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41 p.

diagram

CARIBBEAN CENTRE FOR RESEARCH AND DEVELOPMENT
IN MARINE INDUSTRIAL TECHNOLOGY
TECHNOCARIBE
INSTITUTIONAL OPTIONS

Working Paper submitted by the International Ocean Institute

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EXECUTIVE SUMMARY

The welfare of the Caribbean islands largely depends of the rational and sustainable use of the marine environment and its resources. This requires institutional developments - already in course --to facilitate the articulation of integrated marine policy and planning, national as well as regional; it also requires the development of a whole range of new, and often, high, technologies. This, in turn, calls for (1) the strengthening of national infrastructure for the development and management of science and technology; (2) the establishment of regional centres in accordance with Articles 276 and 277 of the United Nations Convention on the Law of the Sea and (3) well coordinated cooperation with the competent international organisations. It requires South-South as well as North-South cooperation. New concepts of "technology transfer" are also needed.

This working paper analyses some recent proposals for the enhancement of international, public/private cooperation in technology development and management, such as the proposal for the establishment of a Mediterranean Centre for Research and Development in Marine Industrial Technology (Meditech), put forward by the International ocean Institute, the Government of Malta, UNEP, and UNIDO; and, in the Caribbean area, UNEP's proposal for the establishment of a system of regional activity centres (RACS) and regional activity networks (RANs); the proposals put forward by Our Own Agenda, a Report by the Latin American and Caribbean Commission on Development and Environment; and Project Bolivar, proposed by the Government of Venezuela.

The Working Paper comes to the Conclusion that what is needed is, more than a Centre: It is a System, integrating national, regional, and global efforts. Following the pattern proposed by Project Bolivar, Meditech, and their common source of inspiration, the European system Eureka with its subsystem Euromar, the Working Paper presents an illustrative model of a system called Technocaribe, centred on a Caribbean Centre for Research and Development in Marine Industrial Technology.

The System has the following components:

A Regional Conference composed of the Ministers of Science and Technology of States Parties, the political organ of the system;

A Regional Committee composed of National Coordinators, the technical organ of the

system;

National Coordinators;

a Caribbean Centre for Research and Development in Marine Industrial Technology, the operational organ of the system;

A network of scientific/technological research and training institutions, to initiate project proposals, jointly with:

a network of industrial companies operating in the region.

An illustrative list of priority areas of research and development is compiled from all the documents considered by the Working Paper. It consists of the following elements.

- a) aquaculture technologies;
- b) biotechnology applied to aquaculture, marine-based pharmaceuticals, protection of marine vessels and structures from biodeterioration, and clean-up of chemical and microbial pollution;
- c) alternative energy technologies;
- d) production and utilisation of by-products and wastes from fish and macroalgae processing (e.g., chitin from shellfish wastes);
- e) technologies concerned with and development of new products such as unusual sugars, polysaccharides, carotenoids and algal lipids;
- f) desalination technologies;
- g) design, construction and operation of transportation systems;
- h) technologies concerned with the land/sea interface, including port and harbour development, erosion protection and near-shore engineering;
- i) measurement and instrumentation development, coastal engineering and data acquisition, ship operation and engineering, computer-aided ship design and manufacture; ship and structure model tests, and performance evaluation;
- J) industrial uses of deep bottom water;
- k) Analysis and development of traditional native technologies.
- l) development of automatic samplers;
- m) advanced numerical models of flow processes at seas;
- n) aerial remote-sensing with laser-radar.

To be eligible, projects must have partners in at least two countries, one of which must be as developing country. Projects selected as Technocaribe projects must be financed at least 50 percent by the proposing institutions/companies. Developing country partners will be assisted by international funding agencies through grants or soft loans covering part or all of their investment shares. Developing countries thus will be able to participate as equal partners in the projects and intellectual property rights over jointly developed technologies. The remaining costs, up to 50 percent, will be paid by participating Governments.

It is anticipated that the synergism created by this form of public/private international, North-South cooperation will generate substantial investments in R&D in marine industrial technologies.

Technocaribe could make major contributions to

- . the implementation of sustainable development in the marine sector;
- . the implementation of two important and seminal articles of the United Nations Convention on the Law of the Sea (Articles 276,277);
- . the strengthening of the institutional infrastructure of the Caribbean Action Plan, adjusting it to the new needs arising from UNCED and the integration of environment and development;
- . South-South and North-South cooperation in technology development;
- . the enhancement of "technology co-development," transcending the traditional, and inadequate concept of "technology transfer";
- . the "hybridization" of ancient indigenous and leading-edge technologies, beneficial for both;
- . the development of human resources.

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CARIBBEAN CENTRE FOR RESEARCH AND DEVELOPMENT

IN MARINE INDUSTRIAL TECHNOLOGY

TECHNOCARIBE

INSTITUTIONAL OPTIONS

A. Background

I. The United Nations Convention on the Law of the Sea

1. The United Nations Convention on the Law of the Sea contains the most advanced legal and institutional framework for international cooperation, both South-South and North-South, national, regional, and global, in the development and management of environmentally and socially sustainable marine technology. Considering the particular situation of the States bordering the Caribbean and the circumstance that the International Sea-bed Authority and the Enterprise are to be located in Jamaica, it would seem that the Caribbean countries could play a major role in interpreting, developing, implementing, and utilizing this institutional framework and benefit from it.

2. Technology is defined, in Article 5 of Annex III of the Convention as

the specialized equipment and technical know-how, including manuals, designs, operating instructions, training and technical advice and assistance, necessary

to assemble, maintain and operate a viable system and the legal right to use these items for that purpose on a non-exclusive basis."

