COLLÈGE DE FRANCE

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Mme. Elisabeth MANN BORGESE
Professeur à l'Université Dalhousie, Halifax

sur le sujet suivant :

THE NEW INTERNATIONAL TECHNOLOGICAL ORDER EMERGING FROM THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA.

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Address by Elisabeth Mann Borgese to College de France February, 1989

THE NEW INTERNATIONAL TECHNOLOGICAL ORDER EMERGING FROM THE UNITED NATIONS CONVENTION ON THE LAW OF THE SEA

I am deeply honoured by the invitation to address this audience in this world-famous and historic institution, and I am most grateful to Professor Dupuy and to the Administrator of the College for giving me this occasion.

The subject I have chosen is broadly interdisciplinary. If the framework is a legal one: the United Nations Convention on the Law of the Sea, 1982, the content is political and economic: since it deals with the relations between the industrialised and the developing countries as well as between the free-market countries of the West and the socialist countries of the East: epitomised, as it were, in the ongoing negotiations between the four "Pioneer Investors" in seabed mining, France, India, Japan, and the Soviet Union. The implications far transcend the scope of the Law of the Sea. They touch on the new phase of the industrial revolution through which we are living, and its impact within the industrialised countries themselves and on the relations between

industrialised and developing countries.

I intend to deal with these broader aspects first; then we shall try to give a brief overview of what we mean by "marine industrial technology." Next we shall examine the "technological order" provided for in the United Nations Convention on the Law of the Sea, and, finally, I want to give you two case studies showing how the framework of that Convention could best be utilised for the advancement and development of this new order.

I.

There have been "technology gaps" as long as there has been technology, and that means, as long as there have been human beings: or even longer. For there has been, and there is, technology even among animals. Animal technology, such as sonar in bats or sharks; the invention of the magnetic compass by migrating fish and birds, the fishing technologies among aquatic animals, including the invention of line and hook, net, harpoon, chemical weapons,etc. is an enthralling subject, and I never cease to marvel when looking at the imposing structure of a termite building, with its air-conditioned, temperature-controlled chambers, of a magnitude far exceeding that of Pyramids or sky-scrapers, if you relate their size to that of

the individual builder. Just last month, there was a headline, in the London Daily Telegraph of January 14, "Shark Technology Found to Reduce Drag on Aircraft." It turned out that the skin of sharks is covered with microscopic parallel grooves called "riblets," which are aligned in the direction they swim and reduce their drag and noise. Now British Maritime Technology hopes to apply "riblet technology" to aeroplanes, submarines, turbine blades and propellers on a commercil basis.

Lately we have learned to look with different eyes on the achievements of so-called primitive people in medicine and pharmacology. And there is a new science, biotics, which studies the achievements of animal technology and its applicability to humn technology: a "transfer of technology," so to speak, from the animal kingdom to the realm of humanity.

And where there has been a "technology gap," the "less developed" has paid with his fortune, his freedom, and often his life.

Turning now to more recent times, let me begin by telling you a delightful story I found in the writings of my great friend Abdus Salam, describing a "technology gap" in the early Middle Ages:

Seven hundred and sixty years ago, a young Scotsman left his native glens to travel south to Toledo in Spain. His name was Michael, his goal to live and work at the Arab Universities of Toledo and Cordova, where the greatest of Jewish scholars, Moses bin Maimoun, had taught a generation before.

Michael reached Toledo in 1217 AD. Once in Toledo, Michael formed the ambitious project of introducing Aristotle to Latin Europe, translating not from the original Greek, which he did not know, but from the Arabic translation then taught in Spain. From Toledo, Michael travelled to Sicily, to the Court of emperor Frederick II....Toledo's and Salerno's schools, representing as they did the finest synthesis of Arabic, Greek, Latin and Hebrew scholarship, were some of the most memorable of international essays in scientific collaboration. To Toledo and Salerno came scholars not only from the rich countries of the East and the South, like Syria, Egypt, Iran and Afghanistan, but also from the developing lands of the West and the Norh like Scotland and Scandinavia. Then, as now, there were obstacles to this international scientific concourse, with an

> economic and intellectual disparity between different parts of the world. Men like Michael the Scot ... were singularities. They did not represent any flourishing schools of research in their own countries. With all the best will in the world their teachers at Toledo and Salerno doubted the wisdom and value of training them for advanced scientific Research. At least one of his masters couselled young Michael the Scot to go back to clipping sheep and to the weaving of woolen cloth.

Who would have predicted that the roles would be inverted so dramatically in modern times!

Today we in the North are passing through a new phase of the industrial revolution which causes painful displacements within the industrialized world, strains and stresses between the industrialised and the developing countries, and is generating important structural and institutional changes, nationally and internationally. I want to focus on just a few of the manifold aspects of this development.

The changing nature of science-based technology itself has triggered changes in its management and development.

We know that today research and development (R&D) constitutes a much larger proportion of the activities and of the budgets of the industrial enterprise. Research and development is the basis of technological innovation: Technological innovation is the motor of economic growth. According to some experts (Nobel Laureate Robert M. Solow of the MIT), as much as 85 percent of U.S. economic growth per capita as recorded in historical data is attributable to increases in productivity or technological innovation. Only about 15 percent of the growth could be traced to the use of more inputs. Or, as Ralph Landau put it in a recent article ("U.S. Economic Growth," Scientific American, June, 1988), "Although scholarly research has not yet provided conclusive evidence, my colleagues and I believe it is in this broad sense that technological innovation is the key to viable strategies for future economic growth."

Research and development in high technology, however, is extremely costly. For instance, total national expenditure for R&D in the United States was estimated at $83.6 billion in fiscal year 1983. And not only is it costly, it is also extremely risky, especially in the early phases. The rate of failure has been estimated variously

at between 7 to 1 nd 20 to 1 or even 40 to 1. The farther back in the process of invention we go, the more overwhelming the rate of failure. (Miller B. Spangler, New Technology and Marine Resource Development New York: Prager, 1970). Thirdly, there is a long period of gestation, and it may be many years before there is a return on the capital invested. And lastly, the results of R&D may be useful not only for the company that undertook and paid for the work, but for other projects. In other words, there may be considerable external effects which a private company may have no interest in promoting.

All this has triggered trends which have thoroughly transformed the R&D sector of the industrial enterprise.

1. On the one hand, we see the rise of R&D consortia, to share, and reduce, the cost and spread the risk inherent in R&D in high technology during the early phase -- the "pre-competitive" phase, as it is termed. On the other hand, we see an increasing involvement, first of the Banks, and then of Governments, in the financing of this R&D. Even in the United States, the staunchest defender of private enterprise, over 50 percent of R&D today is paid for by the Federal Government. Without Government participation, none of the

modern high technologies would have passed the first stage of research and development. Here, as one scholar put it (Alexandra Post), "the boundaries between public sector and private sector are getting blurred."

2. For most countries, however, even this public/ private co-investment is not strong enough to make technology development competitive on an international scale. Thus, what is emerging is a new form of international public/private cooperation, exemplified by systems like EUREKA and half a dozen others, well known to this audience. "The growth in international, inter-firm technical cooperation agreements represents one of the most important novel developments of the first half of the 1980s," as Margaret Sharp and Claire Shearman put it in European Technological Collaboration (Royal Institute of International Affairs, 1987). The sharing of risk and of cost, in many cases serves to encourage firms to spend more on R&D than they would do otherwise.

Also at the level of international organisation, thus the boundaries between public sector and private sector are getting blurred: and this should not be surprising, since international organisation is the mirror image of national organisation: so long as national organisation is

fragmented, departmentalised, this reflects itself in the fragmentation of the U.N. sytem of specialised agencie. If there is a trend towards integration at the national level, this same trend can be observed at the international level. For economic and environmental reasons, this type of integration is essential and inevitable, as postulated also in the Brundtland Report. We are just at the beginning of this development: The blurring of the boundaries between private and public sector, spanning national and international levels, is part of this trend. New forms of public/private cooperation -- not "privatization" -- is the answer to some of the problems inherent in the present economic situation. New forms of public/private cooperation, at the nationl and at the international level -- not "privatisation" -- offers the possibility of a synthesis between the necessarily more narrow financial, short-range interests of the private sector, whose business is business, and the far wider, social and environmental, long-term concerns and responsibilities of the State.

