the quantity, rate and direction of accumulation. Then the respective rights of the littoral states can be assessed and understood according to the mutually agreed limits of national jurisdiction.

It is certainly easier to resolve the matter if the delimitation of the respective boundaries are determined at an early date. This urgency is particularly pertinent for the liquid minerals than for hard minerals because with the former case the state or concessionaire which undertakes exploration and exploitation first might obtain all or most of the resources. Some commentators are already examining the juridical implications¹⁵ and that ought to be treated with much seriousness. But ultimately, every case will present unique problems and characteristics and must therefore receive careful and sustained attention of highly qualified persons.

(2) Hydrocarbon as a Sector

Among the resources of the Exclusive Economic Zone fisheries would traditionally be considered as supremely important, partly, because of the place it has historically occupied in commerce. However, this is no longer so. Hydrocarbon has assumed a special salience in recent times partly because of the role of energy in the industrializing economies as well as in transport and partly because, since so-called "Energy Crisis" in 1973, petroleum and oil have also become a tool for political pressure among nations. Thus, for a combination of both reasons, every state that discovers commercially exploitable quantities of hydrocarbon in areas of its jurisdiction assumes a privileged position among nations. Primarily for this reason every country would like to strike that quantity of oil in areas of its jurisdiction, including marine areas. Accordingly, most countries have made some efforts to that effect. Somehow, for various geological reasons every country with marine coastline hopes that with

15. Lagoni, "Oil and Gas Deposits Across National Frontiers," in American Journal of International Law Vol. 73 (1979) pp. 215-243.

some effort, hydrocarbon can be discovered in the continental shelf or beyond that.¹⁶ And once hydrocarbon is discovered, a series of operations and activities follow, to ensure that oil is extracted from the ground, processed and sold. Every stage should contribute to national development.

A detailed outline of the tasks and activities related to the search for and extraction of hydrocarbon generally or from marine areas is a complex one, well beyond the competence of this paper.¹⁷ The most we can undertake here is to give the broad themes involved with brief explanatory notes and that will suggest the corresponding needs for training to meet the national objectives.

At that broad level one can suggest that a complete range of operations that can facilitate integration of the offshore hydrocarbon into the national economy will involve the following five operations.

- a) Exploration
- b) Production
- c) Transportation
- d) Processing
- e) Distribution and Marketing

These operations are interrelated and often complementary, with varying sequences. For instances, transportation comes before and after processing. At the same time, there may be instances where processing is omitted altogether. Below, are only brief expository comments on the management profile.

a) Exploration:

This is the general search for petroleum deposits. Essentially it entails use of seismic, geophysical and magnetic techniques of obtaining data and interpreting the information in order to make inferences as given geological formation. A number of methods, including to the probability of the existence of petroleum deposits in a computerized techniques, have been deployed in the interpretation of the geophysical data.¹⁸

16. Because marine petroleum deposits are generally associated with the sedimentary formations of the continental shelf it is often assumed that there would be no such deposits in the sea-bed areas. However, for a summary of the technical feasibility of such deposits see the views of an eminent authority K.O. Emery, "Potential for Deep Ocean Petroleum" Ambio Special Report No. 6 (1979) pp. 87-92.

17. See a lucid and brief outline of the technical tasks by H.D. Smith, "The Problems of Hydrocarbon Extraction" in Maritime Policy and Management Vol. 4, (1977) pp. 351-376.

18. ibid. p 358.

There are three broad points one can emphasize at once. First, that the operations require very highly trained professionals, in every aspect of the operations. It is not sufficient to have, for instance, one geophysicist in the country. There has to be a teamwork. Second, the technology involved in this process is high sophisticated and it is not likely that the technology used in exploration on land will be applicable to the marine conditions. The physical operating conditions will be quite different. And obviously, this set of technology will correspond to the available manpower to obtain any results. Third, exploration for oil is an expensive enterprise because it does not promise any immediate revenue to the exchequer, who would set aside the exploration funds. Perhaps it is for this reason Emery found that 95 per cent of the world's offshore oil and gas has been found by marine private companies from half-dozen industrialized western nations.¹⁹ This point can be further underscored by the experience from Kenya where nine private oil companies or consortia spent a total of about Kf13.2 million on exploration for oil on land territory between 1970 and 1977, and that does not include Kf53,234 paid to the government for prospecting licences.²⁰ The tragedy in this example is that a verdict of "dry well" was returned for all twenty test holes drilled.

A corresponding task conducted in the marine environment would be more expensive and risky. The cost component is again tied to the kinds of technology required for marine environment. Every aspect of the design and operation of the technology such as pipelines and their accessories are time-consuming and delicate matters.