3. Marine technology is linked to, and dependent on, all the major new High Technologies that characterize the so-called Third Industrial Revolution and have contributed to the radical transformation of the economies of the industrialized states into Service Economies. These linkages between marine technology and all the High Technologies were summarized in document LOS/PCN/L.56, 23 February, 1988, "Current Status of Deep Sea-Bed Exploration and Mining Technology."¹

4. Provision for technology development, and especially for the transfer of technology to developing countries, is made in part XI and Annex III of the Convention with regard to Seabed exploration and mining and polymetallic processing technologies. Jamaica, with the Seabed Authority and the Enterprise located on its territory, could become a focal point for the advancement of international cooperation in technology development in this sector. The

¹The table lists:

- . MATERIALS TECHNOLOGY, and its impact on the creation of lighter and stronger materials for use at sub-zero temperatures and high pressures at great depth;
- . MICRO-ELECTRONICS/ROBOTICS impacting on the development of active remote-controlled collectors to "concentrate" nodules, remote-controlled underwater scraper submarines, sub-sea controls, robot collectors;
- . COMPUTERS, whose further development impacts on practically everything connected with seabed mining, from exploration and mapping and data management to navigation and production, processing and marketing;
- . SONAR, e.g., for multi-beam echo-sounder systems;
- . FIBRE OPTICS for cables connecting photo-sleds and
- . ROVs, for improved data transmission, etc.
- . LASER as a mapping tool and, especially, development of quantum lasers for the next generation of supercomputers.

development of other marine technologies, including especially fishing and navigation technologies, technologies for the protection of the marine environment, pollution combating technologies, etc., are covered in Parts V and, particularly, in Parts XII, XIII, and XIV of the Convention. The Convention encourages the strengthening of scientific and technological infrastructure at the national, regional, and global level. It recognizes the fundamental importance of science and science-based technology for the rational and sustainable development of ocean space and resources. It is indeed worth noting that almost 100 of the 320 articles of the Convention touch, in one way or another, on marine scientific research and marine technology. It is also to be noted that the Convention reserves marine scientific research --together with the high seas and the international seabed --for peaceful purposes.

5. At the regional level, which is the focus of this paper, the Convention mandates the establishment of Regional Centres for the advancement of marine science and technology. Their functions are described in some detail in Articles 276 and 277.

II. The Mediterranean Centre for Research and Development in Marine Industrial Technology (MEDITECH)

6. In 1987 the International Ocean Institute launched a proposal and undertook a pilot feasibility study on the possibilities and modalities of establishing such a Centre in the Mediterranean. The study was based on a number of simple, basic concepts:

The Centre is to implement and develop Articles 276 and 277 of the Convention;

To avoid duplication of efforts and proliferation of offices, it would be most appropriate to utilize the existing institutional framework of the UNEP-initiated Regional Seas Programme. The Centre should become part of the network of the Mediterranean Action Plan. It should indeed strengthen that network and contribute to the development of the post-UNCED phase of the Regional Seas Programmes, integrating Environment and Development through environmentally and socially sustainable technology;

The Centre must be based on the most advanced forms of development and management of High Technology. The most advanced model was found in the European EUREKA and EUROMAR system, embodying a new form of partnership between scientific institutions, industries, and governments at an international European level. The novel feature of Meditech is that it opens these systems to the participation of developing countries. This participation, in the IOI scheme, will be paid for by public international funding agencies such as the World Bank (GEF), UNDP, UNIDO, UNEP, the European Investment Bank, etc.: the transfer of technology being one of the foremost goals of GEF, in its quest for sustainable development.

Developing country partners, thus financially assisted, participate in projects as equal partners through joint R&D, with equal rights to the intellectual ownership of technologies jointly developed.

The traditional approach to "transfer of technology," therefore, is no longer

applicable. It must be replaced by the more dynamic concept of "joint development of technology" or "technology co-development." EUREKA, and similar systems, embody this concept as among the industrialized countries. Meditech extends it to include developing countries.

North-South cooperation in R&D in all sectors of high technology is an absolute necessity if we are serious about bridging the technology gap and the development gap largely caused by it, and if we want to enhance sustainable development. This broader issue is already under discussion by the partners of EUREKA, and some countries, in particular Italy and Spain, are favourable to such an opening.

Marine technology is merely an opening wedge. The IOI considers the Meditech project as a pilot experiment to be developed further in two ways: extending it to other regions of developing countries, and expanding it to other sectors of high technology.

7. Meditech is a network consisting of four elements:

the National Co-ordinators. These are appointed in each participating country. It is their task to solicit and pre-select eligible projects for the system. To be eligible, a project must meet certain standards and must have partners in at least two countries, one of which must be a developing country.

the meeting of National Coordinators. It is the task of this meeting to consider all pre-selected projects and identify the best and, where desirable, identify additional partners and funding sources;

the Conference of Ministers (of Science and Industry). This conference makes policy decisions, determines priorities and is responsible for the final selection of projects.

A Coordinating Centre which services the other elements of the network and may assume a number of additional functions and tasks.

8. Projects adopted as Meditech projects will be financed at least 50% by the industries that put forward the proposal (the share of proponents from developing countries to be paid by public funding agencies), and up to 50% by Governments.

9. The synergism generated by this system, integrating science, industry and government, private and public sectors, on a regional basis, is enormous. EUREKA, including EUROMAR, has adopted, over the five years of its existence, over 500 projects representing a total investment of over 80 billion French Francs (about US\$12 billion).² The prospects for MEDITECH thus are good.

III. Latin American and Caribbean Models

10. In the Latin-American/Caribbean region, similar developments are already in course.

²See *Le Monde*, 19 June 1991, "Économie," p. 21.

Our proposals for the institutional framework of a Caribbean Centre for Research and Development in Marine Industrial Technology (TECHNOCARIBE) are based on three recent documents originated in the Region: UNEP's conceptual paper on an integrative system of Regional Activity Centres (RACs) and Regional Activity Networks (RANs),³ Our Own Agenda;⁴ and Project Bolivar,⁵ announced by President Perez of Venezuela in October, 1990.