Another important point: Joint R&D, co-development of technology, is a way of applying the concept of the Common Heritage of Mankind to technology: not to old technology, destroying

property rights and vested interest, but to future technology, not yet owned by anybody, just like the bottom of the sea.

(You will of course remember that the concept of the common heritage of mankind was introduced into international law by Ambassador Arvid Pardo in 1967, and that it has been enshrined in the United Nations Convention on the Law of the Sea, 1982, as applicable to the deep seabed area "beyond the limits of national jurisdiction" and its mineral resources. This means that the Area and its resources cannot be appropriated by anybody; that they must be managed for the benefit of mankind as a whole; that the Area must be reserved for exclusively peaceful purposes, and that it must be utilised with due regard to the conservation of the environment so that it may be shared by future generations. In international law, the concept has been applied also to the moon and other celestial bodies, and their resources; in a more general way to outer space, and its application to other extra-national or functional areas is under discussion. Developing countries have claimed for some time that it be applied to both science and technology.)

Let me return to technology: Given the importance of the R&D sector in the modern

industrial enterpise, it is indeed likely that such a fundamental transformation in this sector will affect the enterprise system as a whole. "Mergermania" is only part of it.The age of the classic private corporation -- centralised and autocratic, be it national or multinational in character, is coming to an end. The system within which enterprises are evolving today has a much larger component of social and environmental responsibility, public participation and community control.

3. Another interesting aspect of the new industrial enterprise is that it is far less resource-intensive as well as far less labour-intensive than its predecessor of the preceding phase of the industrial revolution. Workers, increasingly, have to be scientists, as Adriano Olivetti predicted already thirty years ago. Today -- as revealed by OECD statistics -- the uneducated are the unemployed. Cheap labour, increasingly, is no longer a comparative advantage. Hence, the unprecedented emphasis on "the development of human resources." It is obvious that this causes displacements not only within the industrialised world but between the industrialised world and the developing countries as well. Unless the development of human resources

is realised on a much larger scale than it is today, developing countries are likely to be reduced to a role analogous to that of the uneducated unemployed in the industrialised countries. And this trend may be further aggravated by the low resource-intensiveness of the new technology which depends to a far lesser degree on raw materials to be imported from developing countries. There is a commodity glut, prices have collapsed, and since this slump is structural, inherent in the very nature of the new phase of the industrial revolution and the "service economy" to which it has given rise -- the service sector, today, accounts to over 60 percent of the global GNP -- it may prove difficult to stabilize prices at levels "remunerative to producers and fair to consumers." Efforts to do so might turn out to be what Acting UNCTAD Secretary-General MackIntire once called "efforts to prop up a dying economy rather than trying to build a new one."

4. The fourth, and most alarming aspect of this new phase of the industrial revolution is, in fact, that developing countries are almost entirely left out of it. "There is a growing gap between developing and advanced countries in terms of the material base and infrastructure to support

"information-intensive" services and industries" and "the international situtions in services significantly favours developed countries," Juan Rada wrote in 1987 (The Emerging Service Eonomy, Orio Giarini, Ed.) Less than 3 percent of all funds invested in science and technology throughout the world is allocated to projects being executed in developing countries. More than 90 percent of scientists and experts live in industrialised countries, and 93 percent of all patents are taken out in those countries. These well-known statistics, published by UNCTAD and by UNESCO, may have to be modified soon: Probably they do not yet reflect the rapid scientific and technological advances of India or Brazil, but they certainly reflect the situation prevailing in most developing countries. This imbalance in scientific production is even more marked in the area of marine technology. The technological gap between countries is undoubtedly the most dramatic imbalance in the area of economic and social development -- if, as we believe, it is true that science-based technological innovation is the engine of economic growth.

Thus, unless developing countries are included into the new phase of the industrial revolution, through what used to be called

"transfer of technology," there is the danger that they will be marginalised and doomed to stagnation and increasing misery.

Perhaps, one of the reasons for the relative failure in the "transfer of technology" from "North" to "South" is that we tend to treat the "new technology" as if it were the "old technology." The "old technology" was resource- as well as labour-intensive. It consumed large quantities of steel and other metals and commodities. Machines could be built by relatively unskilled labour. The developing countries had both the raw materials and the cheap labour. The industrial companies benefited from both and triggered a certain degree of development in the developing countries, though not by far as much as some had hoped.

The old technology was "hardware" that could be transferred from "producer" to "user" or "consumer" through a self-contained commercial transaction. The new technology is information: knowledge; development. It is a process rather than a product, a process that involves the consumer together with the producer and transforms the roles of both into what Alvin Toeffler has called the "prosumer" -- with profound effects on

international trade and the transfer of technology.

As Orio Giarini put it, "...the notion of transfer of products or technologies has therefore to give way increasingly to "prosumer" processes of joint collaboration and integration."

I myself have suggested for some time that the concept of "transfer of technology" is obsolete as it no longer corresponds to the nature of technology; and that it should be replaced with the concept of "joint technology development" or "technology co-development." To this, too, we shall return in the final section, as this concept is at the basis of the case studies I want to present to you.

II.

Marine industrial technology affects all uses of the sea in the industrialised countries.

The fishing industry has been transformed by remote-sensing fish-location technologies, computerised and automated gear selection and application; mechanised processing at sea and, parallel to the depletion of natural stocks through these high-tech methods, the rapid expansion of aquaculture, in sea water, fresh

water and brackish water, in ponds, rivers, lakes, reservoirs, canals, race ways lagunae, enclosed seas or even the open oceans, as well as in totally controlled, artificial environments, like green houses or tanks. Aquaculture today already generates 15 percent of global fish and seaweed production, and this percentage is rapidly increasing, at about 6 percent per annum, doubling in less than 12 years, before the end of the century. Aquaculture engineering: aquaculture technology, from pond construction and control of the environment, to artificial spawning, the rearing of larvae, economical feed production, is a new branch of high technology, affected increasingly by the dramatic developments in genetic engineering and bio-industrial processes. The potential is staggering: not only for increased food production, especially in regions where starvation is rampant, but also for pollution control, the pharmaceutical industry and other industrial processes.

Environmental deterioration is an important factor inhibiting the full realisation of the aquaculture potential. To control this factor, the ecosystem of aquaculture facilities, the composition of microbial populations in the pond, ranging from bacteria to protozoa, and the

succession of populations accompanying the changing environmental conditions, have been studied in various types of aquaculture facilities. Some species of bacteria and protozoa were found to have the ability of keeping or restoring the desirable water quality of ponds. This work is being carried out primarily in Japan, under the auspices of the Ocean Research Institute (ORI).

Many marine micro-organisms produce biologically active substances: enzymes, enzyme inhibitors, and compounds having antibiotic, antitumor, antileukemic and other pharmacological value.

So far nearly 3,000 pharmaeutically active substances have been isolated from a vast number of marine animals and plants. Among them are many toxins such as tetrodotoxin (pufferfish toxin), paralytic shellfish toxins, palytoxin, and others. Recent studies indicate that they are the products of bacteria that are associated with the animals and plants that carry these toxins, and thus they can be produced in the lab, without the associatd animals.

The isolation of strains of bacteria capable of determined biological activities, and genetic

engineering to enhance these capabilities, is going to be of great importance, not only for the pharmaceutical industry but for a number of other industries as well: replacing chemical and mechanical processes with biological processes, e.g., for the clean-up of oil spills or the extraction of metals from ores, through bacterial systems. The Mediterranean Blue Plan mentions a future bio-steel industry that could be developed, based on bacteria and solar energy.

The shipping industry has been revolutionised by new materials, computerised ship design, automated construction, satellite-linked navigational aids and, above all, containerisation and unitisation, leading to multi-modal, global, door-to-door services. This has transformed not only the shipping industry as such but also the development and management of ports and harbours, calling for sophisticated, computerized loading and offloading technologies. Floating jetties, constructed of new materials, is another area of R&D in Harbour construction. New types of high-speed hovercraft, like France's ADOC- 12, riding on air cushions, are in the making. Industrial submersibles and underwater multi-service robots, like France's SAGA 1 and ELIT,

will intensify and accelerate deep-sea exploration and exploitation. The offshore oil industry has developed exploration systems involving seismic, acoustic and optical instrumentation combined with data computerisation that has increased its precision by a factor of a thousand, reducing the need for experimental drilling. Passing through the design of a series of exotic platforms of increasing sophistication, it appears to be headed in the direction of sub-sea completiong sytems, making it virtually possible to explore and exploit hydrocarbons at any depth and in any climate.