Exploration for hydrocarbon may therefore entail two perspectives. One is a directly purposive approach such as by oil companies which, with or without any existing data but by inferences from indirect geological or geophysical information, set out to look for oil. The other one is through general scientific research with a view to gather data for purposes of national planning. The latter operation is often undertaken by national institutes of oceanographic or earth sciences. The exercise may actually find hydrocarbon deposits or it may obtain data useful for subsequent determination of the potential existence and quantities of hydrocarbon. In any event, the data collected by such national research

19. Emery, *op.cit.* p. 87

20. Okidi, "History of the Search for Oil in Kenya" (University of Nairobi, IDS (mimeo) October 1979) p. 12-13.

institutions become national assets which may be contributed to the negotiation for the purposive exploration contract with private companies.

b) Production

After it is ascertained that commercially viable quantities of hydrocarbon exists in a given area preparations are made for its extraction or production. One of the most valuable commodities will have been found and in an environment singularly most risky and delicate. At times, the location of the find or possible well are remote from land and therefore, presenting difficult operating conditions. Thus, needless-to-say, the highest sophistication in expertise and technology is an imperative and this must be accompanied by exemplary caution in decision-making on fiscal matters and the choice of applicable technologies and their economies.

The complex engineering operations include fabrication, installation and emplacement of the off-shore equipments, including drilling rigs, platforms and pipeline-laying. H.D. Smith²¹ suggests that platform installation is doubtlessly one of the most spectacular offshore operations. There are concrete platforms already in use; in case of steel platforms computer-controlled methods of tilting the platform have now been developed to enhance precision. Careful considerations go into other generations of technologies to include also the decision on the number of platforms to be deployed in order to enhance economies.

The aim of all that complex operation is to ensure that the oil is drilled and brought to the surface safely and ready for safe transport to the processing plants, wherever that might be. Safety is emphasized here for two reasons. First, for reasons of economy, namely, that oil being as valuable as it is in the market, and having involved the complex and costly technology, should not be lost or wasted. If through carelessness or mishap the oil gets out of control and drains into water it is lost. Secondly, that loss of oil might mean an ecological disaster as was demonstrated in the Santa Barbara Channel disaster of January-April 1969²² or the Chevron Oil Company's well at Venice, Louisiana in March 1970.²³ These incidents also demonstrated how difficult it is to cap the wells

21. Smith, op.cit. p. 359

22. See New York Times, Jan 31 and April 3, 1969.

23. New York Times, March 2, 1970.

once a blow-out occurs and this is an eventuality for which any offshore oil production must have complete contingency plans. Both the waste of oil in such a disaster and the ecological consequences have adverse impact on the national development goals in that oil in water will destroy fish, kill birds and prevent use of beaches for recreation and amenities.