III. UNEP's RACs and RANs

11. UNEP's proposed network of RACs and RANs is an ingenious system of organizing and coordinating an exceedingly complex array of tasks. Summarizing the "Concept Paper" in a few lines, one should start with the breakdown of the Caribbean Action Plan into 5 main programmes:

- . Specially protected areas and wildlife;
- . Assessment and control of marine pollution;
- . Integrated Planning and institutional development for the management of marine and coastal resources;
- . Information systems; and
- . Education, training and consciousness raising.

³"Concept Paper for Regional Activity Centres and Regional Activity Networks." Kingston, Jamaica, RCU of the Caribbean Environment programme, August, 1991.

⁴Our Own Agenda published by the Latin American and Caribbean Commission on Development and Environment, the Inter-American Development Bank, and the United Nations Development Programme;

⁵Proyecto del Programa Bolivar. Caracas, Octubre 8 de 1990.

Secondly, a registry or roster is made of all national and regional organisations and institutions competent in marine affairs [referred to, hereafter, as "roster 1"); thirdly, the most suitable institution is selected as "Activity Centre" for each of the five programmes; and, fourth, this activity centre is given the responsibility of networking with all other competent institutions on the roster in the implementation of the programme. Many, or perhaps most, of the institutions will be part of two or more regional networks, and this will create an interesting and complex "web." Computerization and informatics should be quite capable of keeping the lines straight.

12. Each one of the 5 programmes has a technology development component. Considering the fundamental importance of joint, science-based development of environmentally sound and socially sustainable technology, it could be suggested that a sixth programme should be added to the list: Research and Development in Marine Industrial Technology, with the regional action centre in Venezuela: The Caribbean Centre for R&D in Marine Industrial Technology --charged with networking with all the other competent institutions on the roster.

IV. Our Own Agenda

12. Our Own Agenda. This agenda touches on all aspects of "sustainable development" in the region. It lists nine priority issues that have to be confronted. All of them have a direct bearing on the development and conservation of ocean space and resources:

- . Land use determines the quantity and quality of land-based sources of pollution affecting the sea;
- . The Environment in human settlements, the majority of which today are in coastal areas, interacts with the marine environment;

Water resources will increasingly depend on desalinated sea water;

Ecosystems and biological patrimony reside largely (over 70 percent) in the oceans;

Forest resources in the region have an important marine-related component in the mangrove forests which provide habitat and breeding ground for many species of marine fish;

Sea and shoreline resources fall entirely into the marine sector of development and conservation;

Energy comprises offshore hydrocarbon resources as well as renewable energy resources such as waves and OTEC;

Mineral resources (non-energy) will increasingly be extracted from the sea and seabed, nearshore as well as from the deep seabed;

Industry is the basic tool for the development and conservation of both land- and sea-based resources and processes.

13. Industry is technology-based, and the Agenda gives due consideration to the issue of science-based technology development within the developing countries themselves. "New technology must be generated and defined for the purpose if sustainable development principles are to be rendered applicable." The Agenda gives some guidelines for technology development in the region, among which one might mention in particular the following:

emphasis is to be placed on "the use of traditional technologies [developed through the millennia by native peoples] to complement modern and leading-edge ones (technological pluralism); and constructive integration of new and emerging technology with traditional or modern techniques (technological

hybridization)..."

On the institutional side, the Agenda recommends "the establishment of development banks supported by the public sector, with inputs of venture capital, to promote applications of technological innovations by private production systems; creation of technological research and development within the major public sector productive enterprises" as well as "linkage between transnational corporations and the industrial and technological sectors" which "would help to enrich knowledge and improve their ability to select the right paths for their development and entry into world markets."

14. These are broad guidelines. They now have to be structured into an operational institutional framework.

V. Project Bolivar

15. The third document, of fundamental importance, is Project Bolivar, which could accomplish this very purpose. In October, 1990, President Perez of Venezuela announced this Project, first at the meeting of the RIO Group (October 10), then at the annual conference of the Third World Academy of Science (October 15). His motivation was the same as that which initiated Meditech. He stressed the fundamental importance of science and science-based high technology for economic development. He pointed out that reliance on imported technology was not conducive to development, and that the only way to develop technology based on indigenous R&D was through creating a framework for integrating the efforts of scientific institutions, industrial enterprises, and governments: public and private

sector, on a regional, Latin- American/Caribbean basis.

15. President Perez, just as the IOI, referred to the EUREKA system, among others, as a possible model, and the structure he proposed for Project Bolivar closely follows that model, opening it to the developing countries of the region.

16. Just like Meditech, the Bolivar system has four components:

The Regional Conference (La Conferencia Regional), consisting of the Ministers of Science and Technology and of Industry, or their equivalents, in the member countries, as well as representatives of industrial associations and financial institutions of the Region, and a representative of the Latin American Commission for Science and Technology (COLCYT). The Regional Conference is the political organ of the system. It defines objectives and priorities and gives the final approval to projects.

The Regional Committee (El Comité Regional), consisting of the National Coordinators and their advisors as appropriate. The Regional Committee is the promotional organ of the system. It is responsible for the semi-final selection of projects for submission to the Regional Conference.

The National Coordinators (Coordinadores Nacionales), with the task of "promoting, identifying, evaluating, and coordinating initiatives in each country and propose them to the Executive Secretariat." They will establish contacts with the competent national authorities in their own countries and with their counterparts in other countries.

The Executive Secretariat (Segretariato Ejecutivo), the operational organ of the system. It services the National Coordinators and the meetings of the Conference and the Committee; it gathers, collates, analyses, distributes information relating to the various projects; it comprises, inter alia, a unit for technical project evaluation; it maintains a technology data bank and publishes a bulletin of information.

17. To be eligible projects must follow standards and criteria similar to EUREKA standards and criteria. They must have partners in at least 2 countries. Once adopted as Bolivar Projects, they will be issued a Certificate of Merit (Carta de Mérito) which will give them automatically a preferential status with banking and credit institutions in each country as well as with the multilateral institutions that may associate themselves with the Bolivar system.