The development of offshore oil exploration and production technology is having spin-off effects on the development of deep-sea mining technology which is still in an experimental stage and dependent on research and development in new materials, lasers, robotics, micro-electronics, information technology and data handling, seismic, acoustic and optical technology, satellite-borne navigational aids, and, probably, even bio-industrial processes for the processing of the minerals.

New technologies, finally, are being developed for the generation of energy from the ocean water directly: be it from tides, waves,

currents or salinity and temperature gradients. This latter technology, known as Ocean Thermal Energy Conversion (OTEC) has given rise, as a by-product, so to speak, to a whole new series of industrial processes, utilizing the cold, unpolluted and nutrient-rich bottom water which is pumped to the surface for the generation of low-pressure steam that is passed through a turbine to generate electricity. This audience, undoubtedly, is well familiar with this process in the development of which France has played, and is playing, a leading role.

If just enough energy is produced to pump up the cold water -- and this is already economically attainable-- this cold water can then be utilised for air-conditioning, or it can be piped into an industrial park and used for aquacultural, agricultural and bio-industrial purposes. It is amazing what the combination of this cold water with tropical sun can do. Salmon can be cultured, and magnificent srawberries can be grown in tropical climates where they never could have grown naturally.

I could continue at length, but what has been said, I think, is enough to indicate the importance of the new marine industrial technology.

Table 1

SOME ASPECTS OF OCEAN ENGINEERING	
a)	Fishing craft and gear
(b)	Research vessels, including submersibles for exploration
(c)	Ships for transportation and as support vessels
(d)	Harbours, docks, jetties and other coastal structures
(e)	Coastal protection works
(f)	A variety of offshore structures (fixed and floating) for oil & natural gas, including pipelines
(g)	Structures and systems for ocean energy, of which the most promising are tidal, wave & OTEC; mining, floating processing plants, power stations, etc.
(h)	Materials for the highly corrosive ocean environment & methods for their protection
(i)	Instruments for communication, navigation, measurement of environmental parameters, data acquisition & transfer (waves, winds, currents temperature gradients, etc.
(j)	Facilities for waste disposal and the control of pollution in the oceans

What I want to stress is that marine industrial technology is High Technology. It is part of the Third Industrial Revolution, based on micro-electronics and information, new materials, robotics, lasers, satellite technology and bio-industrial processes. It is sheer romanticism to think that developing countries could really benefit from their newly acquired Economic Zones if they do not enter into this new phase of the industrial revolution and develop and utilize the new technologies.

If marine technology is High Technology, this means, on the one hand, that it must be treated as such, and it cannot be treated as if it were "old technology." On the other hand, it means that if we make a break-through in joint technology development in the marine sector, it is likely to have consequences in all sectors of High Technology as they are all synergetic, and a break-through in one affects the development of all.

What I want to stress is that such a break-through in the marine sector is indeed possible because the United Nations Convention on the Law of the Sea offers the most advanced legal and institutional framework for technology co-development that exists today.

III.

The framers of the 1982 United Nations Convention on the Law of the Sea were fully aware of the importance of "technology transfer," and they provided for it in three ways:

First, the Convention imposes on the "competent international organisations" (FAO. IOC, IMO, UNEP) the duty of assisting developing countries in acquiring the technology they need to benefit from, and comply with the provisions of, the Convention. Thus Article 202, in the Part of the Convention that covers the protection of the marine environment, provides that each State, directly or through competent international organizations shall promote training of scientific and technical personnel in developing countries and supply them with the necessary equipment and facilities as well as enhance their capacity to manufacture such equipment. Article 271 provides for international cooperation for the development and transfer of technology through existing programmes, or new programmes to be established, bilaterally, or through the competent international organisations; and there are half a dozen other articles calling for the assistance of these organisations to developing States.

The efficacy of these articles, of course, is limited by the budgets and organisational capacities of these organisations, which, in fact, are quite inadequate. If they are to fulfill these new obligations in earnest, they must be strengthened, financially as well as structurally. At this time, they all are studying the implications of the Convention for their functions. Until these implications are clearly spelled out, as, for instance, in the excellent study undertaken by IMO, and the necessary restructuring and refinancing has taken place, these provisions of the Convention remain "soft law" -- hortatory, expressing an intention, but not likely to make a real impact on the transfer of technology.

The second way in which the Convention enhances technology transfer is articulated in Part XI and Annex III of the Convention and is limited to the technologies needed for the mining of manganese nodules from the deep seabed.

> Technology, in this context, is defined as specialised 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.

It is significant that advice and assistance are limited to the assembling, maintenance and operation of the system: it does not include the further development of the system: Its improvement and updating which is an essential part of contemporaty technology management.

During the first ten years from the beginning of commercial mining on the part of the Enterprise, that is, the operational arm of the International Seabed Authority, such technology must be transferred by operators operating under a license in the international area, to the Enterprise and to developing countries -- provided it, or an equivalent technology is not available on the open market. The Enterprise must first prove that this is the case. The transfer then is to be negotiated on fair commercial terms, between the operator and the Enterprise, and, failing an agreement, it is subject to compulsory arbitration under UNCITRAL rules.

In case of a joint venture with the Enterprise, the situation is far less stringent. The Convention stipulates that "transfer of technology will be in accordance with the terms of the joint venture agreement," and these are not

defined by the Convention but are wide open. They could, and should, be developed by the PrepCom. with rules and regulations.

These provisions have been widely criticized: for the industrialized countries and their companies, they appear to be too stringent, even though it is generally recognized that the language is far more stringent than the substance and that there are sufficient loopholes to make it very difficult for any court to enforce these provisions.

During the recent negotiations at the Preparatory Commission, furthermore, industrialised States invoked -- somewhat out of context -- Article 302 of the Convention which exempts any State Party, in the fulfilment of its obligations under the Convention, from supplying any information the disclosure of which is contrary to the essential interests of its security. Given the military implications of several, if not most, of the technologies developed for the exploration of the deep sea, this would open another loop-hole that would be hard to close.It is difficut to uphold, on the other hand, that the article was intended to be applied to technology transfer. The Article begins with the phrase "Without prejudice to the right of

a State Party to resort to the procedures for the settlement of disputes provided for in this Convention..." The reference is to the peaceful settlement of disputes. Had it been the intention of the drafters to apply it to technology transfer, the Article might have begun, "Without prejudice to the obligation of technology transfer as described in Art. 144 and in Article 5 of Annex III,..."

Developing countries are dissatisfied with the provisions because they are not stringent enough, taking, in the best of cases, so much time to be complied with as to make them useless; they also find them too limited in scope: Processing technologies are not included in the "binding" provisions and are dealt with in an even looser manner. If the Enterprise is unable to obtain processing technology on fair and reasonable commercial terms and conditions, either the Council or the Assembly may convene a group of States Parties having access to such technology. This group shall consult together and shall take effective measures to ensure that such technology is made available to the Enterprise. Each such State party shall take all feasible mesasures to this end within its own legal system. This paragraph, in Article 5 of Annex 3, is the only

reference to processing technology in the text.

As is well known, a number of Resolutions were adopted togeher with the Convention by the Third United Nations Conference on the Law of the Sea. Of these, the first two are particularly important since they establish an interim regime for seabed exploration, technology development and development of human resources, for the period from 1983 to the coming into force of the Convention. Resolution II, governing preparatory investment in pioneer activities relating to polymetallic nodules, imposes specific obligations on the registered pioneer investors with regard to

. the exploration of a first mine site for the future Enterprise; the costs of this exploration, plus interest thereon at the rate of 10 percent per annum shall be reimbursed by the Enterprise to the Pioneer Investors;

. the training of staff from developing countries for the future Enterprise; and

. arrangements to assure that the Enterprise has the necessary technology to keep pace with the Pioneer Investors. Every registered pioneer investor shall "undertake before the entry into force of the Convention, to perform the obligations prescribed in the Convention relating

to transfer of technology;"

each one of the four shall also "ensure that the necessary funds are made available to the Enterprise in a timely manner in accordance with the Convention, upon its entry into force."