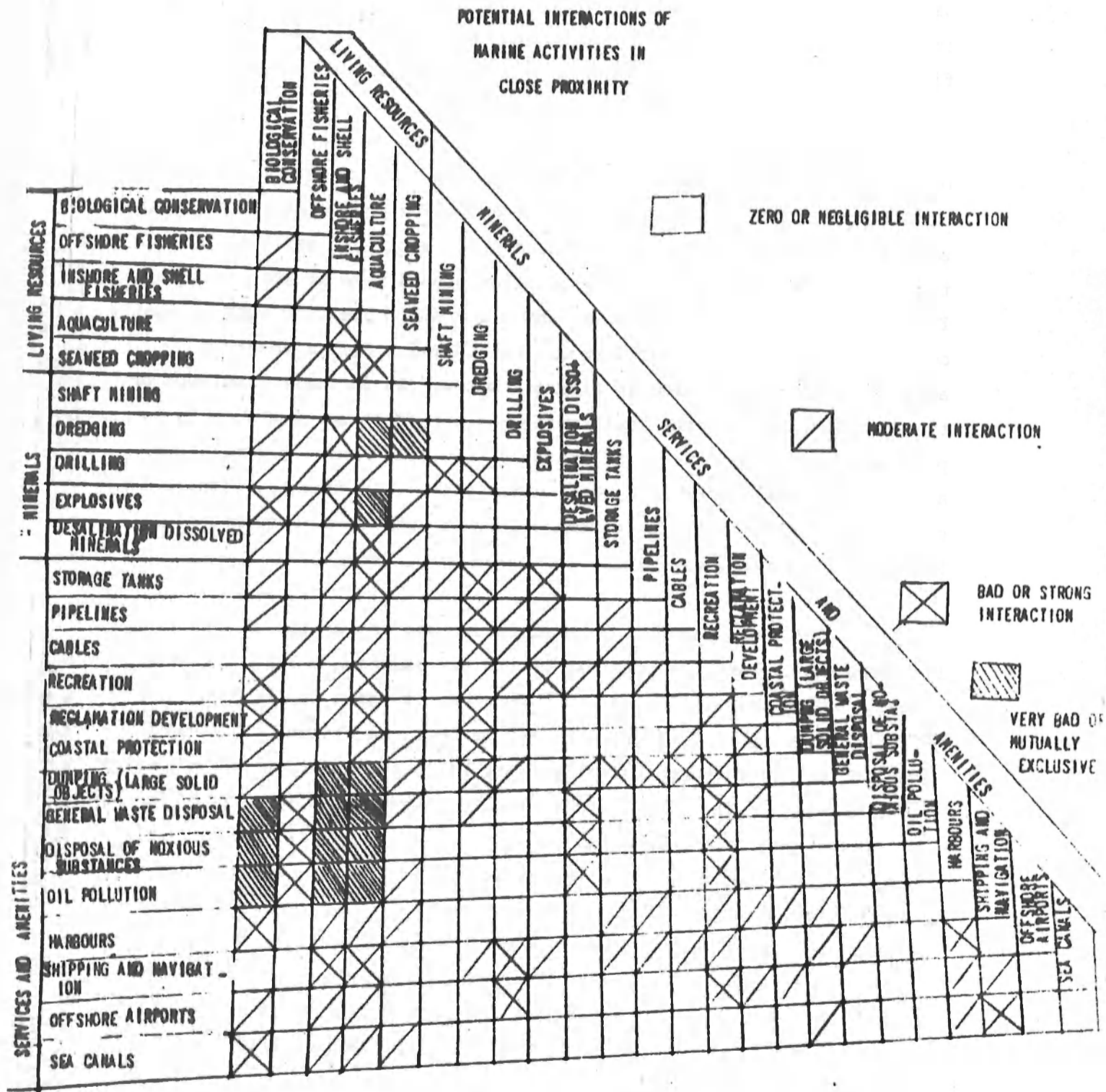
This point calls to mind the fact that before the offshore oil production is commenced there should be a comprehensive plan to balance out the contending uses of the areas involved. As pointed out earlier, fisheries have as important a role as oil (if not more so) and the management of offshore oil production should take it into account. There are other uses of the ocean space for which planning must be wholly completed and possible conflicts are reconciled. Such a range of activities are illustrated in Figure 1 below. An intimate knowledge of the area involved and the engineering aspects of these operation is a prerequisite to the rational planning of the long-range operation for assured long-term benefit to the coastal state. In essence, this is part of the field of "Coastal Zone Management," taught in several United States Universities, especially under Sea Grant Program.

Offshore operation in exploration and production of hydrocarbon has largely been the preserve of the pre-existing private oil companies. Smith points out that such has been the case in the North Sea where the majority of the companies are of American origin.²⁴ So here also is the relevance of the estimate by Emery that private oil companies from a half-dozen industrialized western countries are involved in 95 per cent of the world's offshore oil and gas.²⁵ This applies to nearly all the hydrocarbon production in the developing countries. But the extent to which individual states might resent the trend is perhaps illustrated by the situation in Canada where the nationalistic position on their economy led to the establishment of the public oil corporation- (Petro-Canada), and its decision to go into oil operations. In 1981 Petro-Canada bought up all interests of a Belgium oil company, Petrofina, in Canada; by 1983 it had bought up the marketing infrastructure of Shell-BP in Canada. The important point in this trend was that after acquisition of Petrofina in Canada some oil companies feared that their own interests were not secure. For instance, Mobiloil Company which had discovered

24. Smith, op.cit. p. 361

25. Emery, op.cit. p. 87

FIGURE I



Source: Uses of the Sea: Study Prepared by the Secretary-General. New York: The United Nations. Doc. No. E/5120 dated 28 April, 1972, p. 35.

Hibernia fields off Newfoundland became reluctant to expand their operations or to openly reveal their actual exploration data arguing that they were not sure that they would eventually fall to the fate of Petrofina.²⁶

Perhaps the net implication of this position is that any oil company which has the sole custody of the data from exploration may in fact withhold that information from the national authorities if in their view the national polity is not unequivocally hospitable to foreign investors. On the other hand, the national safeguard is not to swear oath of allegiance to the foreign investors but to ensure that national experts actually involved enough to have access and custody to that information as it gets generated.