18. While stressing the need for flexibility and spirit of innovation, the Bolivar Programme indicates certain priority areas for project selection. These are:

- i. Mining technologies (nonferrous and precious metals; nonmetallic minerals, carbon and ferrous metals; technologies for polymetallic extraction);
- ii. Energy (development of natural gas; renewable energy resources, inter alia);
- iii. Fisheries technologies (export of tuna, shrimps, etc.; conservation and freezing; fisheries engineering and technology, aquaculture);
- iv. Electronics and informatics.

19. It should be noted that (i.), i.e., mining-related technologies, overlaps with the

priorities of the Sea-bed Authority and its Enterprise which will be located in the Caribbean. It seems therefore highly advisable that, in order to maximize benefits and avoid duplication of efforts, systemic forms of cooperation between Project Bolivar and the International Sea-bed Authority and its Enterprise should be envisaged.

20. It is further to be noted that priority (iii), fisheries-related technologies --lies entirely in the sector of "marine technology," while priorities (ii) and (iv) have strong marine components. It seems logical, therefore, to suggest that, just as EUREKA has a subsystem, EUROMAR, entirely devoted to the development of marine technology, Project Bolivar should have a subsystem entirely devoted to that sector of technology development. Venezuela's offer to host a Caribbean Centre for Research and Development in Marine Industrial Technology should be seen in this context which will considerably facilitate the establishment of this Centre.

21. The following section will attempt to draw together all the strands emerging from the above mentioned proposals and agendas in one more network, within the complex and multidimensional system of managing sustainable development in the Latin-American/Caribbean Region, a network centred on a Caribbean Centre for Research and Development in Marine Industrial Development.

B. The Caribbean Centre for Research and Development in Marine Industrial Technology: TECHNOCARIBE

I. Geographical Scope

22. Our Own Agenda as well as Project Bolivar cover the Wider Caribbean as well as the entire South American region. UNEP's Regional Seas Programme covers the Wider Caribbean, leaving the South Atlantic and the South Pacific to other regional seas programmes.

23. It is one of the merits of the Regional Seas Programme to have developed the concept of sea-centred, environment-oriented regionalism to complement the traditional, continent-centred, political-oriented concept of regionalism. Marine technology development must respond to the needs and priorities of specific sea-centred regions. These may be different in the Caribbean, in the South Pacific, or in the South Atlantic, although there may be as many similarities as there are differences.

24. The Agenda as well as the Bolivar system are flexible enough to allow for subsystems in the marine sector. Technocaribe could be a subsystem of Project Bolivar in two ways: functionally, in that it is limited to marine technologies; geographically, in that it is limited to the islands and the countries bordering the Caribbean Sea, Parties to the Cartagena Convention. Other subsystems could be created for the South Pacific and Atlantic. This is an issue for discussion, and it is not necessary to foreclose any future development.

25. The initial Parties to the Convention establishing Technocaribe might be the States Parties to the Cartagena Convention. For the future, there are two options: Project proposals may come from other members of Project Bolivar, and it may turn out to be mutually beneficial to include them. In this case, the membership of Technocaribe would eventually coincide with the membership of the Bolivar system. The alternative is that differences of needs and priorities are greater than common interests and that the subsystem remains limited to the Wider Caribbean.

26. It should be noted that, just like the Mediterranean, the Caribbean is bordered by developed as well as developing States, the latter including, in the first place, the United States; in the second place, the U.K., France, and the Netherlands through their Caribbean territories. The mode of their participation is another issue to be discussed. Other industrialised States, for instance, Canada, have considerable interests in the Caribbean region. There are about 100 Canadian companies involved. None of them has carried out any research and development in the region. Canadian companies might be included through subsidiaries established in, and under the jurisdiction of, Caribbean States.

27. The inclusion of companies from industrialised countries --not considered in Project Bolivar -- would respond to the recommendation of the Agenda, for cooperation with transnational companies. North-South cooperation is an essential aspect of technology co-development, beneficial to all parties concerned. In the Caribbean, just as in the Mediterranean, preconditions for North-South cooperation are excellent.

II. The Regional Conference

28. Project Bolivar, like EUREKA, provides for an annual conference of Ministers of Science & Technology and Industry, to make policy decisions, set priorities, and make the final selection of projects. The same Ministers would be competent with regard to marine technology. One could imagine that they might be accompanied by the Ministers or Secretaries for Ocean Development (where these might be established in Caribbean countries) or the Ministers charged with the inter-ministerial coordination or integration of ocean policy (where they exist). As in Project Bolivar, the Regional Conference would be the political organ of Technocaribe. One should add: representatives of UNEP's Coordinating Centre for the Caribbean Action Plan, IOCARIBE, UNIDO, FAO, IMO, the Sea-bed Authority, UNDP, the Economic Commission for Latin America and the Caribbean, COLCYT, the World Bank, the Inter-American Development Bank, and OAS.

III. The Regional Committee

29. The Regional Committee should consist of the National Coordinators of member States. As in Eureka, Meditech and Project Bolivar, it should be the task of the Regional Committee to facilitate project development, identify partners and funding sources, and make the semi-final selection of projects. The Regional Committee should meet at least twice a year.

IV. The National Coordinators

30. The Ministers of Science and Technology in each member State should appoint a National Coordinator. In small countries, where fewer projects may originate, the National

Marine Technology Coordinator might be the same person as the Coordinator for Project Bolivar. In larger countries, or countries not members of Project Bolivar such as the USA, the Metropolitan countries if they were to join, a special Marine Technology Coordinator should be appointed. In the larger Caribbean States the marine technology coordinator should share offices and facilities (data base, communication networks, printing facilities, computers, etc.) with the National Coordinator for Project Bolivar. This, obviously, will reduce costs.

V. The Executive Secretariat

31. Here the options are numerous, on a flexible continuum. Project Bolivar provides for normal project facilitating and coordinating services. This includes the publication of a bulletin with state-of-the-art information on technology in the region and new developments in other parts of the world, and the status of ongoing Bolivar projects. The Technocaribe Bulletin might be a special section or supplement of the Bulletin for Project Bolivar, which would reduce production and mailing costs. The Bulletin would draw on the data bank established under Project Bolivar.