In the present situation of uncertainty with regard to the future of nodule mining, it is obviously extremely difficult to comply with these provisions. I shall try to show, in the first of the two case studies, how I think this framework could be utilised to make technology transfer under the Convention beneficial to all parties concerned.

The third instrument for technology transfer under the Convention is provided by Articles 276 and 277 which prescribe the establishment of Regional Centres for the advancement of marine sciences and technology, in accordance with yet another Resolution adopted by UNCLOS III, the Resolution on Development of National Marine Science, Technology and Ocean Service Infrastructures. (Annex VI to the Final Act). This Resolution is important in that it expresses awareness of 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 if the goals of the new ocean regime are to be met, and it warns that, unless urgent measures are taken, the marine scientific and technological gap between the developed and the developing countries will widen further and thus endanger the very foundations of the new régime. Regional centres, fostering south-south as well as north-south cooperation, and based on cost-sharing and economies of scale, can play a crucial role in narrowing this gap.

The scope of the activities of these Centres are described in some detail in the two above mentioned Articles. They include the acquisition and processing of marine scientific and technological data and information. The range of technologies considered covers marine biology, including the management of living resources, oceanography, hydrography, engineering, geological exploration of the sea-bed, mining and desalination technologies as well as technologies related to the protection and preservation of the marine environment and the prevention, reduction and control of pollution.

The Convention does not identify the "regions" within which such Centres are to be established, nor does it give a time schedule for their establishment, or any indication as to how

they should be financed.

IV.

Over the past few years, the International Ocean Institute has carried out a great deal of research on the possibilities of interpreting and developing the U.N. Convention on the Law of the Sea framework in the direction of the bridging of the science and technology gap in such a way that all parties should benefit from it. I am convinced that the confrontational approach, the zero-sum-game approach of "I win as much as you lose" is not applicable to the complex process of high technology development. An approach has to be developed from which all parties gain. Only that kind of approach will be acceptable to the industrialised as well as the developing countries. Only such an approach will give successful and lasting results.

With regard to seabed mining technology and Part XI of the Convention, this work was undertaken in cooperation with the Delegation of Austria, in a series of working papers entitled JEFERAD (Joint Enterprise for Exploration, Research And Development) in 1984 and 1985 (these documents are part of the official record of the

Prep.Com, under the number LOS/PCN/SCN.2/L.2, L.2 Add.1 and L.2 Add. 2), and the Delegation of Colombia, in another series of papers entitled The International Enterprise (1987-88, (LOS/PCN/SCN.2/WP14. WP 14 add. 1 and add. 2). Studies on the possibility of establishing Regional Centres in accordance with Part XIV of the Convention were carried out under the auspices of the Government of Malta and in cooperation with UNIDO and UNEP (1987/88).

The institutional arrangements proposed in both series of studies are essentially similar and based on research on the most advanced forms of organisation and financing of research and development in high technologies in the industrialised countries. The most pertinent model we found was that of the EUREKA system, including the EUROMAR projects.

EUREKA is, in fact, a very simple model, flexible, decentralised, and cost-effective. Over a period of barely three years, EUREKA has generated 5 billion dollars of investments in R&D in high technologies. Just recently (October 29, 1988) Le Monde carried a front-page article announcing that three industrial giants, Philips, Siemens, and SGS-Thomson,have formed an R&D consortium within the EUREKA framework generating

an investment of over twenty billion French Francs, divided among the three industries and the Governments of the Netherlands, West Germany, France and Italy. They are doing together what none of them could do alone.

What is significant, however, is that these arrangements, so beneficial to all participants, are restricted to the industrialised countries of the North. The developing countries, as well as the Socialist countries, are totally out.

Our proposal would extend the scheme to the developing countries, whose participation should be facilitated by the World Bank, Regional Banks, UNDP, etc., as well as to the socialist States of Eastern Europe, ready and eager, with Perestroika, to cooperate with the West and the South in technology development.

The internationl community should be ready for this sort of development.

As far as the developing countries are concerned, let me quote President Mitterand's statement to the "summit" at Versailles, as far back as 1983. He proposed nothing less than the launching of a "concerted programme" by establshing "international commissions for research and development and for technical cooperation between private and public firms and

States." In this proposal he stressed the importance of the participation of developing countries in joint undertakings to assure acquisition by them of the new technologies.

Almost six years have passed: the time has come to implement this proposal.

As far as the socialist countries of Eastern Europe are concerned, President Gorbachev's path-breaking book Perestroika abounds in references to the need of creating new forms of international technological cooperation between East, West, North, and South, and the willingness of the Soviet Union to participate in such new undertakings. Gorbachev stresses the need for "intelligent joint work in exploring outer space and the world ocean and the use of the knowledge obtained to the benefit of humanity." He calls for the "broad internationalization" of relations in the economic, information an ecological areas. He proposes to "promote major joint research and engineering programs and projects." In doing so, he continues, " it is possible and expedient to cooperate with non-socialist countries and their organisations...". He writes: "We believe that joint firms and ventures set up in collaboration with the business circles of Asia-Pacific countries could take part in tapping the wealth of

these areas." Speaking of the building of "European home," from the Channel to the Urals, he notes: "We, in the Soviet Union are prepared for this, including the need to search for new forms of cooperation, such as the launching of joint ventures, the implementation of joint projects in third countries, etc. We are raising the question of broad scientific and technological cooperation not as beggars who have nothing to offer in return...." He is full of praise for Giulio Andreotti's idea of a "world laboratory" and seeks American-Soviet cooperation in R&D in the exploration and use of outer space and of planets of the solar system, and research in the fields of superconductivity and biotechnology."

I could continue, but I think the point is clear.

To embody this new spirit of the 'eighties in concrete pilot projects, we are proposing a globally accessible EUREKA for the Enterprise of the Seabed Authority, and regional EUREKAs for the implementation of Articles 276 and 277 of the Convention.

Developments in the Preparatory Commission for the International Seabed Authority and for the International Tribunal for the Law of the Sea are

in fact moving in this direction.

One of the challenging tasks of this Commission, as is well known, is the implementation of an interim regime to regulate the activities of the "Pioneer Investors." In return for the registration of their claims, which gives them exclusive and internationally recognized rights to their mine sites in the international seabed area, these States -- France, India, Japan, and the Soviet Union -- have accepted certain obligations. Apart from some financial obligations, which have to be negotiated in a spirit of fairness and realism, the Pioneers have assumed responsibility for

. the exploration of a first mine site for the Enterprise;

. training of personnel for the Enterprise; and

. arrangements to ensure that the Enterprise will have the required technology once the Convention comes into force.

As pointed out already, in the present situation of uncertainty surrounding the feasibility and timing of manganese nodule mining, it is not easy for the Pioneers to fulfill these responsibilities in a rational manner.

We have argued ever since 1983 that there are three fundamentally important points on which any

agreement on "Obligations" must be based:

1. While there may or may not be any seabed mining during the rest of this century, it is absolutely certain that there will be significant investments in R&D in deep-sea exploration and mapping. Barely 3 percent of the ocean floor has been explored in any detail. This work has revolutionized our concepts of the evolution of our planet. Sea-floor spreading and continental drift have been documented with an infinity of data. The discovery of rifting and of the "hot vents" and "chimneys" along the Pacific ridges has thrown new light on the processes of metallogenesis on our planet, and this, in turn is a key for the discovery of mineral and metal resources in the deep ocean floor. Technologies are now being developed which will make this exploration of the deep sea floor much easier and much faster. It is in this exploration and R&D activity that the Enterprise must share if it is "to keep pace" with the activities of the Pioneer investors.