We might add here, parenthetically, that Petro-Canada International has also been established as the international corporation with the purpose of actually assist developing countries develop their own capabilities in the oil fields, including in exploration and production.

c) Transportation

There are two basic options for transportation of the oil. One is to pipe it to shore; another is to load it on tankers at sea. While both modes may in fact be used simultaneously especially during the early stages of production,²⁷ large fields are often developed by offshore loading. In any event the mode of transportation would be influenced by the choice of location of processing. It is convenient to pipe the crudes directly to an onshore refinery in the country itself while, it is convenient to load into the tanks if it is for processing abroad. In such cases off-shore loading terminals would be constructed and deployed.

Once ashore the oil may be sent directly to markets abroad by tankers or long-range piping. Or it may be piped and fed to the refineries in the same country for processing.

Lest it be overlooked, let us point out that transportation is the most pervasive attribute in the management of offshore oil production.

26. Observation on the Canadian scene based on discussions with officials of Petro-Canada and Mobil Oil Company in Canada in 1981, especially at St. John's in August 1981.

27. Smith, op.cit. p. 359

Transportation of extracted oil, as mentioned above is only one requirements for equipments to be used in the production operations offshore. This aspect will be further mentioned under the general theme of other support services below. Meanwhile, let us complete the vertical line relating to the oil itself and look at processing as the next step, after transportation.

d) Processing

The operations encampused under the rubric of processing include every aspect of cracking of crude oil and gas products into their usable component parts. Certain aspects of the operation actually commence in the offshore setting such as the separation and liquefaction or flaring of gas contained in crude oil to stabilize the oil and in order to avoid explosion risks, before it is transported. The scale of this operation depends on the quantities involved; in certain instances the separation may be done ashore.

But an important point to note here is that like most of the offshore operations, this activity involves highly sophisticated technology and entails deployment of very limited but highly trained manpower. That is to say, this aspect of management of oil industry is not one that will generate much employment to the country involved. In actual fact, the oil companies are likely to recruit their labour force from a variety of places where they have worked before, such as in the Gulf of Mexico, North Sea and North-western Atlantic.

Once the petroleum, oil and gas are brought ashore in form of crudes there is a whole complex of processing activities that are required. In most cases developing countries export their oil in form of crude. Nigeria, the largest oil producer in Africa (Nigeria and Libya contend, for this top slot) was known to get a large revenue from sale of its so-called "sweet", sulphur — free crude most of which is exported to the United States, European Economic Community countries, Japan, Eastern Europe and Africa, in that order.

This tendency, where it persists, means that oil production is really not integrated into the national economy. The national setting functions as a warehouse of raw materials for industrialization in other countries. This is the role which the developing countries have played

in the past: "raw materials warehouse". And that is, by and large, where the scope of their management of the petroleum and oil resources from the Exclusive Economic Zone or continental shelf was often ended.

Where this stage has been exceeded in developing countries there is often only nominal refineries largely for domestic fuel consumption. The rest of the economy relies on the export of crudes for revenue. But the tragedy with the general euphoria associated with revenue from crude is that it may lead to a general neglect of other economic sector. Very often the victim is the agricultural sector. The combination of warehouse syndrome and neglect of agricultural sector has been manifested rather forcefully in the case of Nigeria. The country was formally declared a major oil producer in 1973 when it joined OPEC and from then, crude oil exports contributed over 80 per cent of its overall foreign exchange earning. Arthur Nwankwo, Nigerian commentator, points out that concurrently Nigerians abandoned agricultural sector where previously palm produce and cocoa alone had contributed 70 - 80 percent of the countries foreign exchange earnings.²⁸ And worse, domestic staples, such as rice and beans, previously produced locally were from then imported. The heavy emphasis once placed on the production of cassava, rice, millet, yam and beans as export crops practically vanished.

Nwankwo points out further, that before Nigeria established its first refinery to cater for domestic gasoline consumption the country exported crude oil to the western countries which after refinery (value-added) it reexported it and Nigeria bought the fuel at a high cost. Thus, "foreign exchange earned from exports of crude oil was virtually swallowed by importation of gasoline."²⁹ He adds, in the same lines that when the first refinery commenced production in 1965 it had a capacity of 32,000 barrels per day, limited to producing only petrol, diesel oil and kerosene. But because it was not constructed for production of lubricants, aviation fuel, bitumen, among other by-products of crude oil these were still imported at substantial foreign exchange cost.

The important point in this scenerio is that agricultural sector had been abandoned and food imported at exorbitant costs. Instead of agricultural occupation the population took to peddling of a wide

28. Nwankwo, Arthur A. After Oil, What Next? Oil and Multinationals in Nigeria (Enugu, Nigeria: Fourth Dimension Publishers, 1982) p. 11

29. ibid p.14.

variety of consumer goods ranging from simple domestic hardware to major electronic equipments, some of which were re-exported to neighbouring countries.