32. As in Meditech, this function of informatics could be conceived as the primary "module." Adapting the Meditech model to the Caribbean situation, one might obtain the following scheme:

Technocaribe Module 1

Informatics

Technocaribe collates information on	-----> Requests for more information <-----	-----> National gov.ments R&D Centres Regional & internat.
.R&D activities	----->	High Tech Centres
.Training programmes		U.N. Agencies.
bi/multilateral funding sources		Scientific Institutions listed in roster 1
.advances in associated High Tech		Industrial firms listed in roster 2
.Marketing options		OAS,Caricom
.Bolivar projects		

Possible outcomes

- . Harmonisation of Laws & policies
- . Informal contacts
- . Agreements on Joint R&D
- . Subregional Organisations
- . Treaty arrangements

One professional and two secretarial assistants could handle this basic function. In the Mediterranean, the estimated budget for this model was \$100,000 per year.

33. There has to be a module for technical project evaluation. To start with, this should consist of one professional and one secretarial assistant, added on to the technical project evaluation unit of Project Bolivar. The cost for this would be in the range of \$75,000 a year.

34. If the Executive Secretariat were to become itself a highly qualified scientific/technological institute, other modules, for additional functions, could be grafted to this primary one, as desirable and feasible.

35. There could be a module for Training and Advisory Activities, headed by a Training Coordinator, who should network with the selected R&D projects for on-the-job training (a "Roster 2" should be compiled, listing industrial companies participating in Technocaribe); with the institutions on Roster 1, for scientific/technological study fellowships, with IOI-Colombia (to be established in 1992) for foundation courses, and with the Training Panel of the Seabed Authority. This module would add another \$100,000 to the budget. Advisory activities could best be carried out through consultants listed in the data bank.

36. Some of the R&D projects approved by the Regional Conference could actually be carried out at the Centre itself, and thus, following the Mediterranean model, Technocaribe could be "catalyser, promoter, coordinator and developer."

If the work is entirely distributed by the Regional Conference to existing national institutes, the Centre would have acted as a catalyst and arranged for the networking of various institutions through appropriate work allocation. It would have acted as a promoter if the proposal submitted by it to the Regional Conference, after appropriate interactions with the national institutions, were based on understanding of which future technologies were necessary in the Caribbean context. Its role would be of coordinator if the Regional Conference entrusted to it the job of co-ordinating/overseeing the work being done in different laboratories/institutions. If the entire work were entrusted to it, the Centre would be acting as a developer of the technology.

The flow chart designed for Meditech and reproduced here, would be fully applicable to Technocaribe. Each project carried out at the Centre itself would constitute an additional

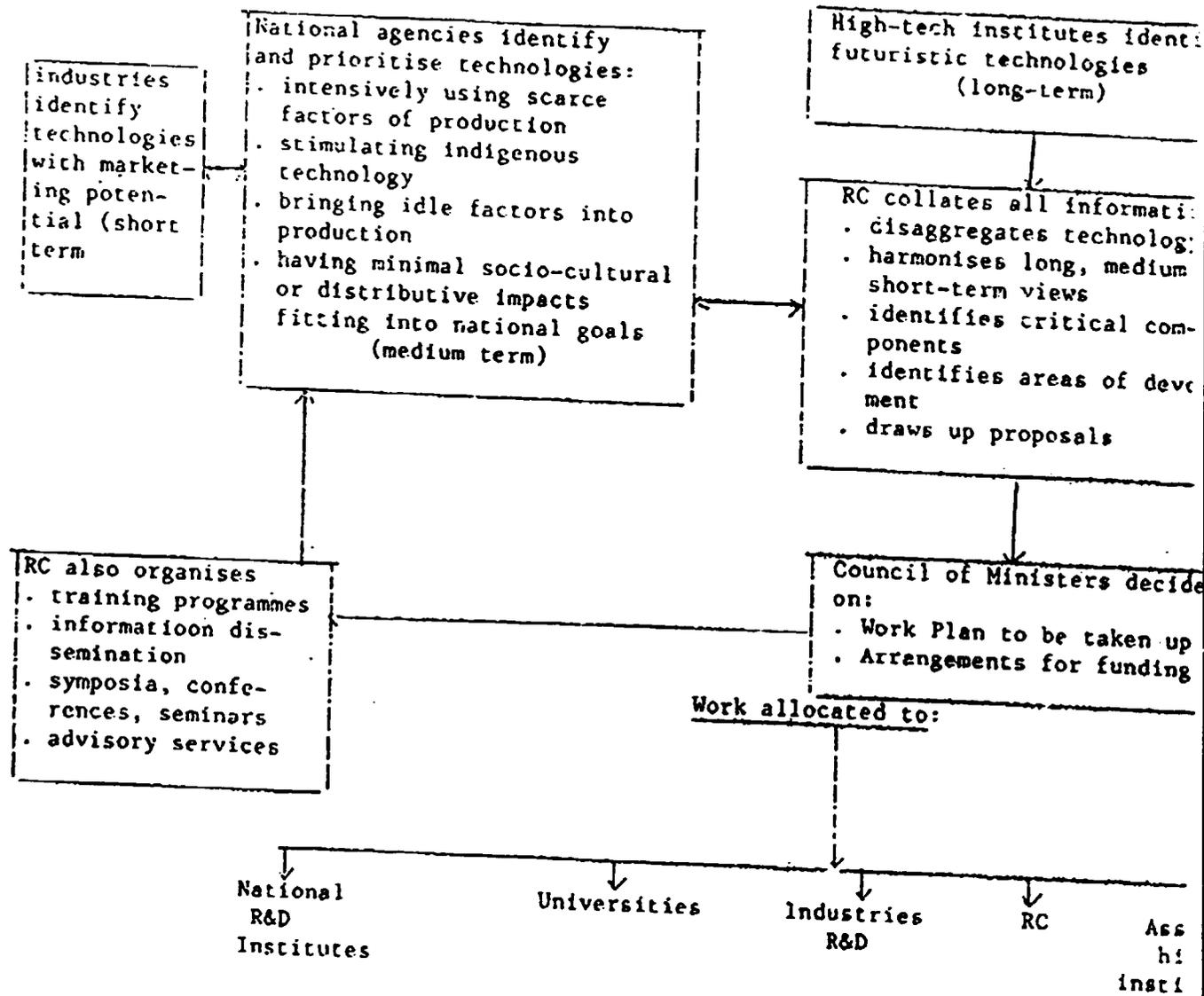


Figure 4

module, financed according to the Project Bolivar rules.