2. This R&D activity will not, and cannot, be carried out by the private sector alone, as eloquently and convincingly demonstrated by an Australian Working Paper submitted to the Prep.Com. two years ago. In that paper, the

Delegation of Australia demonstrated that, given the present level of prices of, and demand for, the minerals contained in the nodules, i.e., nickel, copper, cobalt and manganese, and, given the high cost of,and the high risk inherent in, tne necessary research and development, the return on investment would be zero if not negative: and that is the bottom line. That other private companies may have made similar calculations, may be deduced from the fact that all they have invested in recent years is about one million dollars. Risk and cost are too high, and there can be no return on the investment for years to come. This type of work can only be carried out by public/private international R&D consortia, on the pattern of EUREKA. This is the way in which high technology R&D is carried out: there is no other way. And sea-bed exploration and mining technologies are High Technology.

3. The only rational way for the Pioneer Investors to fulfill their responsibilities with regard to exploration, training, and technology arrangements is to do it jointly, forming an R&D consortium which will be a pre-figuration of the Enterprise itself. In the Colombian working paper, we show that joint exploration of the mine site would cost about 30 percent less than if each

Pioneer carried this exploration out independently. The costs for R&D would triple due to duplication of efforts, and the training of three or four equal groups of personnel in independent and separate programmes could increase training costs by 50 to 100 percent compared to the cost of training a single group in a specific and unified programme.

The Prep.Com. has in fact started moving in this direction.

The Pioneer Investors have already agreed jointly to explore the mine site for the Enterprise and to train personnel in conjunction with this exploration.

France, Japan and the Soviet Union will carry out exploration in the mine site in the Pacific reserved for the Enterprise of up to a total of 52.3 sq km, with the understanding that the cost of this exploratory work, plus 10 percent interest, will be re-imbursed by the Enterprise once the Enterprise starts commercial exploitation; and that it will be re-imbursed even if the Convention does not enter into force. They have proposed a rather detailed plan, to be carried out in two stages, each stage lasting up to two years.

In the context of this exploration plan, they

propose to carry out, in the mine site reserved for the Enterprise, a training programme for 8-12 trainees, to be selected by the Prep.Com. Candidates should be qualified scientists in the fields of marine geology, geochemistry, geophysics. The training they will receive from the Pioneers will be both theoretical and practical and the trainees will have the opportunity to work on the data already acquired for the site reserved for the Enterprise as well as to participate in cruises at sea for the acquisition of additional data, and to participate in the final synthesis.

This is a sound approach. It should be emphasized, however, that exploration, training and technology development are inextricably linked together in any such venture employing High Technology. Technology is tested and upgraded during the exploratory work, and participation in this process is the most cost-effective way of training and learning.

With regard to the technologies employed, the Pioneers warn that:

> It must be emphasized that this work will not allow an exhaustive mapping of the nodule fields to be mined. Such mapping would need

years at sea with the presently available equipment.

The evolution of the technology leaves hopes in a relatively near future for new more efficient tools that will allow an enlarged synoptic view of both obstacles and nodules abundance, using acoustical or optical sensors on board of faster submersible vehicles.

It would be wasteful, as the time to start a commercial operation is so far away, to devote too much hard work to make such investigation with the existing equipment.

Here is the crux of the matter: the final, and the decisive step to be taken by the Pioneer investors: the real occasion to do something innovating, something in step with the time: something concrete to give reality to the proposals made by Presidents Mitterand and Gorbachev.

These technologies should be developed jointly, and financed jointly, by a JEFERAD, International Enterprise, R&D Consortium, a global EUREKA, or whatever name we might want to give to it, with the participation of North, South, East and West. There would be cost sharing,

risk-spreading, internationally controlled environmental safeguards, the opportunity to take on trainees from developing countries: and at the end of the day, there would not only be technology, trained human resources, and an explored and exhaustively mapped nodule field, but there also would be an Enterprise with which everybody could live. There would be a new form of scientific/industrial cooperation, transcending the obsolete notion of "technology transfer" and replacing it with the more dynamic concept of "joint technology development" or "co-development." This would enhance not only development, but common security as well: for technologies developed by an international enterprise for peaceful purposes will not be developed by the Pentagons of this world for military purposes. Last, not least, it would be a way of applying the concept of the Common Heritage of Mankind to technology: for technologies, developed in common, will be owned in common.

There is one complicating factor, which, however, may make the proposal even more attractive, if somewhat more complex.

India, whose Pioneer area is in the Indian Ocean, is apparently excluded from the exploration

and training activities to be conducted in the Pacific. India is to carry out analogous activities in the part of its Indian Ocean mine site that is reserved for the Enterprise.

To exclude India, the only developing country, from the joint undertaking of the others would defeat the very purpose of the proposal. India, too, should have the benefits from joint technology development projects and joint training efforts. This means, the scope of the proposal needs to be somewhat larger. What we need is a flexible framework within which, first, Pioneer Investors, later, the companies of other industrialised and developing countries can cooperate in determined, selected R&D projects related to ocean mining, where the companies or countries that put forward a proposal would bear half the cost, and Governments and the Authority would pay the other half. The participation of developing countries should be facilitated by the World Bank, regional banks, UNDP or even national agencies such as CIDA, NORAD, Danida, etc.

In the EUREKA scheme, the final approval of projects is the responsibility of a meeting of Ministers of participating countries, In our scheme it would be the Council of the Authority, on the advice of its Legal and Technical

Commission, that would be responsible, and, until the Convention comes into force, it would be the General Committee of the Prep.Com, on the advice of its Commission of Experts.

Flexibility with regard to participation should be matched by flexibility with regard to the scope of projects to be selected. The necessary development of exploration technology would constitute one project, or one set of projects. The technology for the exploration of manganese nodules could, of course, equally applied to the exploration of polymetallic sulphides and cobalt crusts whose exploitation might become economically feasible even before that of the nodules. A large portion of these are in the international area. According to the latest findings, they contain commercially interesting quantities of gold. Some scientists -- e.g., Dr. Alexander Malahoff of the University of Hawaii -- have pointed out that gold may be in fact the driving force that will get ocean mining off the ground. The Authority would do well if it started at an early date to draft rules and regulations for the exploration and exploitation of these resources as well, and even the Prep.Com. should not ignore this eventuality.

Thus the development of technologies for the

mining of sulphides and crusts might constitute another project or set of projects. OTEC research, wave energy research -- quite conceivably to be linked to metal processing or pre-processing at sea or even on the sea floor -- might constitute a third project, or set of projects. Presently such projects are carried out in only very few countries -- Japan, USA, India, France -- and they are progressing only slowly because of low levels of funding. Under a global EUREKA for ocean mining technology, giving new meaning to the "Enterprise," they could develop much faster.

There is nothing in the Convention, finally, that would prevent this Enterprise, conceived as a global EUREKA, from exploring the EEZs of developing countries, if invited to do so by such countries.

As is well known, the EEZs of developing countries are under-explored, with regard to minerals as well as with regard to oil. Some of you may remember that Robert McNamara, then President of the World Bank, proposed at Cancun (1981) a special fund to finance the search for oil in developing countries. Funding should have gone especially to countries with deposits too small to attract large oil firms which are mainly interested in more profitable giant fields; yet,

these resources might be big enough to take care of internal consumption and reduce import bills. The Bank estimated that up to 15 percent of oil reserves lay in developing countries outside OPEC.