Recent efforts to reverse this trend range from closure of borders; war against indiscipline (WAI), to a determination that Nigeria must actually establish its own full-scale petrochemical industries. It has been pointed out that offshore operations are not a major source of employment. Apart from the fact that most of the operations are highly capital intensive the oil companies are likely to bring along with them old hands who have worked in offshore operations elsewhere, such as Gulf of Mexico, North Sea or northeastern shores of North America or even Prudhoe Bay. Least of all are they likely to take on the regularly unskilled workers engaged in agriculture. For these reasons it is arguable that if petroleum discovery is to assist in diversification of the economy generally, and employment in particular, then the country must plan and undertake petrochemical industries.

In the case of Nigeria two industries expected to commence operation in 1985 are: at Kaduna, to produce Linear Alkyl Benzene and at Ekpan (Bendel State) to produce polypropylene and carbon black.³⁰ The reports add that a second phase of industries are now slated for Rivers, and possibly Imo, States.

The industrial concerns expected to benefit from such petrochemical plants include packaging, building construction, housewares, furniture, automobiles, textiles, rubber products, fertilizers and insecticides.

Obviously industries such as fertilizers and insecticides would have direct and positive impacts on agriculture. Besides, if the full gamut of refinery was done including cracking the remains after petrol, diesel oil and kerosene, the other products such as bitumen would have further advantages for the economy, such as in road construction. But that list suggests the kinds of economic spin-offs that might ensue from petrochemical industries as opposed to simply exporting crude oils.

30. The Guardian (Lagos) June 17, 1984 pp. 1 and 12 and Nigerian Statesman (Lagos) June 18, 1984 pp. 1 and 9.

Nigerians estimate that the Rivers project alone, as presently conceived would generate some 45,000 jobs.³¹ It is perhaps a relevant coincidence that during the same time the new Government decided that all the major government consultancy contracts must be given to the national universities and polytechnics, unless they agree that the nature of the projects require external collaboration.³²

Those who plan the management of offshore petroleum and oil must reorient the perception of the developing countries from dependence on cottage/village technology. These countries must involve in management of the advanced technology for diverse productivity using their natural resources. Most of that offshore oil has actually not been discovered yet; in some cases the exploration is yet to be started. In most cases exploration is underway. There are specific instances where actual proven reserves have been found and production under way, such as the case of Nigeria, Cameroon, Gabon and Angola. There are others, such as Mozambique where prospects are fairly good and serious prospecting and production agreements have been negotiated. Yet there are instances such as Kenya where exploration though seemingly serious, have not yielded any actually positive results. The majority of African countries are in the latter category. This is the stage at which management planners have to embark on programmes of training and creating awareness, as will be discussed again later. The intention should be to enhance self reliance for developing countries to the extent possible, through diversified economic activities and effective control of the natural resources. Diverse and exhaustive processing of resources can be effected, for instance, by creating vertical and horizontal integration of the petroleum and petrochemical and oil industries at different stages. Concomitantly there would be established linkages which ensure the integration of such industries into the fabric of national economy.

e) Distribution and Marketing

In view of the foregoing discussions we would include the distribution and marketing of petroleum, oil, gas and petrochemical products of all kinds. It is important to note that the petroleum and oil market

31. The Guardian loc. cit.

32. The Guardian (Lagos) June 18, 1984 pp. 1 and 2.

has become particularly complex, to correspond with the economic and security value of the commodity. It would be upto the experts in the field to determine the extent of domestic and export markets and to feed information back to the production process.

3. Governments Decision - Making and Fiscal Aspects of Management

The extent to which a country can benefit from off-shore oil resources depends largely on the governments' mastery of the fiscal regime related to the full range of the operations. Thus, there must be a clearly aligned governmental structure to deal with such work programmes. Very often the work is left to be handled entirely by the ministry responsible for petroleum or energy without involvement of the Treasury even when most of the initial investment in exploration and production had been issued by the exchaquer. But even if such an investment outlay was not made in the ordinary sense, the exchequer is the custodian of national wealth. The resources are vital to the country as a source of revenue and as a national heritage, and the State is expected to perform its inherent duty of exercise of permanent sovereignty over natural resource by ensuring the full realization of the full benefits ~~accruing~~ from such natural resources.

Nearly each of the government's ministries should have cadres of people to deal with the all-pervasive question of offshore hydrocarbon resources from its exploration to marketing as an interdisciplinary matter. One can see immediately that several ministries, such as treasury, planning, energy, transport, labour, education, legal affairs, natural resources, tourism, physical planning, and industry, would be involved.