VI. Priority Areas of R&D

37. Here is a synopsis of the priorities listed in the various documents under consideration. subjects a)-i) are taken from the Meditech Proposal, from which also the proposals of the UNIDO "Viability Study" are taken, which, therefore, are not listed separately. They also cover all the priority areas listed in Project Bolivar (mining technologies; fisheries; energy; informatics). Item j) has been added, based on recent experimental work in Hawaii; item k) is taken from Our Own Agenda. l), m), and n) are taken from Euromar.

- a) aquaculture technologies;
- b) biotechnology applied to aquaculture, marine-based pharmaceuticals, protection of marine vessels and structures from biodeterioration, and clean-up of chemical and microbial pollution;
- c) alternative energy technologies;
- d) production and utilisation of by-products and wastes from fish and macroalgae processing (e.g., chitin from shellfish wastes);
- e) technologies concerned with and development of new products such as unusual sugars, polysaccharides, carotenoids and algal lipids;
- f) desalination technologies;
- g) design, construction and operation of transportation systems;
- h) technologies concerned with the land/sea interface, including port and harbour development, erosion protection and near-shore engineering;

- i) measurement and instrumentation development, coastal engineering and data acquisition, ship operation and engineering, computer-aided ship design and manufacture; ship and structure model tests, and performance evaluation;
- J) industrial uses of deep bottom water;
- k) Analysis and development of traditional native technologies.
- l) development of automatic samplers;
- m) advanced numerical models of flow processes at seas;
- n) aerial remote-sensing with laser-radar.

38. This constitutes a wide range of options. Many of these technologies are needed to implement the priority programme of UNEP's Caribbean Action plan:

- . Specially protected areas and wildlife;
- . Assessment and control of marine pollution;
- . Integrated Planning and institutional development for the management of marine and coastal resources;
- . Information systems; and
- . Education, training and consciousness raising;

as well as those listed in Our own agenda:

- . Land use
- . The Environment in human settlements
- . Water resources
- . Ecosystems and biological patrimony
- . Forest resources, including mangrove forests
- . Sea and shoreline resources
- . Energy

Mineral resources (non-energy)

Industry

39. Needless to say, not all these priority areas need to be taken up at once; one could also imagine that responsibility for project pre-selection in different priority areas could be divided between different centres (e.g. technologies pertaining to the development of living resources and coastal management could be assigned to the Institute to Marine Affairs in Trinidad & Tobago; technologies relating to seabed mining, to the Seabed Authority in Jamaica, etc.)

VII. Project Funding

40. There are differences between the project funding mechanism provided for by Project Bolivar on the one hand, and those provided by Eureka and Meditech on the other. Eureka provides that the proposing industries themselves must contribute at least 50 percent of the funding required while up to 50 percent will be contributed by Governments and, where applicable, by the European Community. In the Meditech proposal, likewise, the proposing industries must contribute at least 50 percent; in the case of developing countries, however, this amount may be partly or entirely provided, as a grant or low-interest loan, by international funding agencies. The other 50 percent, as in Eureka, are to be paid by Governments and, where applicable, international organisations. Project Bolivar is less specific: it merely establishes that projects selected by the Regional Conference will automatically enjoy "preferential status" with national and international banking and credit institutions.

41. The marine technology sector --perhaps more than any other --will involve North-

South cooperation, and this cooperation must be beneficial for all partners, or otherwise it will not take place. The advantages for the partners from the "North" would be: cost-sharing, and, therefore, a reduction of their own investments; risk-sharing; and creation of new markets. All three are important; the first is quantifiable in monetary terms. These should be set out as precisely as possible. One might suggest, therefore that Technocaribe should follow the Meditech model rather than the Bolivar model on this point.

C. Conclusion

42. All the elements for the establishment of Technocaribe are already in place. One might say, the premises are exceptionally good. Without the need for new bureaucracies a cost-effective system or RAN, coordinated by a Centre (RAC) can be created. All that is needed is a design to put the existing pieces together in a meaningful structure.

Technocaribe could make major contributions to

- . the implementation of sustainable development in the marine sector;
- . the implementation of two important and seminal articles of the United Nations Convention on the Law of the Sea (Articles 276,277);
- . the strengthening of the institutional infrastructure of the Caribbean Action Plan, adjusting it to the new needs arising from UNCED and the integration of environment and development;
- . South-South and North-South cooperation in technology development;
- . the enhancement of "technology co-development," transcending the traditional, and inadequate concept of "technology transfer";
- . the "hybridization" of ancient indigenous and leading-edge technologies, beneficial for both;

the development of human resources.