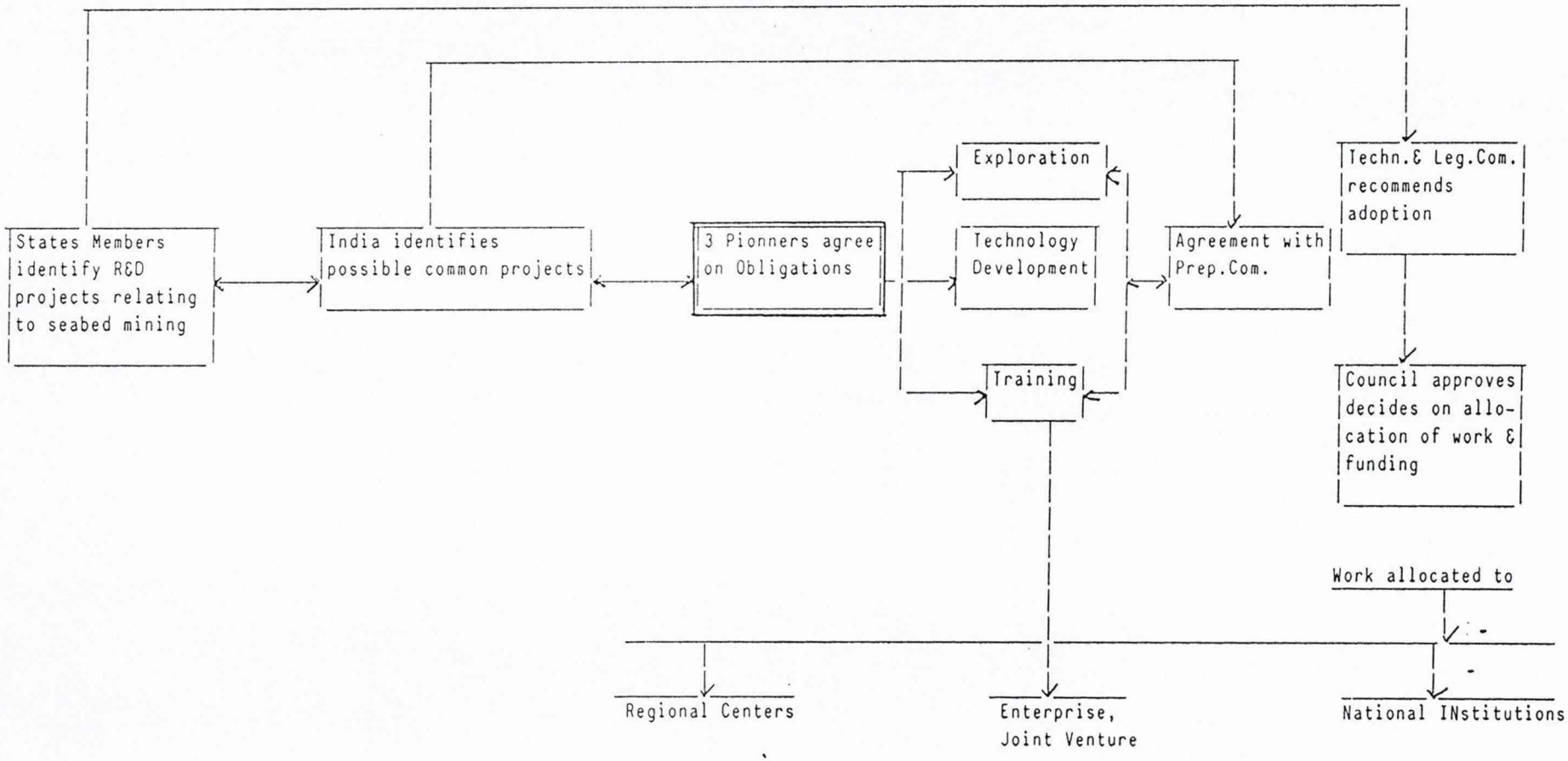
President Mitterand announced agreement on the establishment of this fund at a Press conference: but it never came into being. The chairman of Exxon, Clifford Garvin, stressed that the Bank was not the right institution to put up this risk capital, and that the oil companies were better prepared to undertake this work, and under pressure from Exxon and other companies, President Reagan vetoed the plan.

The private companies, however, never did this work. If exploration of this sort is unattractive for a private company because risks and costs are too high, here, again, might be room for a global EUREKA type of project: businesslike and apt to attract World Bank or similar funding. The technologies for the exploration of offshore oil and minerals are similar or even identical, and thus the Authority and the Enterprise might be well suitable to do this work on a joint venture basis.

These are random examples. What I wanted to emphasize is that even if nodule mining is not profitable in terms of short-term financial

returns on investment, this does not mean in any way that the "Enterprise" -- or the International Sea-bed Authority as a whole -- is useless: that it must be reduced to a "nucleus" of more or less idle bureaucrats, who have to be there because the Convention says so, but who in fact will have to sit and wait until market forces will drive the price of minerals up and make nodule mining profitable. Sea-bed mining will become profitable not because of "market forces," but because technologies may be developed: exploration technologies; mining technologies; processing technologies; waste managment technologies: and they will be developed jointly, through a re-conceptualized Enterprise, a global EUREKA, and this new generation of technology will reduce the cost of production so as to make it profitable. Our re-conceptualised Enterprise must be active where the action is: and the action is in exploration, in technology development, and in the development of human resources: all three interlinked in a flexible framework able to contain and to promote a variety of projects relating to the exploration and exploitation of the mineral resources of the sea, facilitating the participation of developing countries and being immediately practical and useful to all parties

Fig.1


States Members identify R&D projects relating to seabed mining
India identifies possible common projects
3 Pionners agree on Obligations
Exploration
Technology Development
Training
Agreement with Prep.Com.
Techn.& Leg.Com. recommends adoption
Council approves decides on allocation of work & funding
Work allocated to
Regional Centers
Enterprise, Joint Venture
National INstitutions

concerned.

The first step would be an understanding among the Pioneer Investors with regard to a joint undertaking for exploration, R&D, and training. What I am suggesting is that it would be wise to make this agreement within somewhat wider parameters: looking forward to subsequent developments profitable to all, so that the project undertaken in fulfilment of existing obligations would be just one among a variety of investment-generating projects later on. This kind of development would be encouraged if we designed a framework for it now, using the "obligations" as a catalyst, as it were. If the framework we are buiding now is too narrow, real development will take place outside of it, and it would be much more difficult to re-capture it for the benefit of mankind as a whole later on when there will be other vested interests. It would be tragic, for instance, if the Enterprise were to remain locked into the manganese nodule business while the Pioneers and other industrialised countries are in reality shifting their attention to the sulphides and crusts. A global EUREKA would accelerate this type of research on sulphides and crusts, and spur the Authority to adopt, in good time, rules and regulations for the utilization of this other part

of the Common Heritage of Mankind. I do not say that this is necessarily going to happen: It is just one scenario among many possible ones.

Let me now come to my second case study, the Mediterranean Center for Research and Development in Marine Industrial Technology. This is conceived as a pilot project for the establishment of such centers in other regions, in fulfilment of Articles 276 and 277 of the United Nations Convention on the Law of the Sea.

Since these are new institutions to be established under the Convention, it is, in a way, surprising that the Preparatory Comission has no mandate to deal with them.

There might be two explantions for this. A pessimistic explanation might be that these articles are considered "soft law," thrown in to assuage the developing countries, but without any real intention of doing anything about implementation. At a time when existing international organisations are starved for funds and struggling to keep going, who could imagine the creation of a slue of new ones, with various new sets of bureaucrats competing for non-existing funds!

The second explanation would be less

pessimistic. Perhaps it was thought that these Centers would have to be different in each region, depending on existing infrastructure, local economic and technological conditions, and regional needs. A global body, like the Prep.Com. would not be suitable to cater to those needs.

And yet, there are some basic principles which all the Centers will have in common: and in common with the Enterprise of the Seabed Authority. The guiding principle for all of them should be the principle of joint technology development or co-development of technology, financed internationally, jointly by the private and the public sector. To maximize benefits it will also be necessary to somehow link and coordinate their activities. The Convention itself establishes a link between the Centers and the International Seabed Authority in Art. 276, which mandates that "States, in co-ordination with the competent international organizations, the Authority and national marine scientific and technological research institutions, shall promote the establishment of regional marine scientific and technological research centres, particularly in developing States, in order to stimulate and advance the conduct of marine scientific research by developing States and foster the transfer of marine technology."

The regional centers also could perform a useful function in pre-training skilled man-power for service in the various organs of the International Seabed Authority and the R&D division of the Enterprise. We have shown how this could be articulated, in a paper introduced in the group of experts established by the Second Special Commission of the Prep.Com.

There undoubtedly is considerable interest in developing countries in the establishment of such Regional Centres. Developing countries are fully aware that without them it would be impossible for them individually to significantly advance the conduct of marine scientific research and the transfer of marine technology. One should mention, in particular, the Indian Ocean Region, with the IOMAC project; the ASEAN region as well as the Caribbean.

But no concrete proposal for the implementation of Articles 276 abd 277 has come forward: except the one developed by the International Ocean Institute. The Secretary General of the United Nations announced it in paragraph 15 of his latest Report on the Law of the Sea to the General Assembly. He also informed the General Assembly that he had initiated a

process of consultation with the Mediterranean States.