The key fiscal questions involved are licensing of exploration; production taxation; export taxation; industrial incentives; and the use to which the revenue it to be put. Above all these is the legislation and protocols for regulation of the basic offshore industrial operations. There would also be labour policy and health to deal with deployment of nationals and non-nationals in the operations as well as the stipulations on working environment of the people in the full range of the industry.

4. Other Support Services

There are several support services which are part of, or inextricably linked to the management petroleum and oil sector in marine activities. But for purposes of this discussion paper we shall outline only three broad areas as follows:

- a) Transportation Services
- b) Research and Information Services
- c) Operational and Development Services

a) Transportation Services

Ports and harbours as basic infrastructures are required for two sets of functions related to offshore oil and gas development. First it is the epicentre for haulage of the equipments to be used in offshore operations, ranging from rigs and platforms to the smaller units. Thus, the room required for berthing will, of necessity, be vast. Second, ports and harbours will be required for ships and tankers to move the crude or refined oil to the refineries or markets. Some of the carriers will be the so-called Very Large Cargo Carriers (VLCC's) which will require particularly deep harbours. The latter category might, in fact, require also the construction of offshore terminals.

But the fact of the matter is that to support offshore operations for oil and gas consideration of space and safety in the ports and harbours is particularly important. In most cases there will be a need to vastly expand the facilities to create the required space. At the same time there must be carried out detailed hydrographic surveys of the harbours and their approaches to ensure the required depth and clearance in the interest of safe navigation.

Most national ports are inadequate for conventional trade activities, not to speak of the offshore oil and gas activities. A whole new infrastructure with its corresponding management staff will be necessary for the offshore operation. This is one of the points that readily hits one on a visit to St. Johns, Newfoundland where people are rather excited about the great "Hibernia" fields. At present ports and harbour facilities are woefully inadequate and discussions with the officials of the Ports Authority suggest that the level of awareness of the infrastructure which would support such operations is still lacking. One might

suspect that unless there is a very urgent change in Newfoundland the only way the operation will go on is if the operations use offshore platforms and ship crudes directly to overseas markets. In which case, they will have provided yet another warehouse for crude oil to fuel industrialization elsewhere.

b) Research and Information Services.

Advancement of the knowledge of the marine resources, and the ocean area generally, depend on research and information services. Research may fall into two related categories. First, the nation will undertake research with a view to compile knowledge of the oceanic data, dynamics and resource profiles. This requires ships, laboratories, equipments and, above all, manpower, for the work to be done on a continuing basis. "New Scientific knowledge is built upon existing knowledge, and successful research calls as much for access to scientific literature and data to ships and laboratories."³³ This category of research may lead immediately to discovery of mineral resources, as was the finding of the hydrothermal brines in the Red Sea or it may simply provide basic data. The second category is the notion of research with resource exploration specifically in mind. As pointed out by Emery in a statement quoted earlier, private oil companies from western countries have been dominant in this field and in several places they have found oil. Whether or not they reveal their oil finds depends entirely on them as the information might be their industrial secret unless there are nationals of the territorial state, competent experts, with a practical access to the information. The information from such research should be properly considered part of the wealth of the country within whose jurisdiction it is collected.

In sum, research itself is a conditio sine qua non of marine resources management as well as part of management. And to have control over the findings and timing of exploitation of the resources the national institution must have a direct control over the research of both categories. That determination to have national control over the data is a political decision but whether or not it can be realized depends on the range and depth of expertise available to the nation.

33. IOC, Marine Science and Ocean Services for Development: A comprehensive Plan for Major Assistance Programme to Enhance the Marine Science Capabilities of Developing Countries (Action Paper of the 15th Session of the IOC Executive Council 1-6 March 1982) IOC/EC - XV Annex 5 Rev. Paris. 15 Dec. 1981. p. 11.

To support the national research institution and experts there must be a complete and competent information service in marine affairs. This will require information experts, complete with system for synthesis, storage, retrieval and dissemination of information.

c) Operational and Development Services

As an area of recent offshore operations, North-East Scotland coastal areas display a wide range of establishments supporting offshore operations. A visit to that area, from Aberdeen, through Peterhead, Fraserburgh to Inverness, finds a wide range of companies which specialize in support services for offshore operations in the North Sea.³⁴ There are a number of industries fabricating and producing the equipments utilized in the offshore operations. On the other hand, there are industries whose speciality is to service those equipments by way of maintenance, surveillance and efficiency control. Other aspects of the industries relate to storage services.

A special category of services may specialize in emergency combat as in the capping of blow outs or tanker rescue services.

Above all, the offshore operations involve human beings working in an unusual environment with its unique stresses. Therefore, a unique range of medical services is required. Besides, for the same reasons that human beings are involved there will be a necessity for special skills in land use planning to rationalize settlement and to expand social catering services as education and housing. Several other economic activities will automatically follow and therefore employment planning is a crucial management question. Planning for these purposes require persons with unique training including comparative perspectives.