43. The final section presents an illustrative model for the establishment of Technocaribe.

D. Illustrative Model

Draft Agreement

Conscious of the increasing importance of sustainable ocean development in the global economy/ecology;

Aware that ocean development is impossible without a strong basis in marine science and technology;

Aware also of the linkages between marine technology and the whole range of new High Technologies;

Convinced that joint Research and Development is today the most effective mode of "transfer of technology;"

Observing the existence of many traditional, indigenous technologies in the region, which could be strengthened by "hybridization" with leading-edge technologies;

Prompted by the desire to contribute to the implementation of sustainable development in ocean space through the advancement of environmentally sound and socially sustainable technology;

Recalling the Resolution on Development of National Marine Science, Technology and Ocean Service Infrastructures, adopted by the Third United Nations Conference on the Law of the Sea which stresses the rapid advances being made in the field of marine science and technology, and the need for the developing countries to share in these achievements;

Recalling also the United Nations Conference on the Law of the Sea, 1982, which, in Articles 276 and 277, provides for the establishment of Regional Centres to enhance this goal

Desirous to contribute to the strengthening of the institutional infrastructure of the Cartagena Convention and the Caribbean Plan of Action adjusting it to the new needs

arising from Unced and the integration of environment and development;

Noting that The Latin American and Caribbean Commission on Development and Environment, as well as other bodies and institutions in the region, have made important contributions to the fulfilment of this aim;

Believing that "Project Bolivar" provides a most suitable framework for the enhancement of joint research and development in high technologies among which marine technologies play an important role;

Convinced of the need of strengthening South-South and North-South cooperation in technology development and the development of human resources;⁶

the Parties have agreed as follows:

Article 1

Establishment

A system, called Technocaribe,⁷ is hereby established.

⁶These preambular paragraphs are derived from the conclusions of the previous section.

⁷It is important that it is as system, not simply a "centre" or an "institute." If it is to enhance regional cooperation, it must be, from the outset, a system, involving all the major actors in the region. The importance of the "centre" depends on political choices. It may be merely a coordinating agency; or it may be a fully operational centre. The system as a whole is decentralized and project-oriented. Any component of the system may acquire the importance it desires.

Article 2

Purpose

The purpose of Technocaribe is to enhance cooperation between science, industry, and governments, public and private sector, at the regional level, in research and development in marine industrial technology.

Article 3

Membership

The initial Parties to this Agreement shall be the States Parties to the Cartagena Convention. The Agreement is open to accession by any other Caribbean State or Territory.

Article 4

System Components

Technocaribe shall have the following components:

- . A Regional Conference
- . A Regional Committee
- . National Coordinators
- . The Caribbean Centre for Research and Development in Marine Industrial Technology
- . Scientific Institutions and Organisations listed in Roster 1
- . Industrial companies listed in Roster 2.

Article 5

The Regional Conference⁸

1. The Regional Conference shall be the political organ of the system.
2. The Regional Conference shall be composed of the Ministers of Science & Technology and Industry, or their equivalents, of States Parties, and of representatives of all competent international organisations and funding agencies in the region.⁹
3. The Regional Conference shall meet once a year, at places to be determined from time to time.
4. The Regional Commission shall elect its own Chairperson.
5. The Regional Commission shall make policy decisions, set priorities, make the final selection of projects, and assign them, for execution, to the institutions and companies on Rosters 1 and 2, or to the Caribbean Centre for R&D in Marine Industrial Technology, if it wishes to be a partner to any of the projects.
6. The Regional Commission shall elect the Director General of the Caribbean Centre for R&D in Marine Industrial Technology, upon nominations by the Governments of States parties.
7. The Regional Commission shall appoint an independent Auditor for the annual audit of the records, books and accounts and annual financial statements.

⁸This, and the following articles, follow the pattern of Project Bolivar.

⁹UNEP's Coordinating Centre for the Caribbean Action Plan, IOCARIBE, UNIDO, FAO, IMO, the Sea-bed Authority, UNDP, the Economic Commission for Latin America, the Caribbean, COLCYT, the World Bank, the Inter-American Development Bank, and OAS.

8. Decisions on procedural questions shall be taken by simple majority; decisions on substantive matters require two thirds of the members of the Commission present and voting.

9. Two thirds of the membership shall constitute a quorum.

Article 6

The Regional Committee

1. The Regional Committee shall be the technical organ of the system. It shall be composed of the National Coordinators of member States. The Regional Committee shall facilitate project development, identify partners and funding sources, and make the semi-final selection of projects which they shall submit to the Regional Conference. The Regional Committee shall meet at least twice a year.

2. The Regional Committee shall elect its own chairperson for each session. Decisions on procedural matters shall be taken by simple majorities; decisions on substantive matters require approval by two thirds of the members present and voting.

Article 7

The National Coordinators

1. The Ministers of Science and Technology in each member State shall appoint a National Coordinator. In small countries, where fewer projects may originate, the National Marine Technology Coordinator may be the same person as the Coordinator for Project Bolivar. In larger countries, or countries not members of Project Bolivar, a special Marine Technology Coordinator shall be appointed. The marine technology coordinator should share offices and facilities with the National Coordinator for Project Bolivar as appropriate.

2. The National Marine Technology Coordinator shall solicit, evaluate, and preselect projects, identify partners and funding sources in his own country and in consultation with his counterparts in other member States. Preselected projects shall be forwarded to the

Caribbean Centre for R&D in Marine Industrial Technology.

3. The National Marine Technology Coordinator shall compile, and periodically update, two rosters. Roster 1 shall list all marine scientific/technological institutions in his country, their professionals and projects. Roster 2 shall list all companies in the marine industrial sector in his country. He shall transmit the data rosters to the Technocaribe Data Bank at the Caribbean Centre for R&D in Marine Industrial Technology.

Article 8

The Caribbean Centre for R&D in Marine Industrial Technology

1. The Caribbean Centre for R&D in Marine Industrial Technology shall be the operational arm of the Technocaribe system.

2. The Centre shall be established in Caracas, Venezuela.

3. The Centre shall be headed by the Director-General who shall appoint his own staff.

4. The Centre shall be flexibly organized in various modules,¹⁰ which can be added or abolished according to needs and availabilities.

5. There shall be a core module to facilitate all Technocaribe activities and service the National Coordinators and the meetings of the Regional Commission and the Regional Committee. The core module shall contain a technical unit for project evaluation; it shall keep a marine technology data bank; and it shall publish a marine technology bulletin. Considering the linkages between marine industrial technology and all other sectors of High Technology, both data bank and bulletin should be fully coordinated with the data bank and bulletin of the Bolivar System.