The history of this project, quite briefly, is as follows:

In February, 1987, the International Ocean Institute launched the proposal at an international seminar in Malta, organised by our Institute, in cooperation with the Foundation for International Studies in Malta. Malta, of course, is right in the middle of the Mediterranean Sea, and it is therefore natural that we launched our project in the Mediterranean region. But there were other reasons for selecting the Mediterranean for a pilot project: The Mediterranean is a global society in a nutshell. Developed and developing countries, Socialist and free-market countries, countries of different cultures and religions, inhabit its shores. The Mediterranean is meeting ground for North, South, East and West.

The Mediterranean, furthermore, is the site of the most advanced of the UNEP-initiated Regional Seas Programmes. The Barcelona Convention provides the best possible framework for the establishment of a regional centre. The Mediterranean Action Plan, adopted in Barcelona in

1975, the Long-Term Programme, the Blue Plan, the Priority Actions Programme, the Protocol dealing with Pollution from Land-based Sources, the Genoa Declarion of 1985, all imply the need for the establishment of such a Centre. The Parties are to explore the long-term evolution of the relationship between development and environment in the Mediterranean; to improve technologies required to provide a better understanding of processes and phenomena involved in the complex mechanisms of pollution; to stimulate technological cooperation and exchange of know-how among member States and their scientific and industrial institutions; to explore potential applications of renewable sources of energy; to design improved methods of disposing of solid and liquid waste, and to implement the Long-Term Monitoring and Research programme of MED POL II and III. "The Blue Plan would have liked to have been able to give more consideration to the question of new technologies and their future role in the search for patterns of development that are more mindful of the environmnent, " the Blue Plan states.

The establishment of new industries in the south and east of the basin in particular

> will create urgent need for information on precautions to be taken on installation, recycling and depollution devices...This could offer a broad area for exchange and co-operation between specialists from the north and south, in fields such as energy, water, biotechnologies or waste, which may possibly receive support from the European Community.

The Blue Plan, in fact, contains quite aa research agenda for the Centre we are proposing.

While the role of UNEP is, above all, one of co-ordinating and harmonising, the responsibility for executing these activities now rests almost entirely with the States Parties to the Barcelona Convention and its Protocols. The cost to States Parties of implementing the Protocol on Pollution from Land-based Sources is estimated to be up to 15 billion dollars over the next 10-15 years.

This cost could conceivably be reduced quite considerably if States Parties, their industries and scientific organisations agreed to join their efforts and carry out jointly projects of research and development in marine industrial technologies, with a built-in component of environmental impact

assessment at the R&D stage. The establishment of a Centre for Research and Development in Marine Industrial Technology would enhance both development and environmental quality in the Mediterranean and promote the implementation of the Mediterranean Action Plan.

To link the establishment of the Centres to the Regional Seas Programme, might answer at least one of the questions left unanswered by the U.N. Convention on the Law of the Sea: What are the regions within which the Centres are to be established? The ten existing Regional Seas Programmes provide a most natural setting. Here is an existing legal framework that can be utilised and strengthened by the establishment of such centres: a framework, also, that can be utilised later on for the co-ordination and harmonisation of the activities of these research Centres.

But there was a third reason why we chose the Mediterranean as a starting point. And that was the existence of the EUREKA and, particularly, EUROMAR projects. Co-operation with these systems would immensely facilitate the establishment and operations of the Centre, which we conceive, just like EUREKA as a highly decentralised, flexible system of projects, with a small co-ordinating Centre. The basic difference between our Centre

and EUROMAR would be that our focus is Mediterranean, not European, and that it would include developed and developing countries as equal partners, with the participation of developing countries to be facilitated by the World Bank, ready to invest billions in the Mediterranean during the coming years, by the European Development Bank, or by the by the European Community. Could we not start, quite simply, by opening a couple of EUROMAR projects to the developing countries of North Africa and the Middle East: not as "Associates" but as equal members?

EUROMAR has an elaborate set of projects to monitor environmental conditions of the seas bordering Europe from Satellites, to generate models and data systems, and to improve instrumentation. Obviously the Mediterranean is one of the seas bordering the European continent, and Spain, France, Italy, Greece and Turkey, Members of Euromar, are also Parties to the Barcelona Convention. The Mediterranean marine environment is indivisible. It is impossible to protect it just in the part surrounding the European continent. What is needed is more than a European approach. It is a Mediterranean approach, including equally all countries surrounding the

Mediterranean Basin.

After the initial discussion of the project, and its endorsement by the Government of Malta, we proceeded with a detailed feasibility study. Our consultant, Dr. Saigal -- a senior consultant to the Office for Ocean Affairs and the Law of the Sea of the United Nations -- visited a number of Mediterranean countries and talked to scientists, industrialists, and government officials. We circulated a questionnaire among hundreds of Mediterranean scientific and technical institutions and made studies on particularly three types of technology which we thought particularly useful in the Mediterranean region: Pollution combatting technologies; aquaculture technologies, and desalination technologies, especially in the field of reverse osmosis.

This work was supported both by UNEP and by UNIDO.

We had previously undertaken studies for UNIDO on marine industrial technology and recommended the establishment of regional centres.

Listing critical areas for action by UNIDO, the Executive Director wrote in his report to the Fourth General Conference of UNIDO in Vienna in 1984:

> In the fields of micro-electronics, new materials, marine industrial technology and

energy, the UNIDO secretariat should be requested to promote international centres with the active cooperation of developed and developing countries.

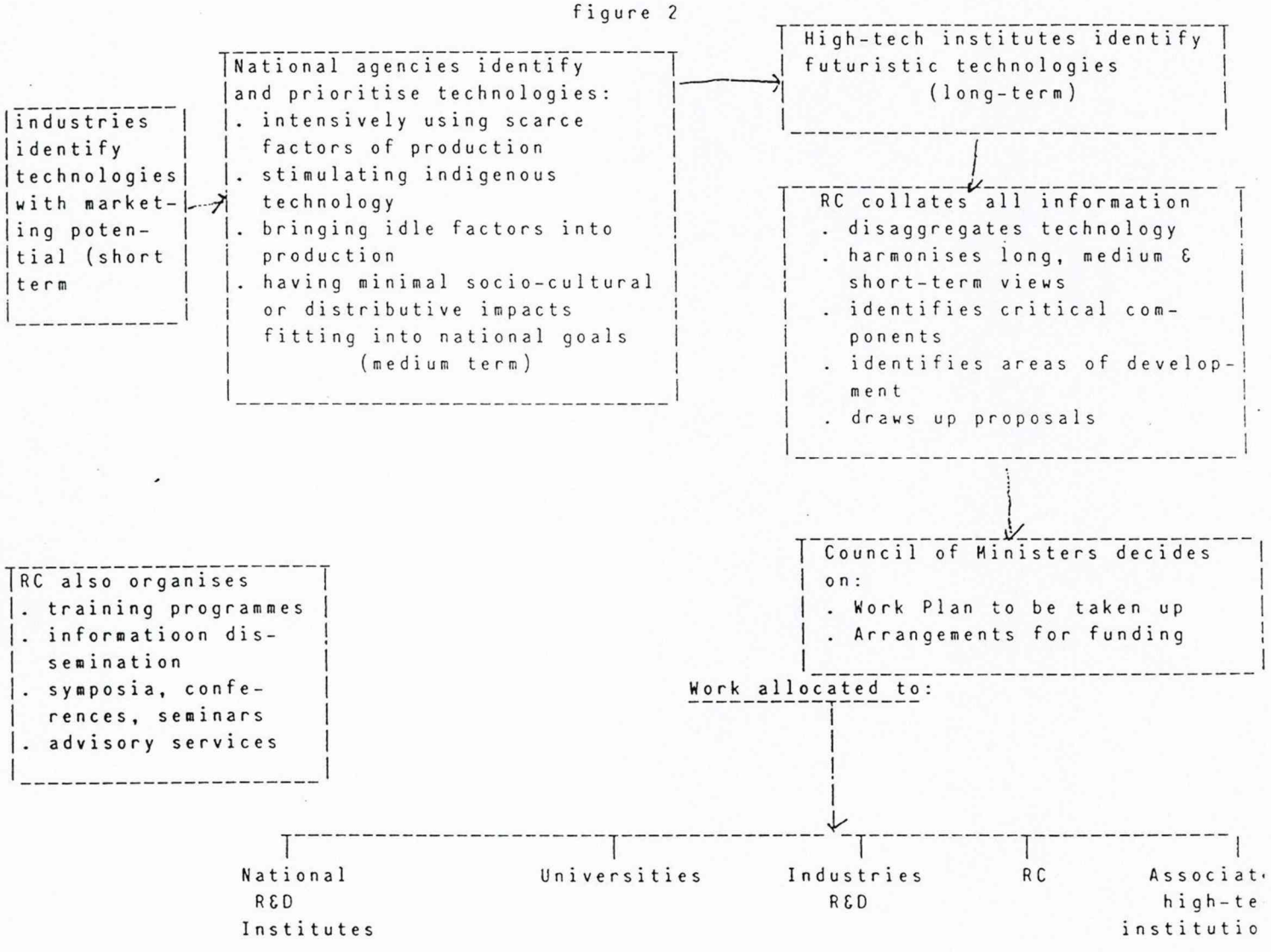
Malta has taken up this challenge.