IV - STATUS OF MANPOWER AND TRAINING IN AFRICA

The discussion of operations related to marine resources development up to this point will have, at once, suggested the range of expertise and manpower needs required for a country to receive the benefits

34. For a discussion of the case of Norway see Wood "Norway Regional Impacts of offshore Hydrocarbon" (Dalhousie University, Institute of Public Affairs Dec. 1980: mimeo.)

from the resources. Therefore, it is not necessary to list the areas of training needed. It implies that the country must strive to train high level manpower in geological and geophysical prospecting; drilling; off-shore production and reservoir engineering; application of various forms of combustion engines to petroleum production; petroleum economics and related fiscal regimes, petroleum technicians; and lawyers. It is not easy to be self-sufficient in these fields but a state should of necessity strive for the best representation. In any event, it must always be borne in mind that technology in these areas is in fast development. Therefore capacity to maintain continuous briefing is indispensable and the nation should encourage its nationals to continue education and experience anywhere. Nigeria was able to call on several of its nationals working abroad in various fields related to petroleum production, even if it did not completely industrialize. African countries could only seriously rely on the most committed nationals for the full range of hydrocarbon related expertise. It is now instructive to glance at the African situation just to point out that the developing countries in Africa have an awfully long way to go. That situation is certainly true of most of developing countries in Asia and Latin America where the exceptions among coastal States would include Brazil, Argentina, India and Indonesia.

One gets an immediate expose of the African scene by glancing at the report of the UNESCO/ECA survey mission to African coastal States done in 1980.³⁵ On the side of teaching or training there has been very little or no programmes to develop high level professional manpower in the marine sciences. In the natural sciences the main focus has been undergraduate teaching producing holders of B.Sc. degrees or equivalents in Biology Chemistry, Physics, Geology and Mathematics. Programmes leading upto Ph.D. degrees in marine sciences are non-existent in the continent.

A few people holding advanced degrees in the basic fields like botany, chemistry, zoology, Geology and Physics have often doubled as experts in marine sciences basically because the subject area is in vogue and there are no bona fide experts in the field. When involved in policy

35. UNESCO/ECA, Marine Science and Technology in Africa: Present State and Future Development (Paris: UNESCO Reports in Marine Science No. 14, 1981, Project RAF/78/024.

matters in such areas such people may, in fact, perpetuate mediocrity and superficiality and therefore lack of professional seriousness. Individuals holding advanced or Ph.D. degrees specifically in marine affairs are actually very few in the continent and non-existent in most countries. Since training programmes in those fields are scanty the number will remain low, unless some concerted efforts are commenced to correct that situation.

Of those who have that advanced training directly in marine affairs the majority are likely to be in marine biology and fisheries. That tendency might perhaps feed into itself. A recent Workshop on Marine Technology lamented of the UNESCO/ECA reports that it did not include off-shore exploration and exploitation of oil and gas which would be of interest to Nigeria, Cameroon and Angola at present".³⁶ Apparently, the organizers held that only countries which already have proven off-shore hydrocarbons should be interested in the subject area. This is certainly a mistaken notion since nationals of the respective countries should in fact have been involved in the exploration process.

There are usually a few geologists in the government, with some knowledge of petroleum operation. But in most of the cases the training is incomplete and, in any event, the person, since graduation, has been pushing papers and attending meetings; he is overworked, frustrated and worse, without access to reading materials on the subject area. After a while, the person can claim profession, only by name, not by substance.

On research, it is sufficient to quote a sentence from the UNESCO/ECA report which observed that: "Research which is the main life-blood of scientific training on which the production of research scientists depends are either completely absent, as in some of the younger universities, or still in a fledging state, as in the majority of the universities."³⁷ As mentioned above for teaching that report concludes on the same page that only a few of the African universities at present have any teaching and research programmes in marine sciences, and even then the main emphasis on research so far is in biology and fishery sciences.

36. International Cooperation in Marine Technology, Science and Fisheries; The Future U.S. Role in Development: Proceedings of a Workshop January 18-22, 1981 (La Jolla, Cal.: Scripps Institute of Oceanography. Washington, D.C., National Academy Press 1981). p. 35

37. Supra note 36, p. 12

Where there is no manpower and expertise development it can be expected that institutional infrastructure will not evolve either. There will be no research vessels, equipments and laboratories. And the vicious circle will continue. For development to occur the bottleneck must be broken somewhere. Most of the discussions have urged for transfer of technology as a means of breaking the bottleneck. In fact, that broad package is often misleading in that the technology might break the bottleneck only if in the fore-front is placed the training of high-level manpower and expertise in the respective fields.