6. A second module may be added to deal with the development of human resources and advisory services. This module may itself organize training programmes in the development and management of marine industrial technologies; it may provide scholarships for existing training programmes; and it may arrange for on-the-job training through

¹⁰the basic structure of the Centre follows the model of Meditech.

placement of trainees with various Technocaribe Projects.

7. The Centre may itself become a partner to Technocaribe Projects for R&D in marine industrial technology. A module would have to be added for each project, and deleted when the project is completed. Such modules would be financed within the Technocaribe financial scheme.

Article 9

Participating Organisations

Scientific/technological institutes listed in Roster 1 and industrial companies listed in Roster 2 shall have the right to submit project proposals to the National Coordinator.

Article 10

Project Selection and Financial Scheme¹¹

1. To qualify for selection as Technocaribe Projects, project proposals must follow the standards and criteria established by the Regional Commission. They must have partners in at least two countries, one of which must be a developing country.
2. Once selected by the Regional Commission as Technocaribe Project, the project is financed according to the following financial scheme:
 - (i) The proponent companies/institutions must provide at least 50 percent of the project cost, in cash or in kind,
 - (ii) the developing-country partner(s) shall be assisted by regional and global funding agencies which shall pay, fully or in part, through grants or long-term low-interest loans, for their investment shares in the project;
 - (iii) The remaining cost, up to 50 percent, will be covered by the Governments of member States and regional organizations participating in the project.

¹¹This follows the pattern of Meditech.

Article 11

Annual Audit¹²

The records, books and accounts of the System, including its annual financial statements, shall be audited annually by an independent auditor appointed by the Regional Conference.

Article 12

Priority Areas for Research and Development¹³

1. The Regional Conference, on the advice of the Regional Committee, shall review and revise from time to time the list of priority areas within which R&D projects are to be selected.
2. During the first year, and until such review and revision has taken place, projects should be selected within the following areas:
 - a) aquaculture technologies;
 - b) biotechnology applied to aquaculture, marine-based pharmaceuticals, protection of marine vessels and structures from biodeterioration, and clean-up of chemical and microbial pollution;
 - c) alternative energy technologies;
 - d) production and utilisation of by-products and wastes from fish and macroalgae processing (e.g., chitin from shellfish wastes);
 - e) technologies concerned with development of new products such as unusual sugars, polysaccharides, carotenoids and algal lipids;
 - f) desalination technologies;
 - g) design, construction and operation of transportation systems;
 - h) technologies concerned with the land/sea interface, including port and harbour development, erosion protection and near-shore engineering;

¹²This is taken from the Law of the Sea Convention

¹³See Paragraph 37, above.

- i) measurement and instrumentation development, coastal engineering and data acquisition, ship operation and engineering, computer-aided ship design and manufacture; ship and structure model tests, and performance evaluation;
- j) Industrial uses of deep bottom water;
- k) Analysis and development of traditional native technologies.
- l) development of automatic samplers;
- m) advanced numerical models of flow processes at seas;
- n) aerial remote-sensing with laser-radar.

Article 13

Intellectual Property¹⁴

1. Rights of access by each State Party to the scientific results of the other Parties' programme are guaranteed by rules on information and patents as set forth below, para.2 and 3, as well as through mobility of staff between the laboratories in the system and equitable sharing among States Parties of orders placed for the implementation of the project, subject to the principle of obtaining the best return for the sums committed.
2. Information resulting from research programmes undertaken in any State Party under the terms of this Agreement shall be communicated to all other States Parties and to persons or undertakings engaged in research or production activities in the territory of a State Party where such activities justify their access to such information. Such information shall not be communicated to any other States, persons or undertakings, except by agreement between the States Parties.
3. If the information referred to above is protected by patents, the latter may be used for research purposes by all States Parties and their associates and contractors in pursuing the aims of the Agreement. All of these shall have the right to obtain licences for the exploitation of such patents for industrial or commercial purposes, on appropriate terms and conditions, where Technocaribe has the right to grant such licences or sublicences.

¹⁴This article is adapted from the Agreement between the European Atomic Energy Community and the Kingdom of Sweden.

Article 14

Amendments

1. Amendments to this Agreement shall come into force when ratified by three-fourths of States Parties
2. Amendments adopted pursuant to this article shall not affect rights acquired under existing contracts.

Article 15

Dispute Settlement¹⁵

The Regional Committee shall be responsible for ensuring that the Agreement is properly implemented. Disputes regarding the interpretation or application of the Agreement shall, upon the request of any State Party, be submitted to a Board of Arbitrators. The Board shall consist of three Arbitrators, one appointed by each party to a dispute, and these two shall agree upon the appointment of the third member, who shall be the Chairman of the Board. If the two fail to appoint the third member, the third member shall be appointed by the President of the International Court of Justice.

Article 16

Depositary¹⁶

The Government of Venezuela shall be the depositary of this Agreement and amendments thereto.

¹⁵Same as footnote 13.

¹⁶Adapted from U.N. Convention on the Law of the Sea

Article 17

Authentic texts

The original of this Agreement, of which Dutch, English French and Spanish texts are equally authentic, shall be deposited with the Government of Venezuela.

Article 18¹⁷

Coming into Force of this Agreement

This agreement shall enter into force 60 days after the deposit of the...instrument of ratification.

Article 19¹⁸

Denunciation

1. Any State Party may, by written notification addressed to the Chairman of the Regional Conference, denounce this Agreement and may indicate its reasons. The denunciation shall take effect one year after the date of receipt of the notification, unless the notification specifies a later date.
2. A State shall not be discharged by reason of the denunciation from the financial and contractual obligations which accrued while it was a party to this Agreement, nor shall the denunciation affect any right, obligation or legal situation of that State created through the execution of this Agreement prior to its termination for that State.
3. The denunciation shall not in any way affect the duty of any State Party to fulfil any obligation embodied in this Agreement to which it would be subject under international law independently of this Agreement.

¹⁷Adapted from U.N. Convention on the Law of the Sea.

¹⁸Adapted from U.N. Convention on the Law of the Seas.