It is most appropriate that the establishment of these Centres, starting with the Mediterranean, should be promoted not only by the Office for Ocean Affairs and Law of the Sea, which has a big stake in the implementation of two important Articles of the Law of the Sea Convention, but also, jointly, by UNEP and UNIDO, symbolising, as it were, the symbiosis between the development of industrial technology and the protection of the environment: economics and ecology. Our Centre, in fact will be one of the first, if not the first, institutional embodiment of the principles proposed by the Brundtland Report, which has many institutional implications, most of which have not yet been spelled out, let alone implemented.

The structure we recommend for our Centre is as flexible as it is dynamic. It is a process rather than a static structure. We have described it in a flow chart.

Within this process, the operational modes available to the Mediterranean Centre would be of

figure 2


High-tech institutes identify futuristic technologies (long-term)
National agencies identify and prioritise technologies:
. intensively using scarce factors of production
. stimulating indigenous technology
. bringing idle factors into production
. having minimal socio-cultural or distributive impacts fitting into national goals (medium term)
industries identify technologies with marketing potential (short term
RC collates all information
. disaggregates technology
. harmonises long, medium & short-term views
. identifies critical components
. identifies areas of development
. draws up proposals
Council of Ministers decides on:
. Work Plan to be taken up
. Arrangements for funding
RC also organises
. training programmes
. informatioon dissemination
. symposia, conferences, seminars
. advisory services
Work allocated to:
National R&D Institutes
Universities
Industries R&D
RC
Associat high-te institutio

catalyser, promoter, co-ordinator and developer.

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

The initial cost of establishing the Centre: a small, co-ordinating Centre, would be very very low. In our study we propose a figure somewhere between $100,000 and half a million. When fully developed, the cost is projected atabout 5.5 million dollars. This figure becomes plausible if compared to the about 14 million dollars spent on the management of EUREKA.

The benefits of establishing the Centre would

be, a listed in our study:

(a) flow of information to all concerned thereby leading to informed and efficient decision-making;

(b) reduction of risks and costs to all concerned;

(c) an enlarged market for industries in the selected regional technologies;

(d) build-up of infrastructure and man-power, especially in the developing countries;

(e) availability of cost-effective pollution control techniques to the developing countries of the Mediterranean with consequent reduced pollution levels;

(f) increased efficiency of capital investments through synergistic networking and avoidance of duplication;

(g) generating an ocean technology that is socially relevant;

(h) maximising of technological options for all

concerned;

(i) reduction of the technology "gap" between the industrialised North and the industrialising South; and

(j) making future ocean technology environmentally harmonious.

Our study concludes that it is not easy to quantify these benefits, but it is obvious that they would more than justify the expenditure of US$ 5 or 5.5 million as compared to the $15 billion likely to be spent on the environment during the next decade.

The next step towards the realisation of this project is a workshop of Mediterranean States, at the expert level, under the auspices of UNIDO in Vienna, on April 17-21 this year.

This, then, is the kind of New International Economic Order we see emerging from the United Nations Convention on the Law of the Sea.

There is, however, one point, that deserves special emphasis.

No amount of international good will and cooperation will be of any avail if there is not a

counterpart effort at the national level. Developing countries themselves must lay the foundation: must build, as a matter of priority, the scientific and technological infrastructure on which international cooperation can be based.It is a matter of goal-setting and political will.

That it can be done is convincingly demonstrated by the case of India which, in spite of all the problems facing its huge population, has risen rapidly to the position of a first-rate technological power.

Most developing countries, however, have not even initiated the process. They pay lipservice to science and technology. In reality they still consider it as a luxury: something which may come later, after the most urgent problems of economic development have been solved. They fail to realise that without a scientific/technological basis they may never be able to solve those urgent problems of economic development.

Development, and technological development cannot come from outside alone.

Already the Koran knew this basic fact. God will not improve the destiny of any nation, it says, unless that nation improves its own destiny first.

In our recent conference, Pacem in Maribus

XVI, in Canada, which was devoted to the subject of technology development, transfer and training, we adopted the following recommendations.

On the National Basis of International Cooperation

"Technology 'transfer' -- more appropriately described as 'joint technology development' must have a strong national basis to make international cooperation meaningful and effective."

On the Building of National Infrastructure

"At the national level, developing countries should be encouraged to

(a) set up a policy making and implementing agency;

(b) build up, under the auspices of such an agency, a strong industrial information system;

(c) set up engineering design and consultancy organisations; and

(d) establish R&D laboratoriesto provide specialised advanced training, do applied research, assist the policy-making agency and industrial enterprises in identifying, selecting and negotiating with, foreign technology suppliers."

These recommendations are based on the Indian experience.

On Financing Indigenous Technology Development

"Every developing country should earmark a certain percentage of its educational budget for the advancement of science and technology, including marine technology. The Third World Academy of Science recommends that 4 percent of the educational budget should thus be earmarked for fundamental science; another 4 percent for applied research, and 10 percent to Research and Development (R&D)."

Thus, the New International Technological Order -- just like the New International Economic Order, or the New International Social and Political Order: just like Perestroika, must be built at three interacting levels: National, Regional, and Interregional or Global, on the basis of self-reliance, South-South and South-North cooperation. If any of these three carrying pillare is missing, the building collapses.

Let me close on a note of optimism, resuming the broader arguments with which we started these lectures.

The previous phase of the industrial revolution was based on technologies which were resource-intensive and capital-intensive: technologies which were embodied, so to speak, in pieces of hardware that could be handled by relatively unskilled labour. These pieces of technology could be traded, but the terms of trade were unfavourable to the developing countries who were, and remained, unable to produce them themselves. It was extremely difficult, under those circumstances, for the developing countries to "catch up" with that phase of the industrial revolution.

The new phase of the industrial revolution is based on technology that is far less "static," that cannot be objectivized, that is a process, that is knowledge, know-how, service: based on human resources in whom capital must now been invested.

Now human resources is what developing countries have: and they can be developed just as fast and effectively as human resources anywhere. That is primarily a matter of goal-orientation and political will. The notion that "technology" can be "bought" and "imported" is obsolete and already discredited. Technology must be developed, and this development must be based on the development

of human resources.It can be done through the proper linkage of the three processes we have just described: National, regional, global, within the most advanced framework we have: the U.N. Convention on the Law of the Sea.

The previous phase of the industrial produced technology that was dehumanizing, subordinating the human being to the machine on a moving belt. Lenin taught that the factory was the model for the totalitarian State. That technology, dehumanising, was also destructive of nature. The "smoke-stack" was the symbol of progress.

The new technology, the technology of the Service Economy, which is not resource intensive, not based on cheap labour, need not be destructive of the environment. Based on the development of human resources, it restores to humanity its rightful central place.

While it <u>might</u> become the source of new forms of regimentation and subjection, thus standing the process on its head and stifling its own further evolution: <u>all</u> technology is "dual purpose" technology, and it depends on us how we want to use it --it may become a source for the rise of a new humanism: A humanism, however, that does not set mankind above nature, but knows it is part of it and depends on a harmonious relationship

between the part and the whole.