In that case the trained manpower would choose, receive the technology or they may, in fact, be able through skilled engineering techniques, to modify or rationalize the technology to suit it to their own circumstances or to adhere to parsimony. This is why there is no limit to the training needed for the developing countries. A working group at the Scripps Workshop considered that there were "some graduate students from developing countries studying in the United States and conducting research unrelated to the needs of their own countries".³⁸ In a general context this view suggests that there is some "village technology" beyond which developing countries should not go. This is a total misconception. Professionals train to be nothing but complete professionals in the fields of their preparation and they should strive to achieve excellence and nothing less. It is only when an engineer has the full knowledge of technology in a given field that he/she can choose what to use, what to fabricate for a given situation or how to rationalize or modify existing technology to suit a given situation. The implication of the submission at the Scripps Workshop is that the so-called developing countries should only train to be simple technicians, who depend on the engineers from the presently industrialized countries eternally.

If developing countries are to realize the full benefits of the marine resources in the Exclusive Economic Zone and continental shelf then they must train their own people and their aim must be pursuit of excellence at every level. That is to say, not every one must be trained to Ph.D. level (or beyond, in terms of excellence in research), but at whatever level one is trained the goal must be universal.

38. Supra note 36 at p. 34

V. SOME SCHEMES FOR TRAINING

Two points are important here by way of preface. First, the interpretation of the notion of transfer of technology adopted above is the governing principle for the design of the scheme for training of manager in marine resources development. What they gain in the course is part of the technology for management of the resources; at the same time the individuals are prepared to receive any technology software and hardware that may reach the country. The training must be as to prepare the individuals to receive, adopt and diffuse the technology.

Second, the training is a purposive exercise. The design of a training scheme should entail a prior careful examination of the range of management and operational activities as discussed in Part III above. Thereafter, every subject in the course should be targetted at specific sectors ranging from exploration to the government's fiscal policies and other decision-making matters.

The training itself may fall under two broad categories: Short courses and Long training. These can take different forms and durations but here only brief outlines can be sketched.

a) Short Courses

These could be designed for management cadre in place. Initially they could be packaged as inter- and multi- disciplinary and general orientational in character. The purpose might be to build up the notion of comprehensiveness and interrelated nature of marine resources management. But that should not exclude also opportunities for individuals to pursue a modicum of in-depth projects in areas of specific interests or formal training.

In that event, the basic professional background of the participants would not matter. They could be drawn from public administration, engineering, economics, geology, biology, law, chemistry, among others.

The duration would depend on a number of factors; the level of managers and their responsibilities at home base is often a leading consideration. But it has been found in experience that if a government

is determined on the training needs then they will be more concerned about the perceived quality of the training programme than the duration. In any event, for an intensive short course any duration upto ten weeks may be reasonable provided that it is packaged to be cost-effective in terms of use of time and resources.

The specific merits may be considered for holding the courses nationally, regionally or globally. Perhaps the regional approach would yield optimum benefits in terms of distance; sharing of resources and experience and follow up possibilities. But there are also instances where the global approach has its advantages.

Content of the short courses may also be varied. Apart from the comprehensive design of the multidisciplinary and interdisciplinary, there can also be designed the short courses for specific subject areas to enhance efficiency in the respective sector. These would also vary in duration depending on the scope of its coverage.

b) Long Training Schemes

This may be called the professional training programmes to produce high level manpower and expertise for high level research and development. The fields would include, inter alia, oceanography, geological and geophysical prospecting, hydrography; resource economists; geophysicists; petrologists; off-shore production and reservoir engineering; petroleum economists; industrial chemists; and resource lawyers and planners. These studies should be pursued to doctoral and post-doctoral level. What is important to note is that such training takes a long time. In point of fact, the developing countries, with only a few exceptions, are very late in commencing the training scheme. This means, in effect, that most of the search for and production of oil in the off-shore areas of these countries will be done entirely by foreign commercial interests in countries where nearly no one at all can monitor or regulate the operations. No one expects the oil to make meaningful contribution to national development under those circumstances.

Even though the training should have commenced several decades ago it is not too late yet. National governments can still embark on concerted training programmes provided that they can secure the requisite

financial assistance. It is also true that because of the costly nature of the training only a few can be trained in each country at a time. It is therefore a decidedly long-term undertaking which does not threaten to saturate any country with highly qualified but idle engineers.

Finally, the technology in these areas is fast in flux. It requires constant followup and updating. Therefore, such expertise as are so trained must have opportunities to update their knowledge constantly.