Different Approaches to International Regulation of Exploitation of Deep-Ocean Ferromanganese Nodules

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Mr. La Que examines the possible advantages and disadvantages of various approaches to international regulation of the exploitation of ferromanganese nodules. These approaches are discussed in terms of control of access, level of production, sharing of revenues, economic impacts on developing nations, location of onshore processing facilities, transfer of technology, and assurance of metal supply to developing countries. The author concludes that none of these considerations needs play a dominant role in choosing the best approach to regulation. Rather, it is the early provision of a system of regulation that will encourage first-generation operations on the scale required to establish their technical and commercial viability that is of crucial importance.

In his memorable speech before the United Nations General Assembly in 1967, Dr. Arvid Pardo, then Ambassador from Malta, drew attention to the potentially vast mineral riches on the deep-ocean bottom.[1] He characterized these resources as "a common heritage of mankind" which should be exploited under United Nations control for the benefit of mankind and, in particular, for the developing

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1. Speech by Dr. Arvid Pardo before the First Committee of the United Nations General Assembly (Nov. 1, 1967). *See generally* Gorove, *The Concept of "Common Heritage of Mankind": A Political, Moral or Legal Innovation?*, 9 SAN DIEGO L. REV. 390 (1972).

nations. He suggested further that properly distributed revenues from this source could have an important effect in reducing the prosperity gap between developing nations and industrialized nations.

A more realistic appraisal of the extent of revenue that might be derived from nodule exploitation has shown that the possible effect on the prosperity gap would be much less than originally suggested. Nevertheless, developing nations, as represented by the "Committee of 77" in the recent United Nations Law of the Sea conferences, have taken a position designed to give a United Nations Seabed Authority management control of nodule exploitation through a United Nations "Enterprise." This Enterprise is described in the Informal Composite Negotiating Text (ICNT) generated in the 1977 Law of the Sea Conference.

Detailed provisions of the ICNT remain a subject of disagreement between representatives of industrialized nations and developing nations. Continuing disagreement may prevent, or at least delay, more probable agreements on other provisions of a new Law of the Sea.

During the course of debates on how to regulate deep-ocean mining, various approaches have been suggested. Certain of these approaches have been rejected by the developing nations for not catering to their special needs or desires. The developing nations would like to have a dominant role in the management of nodule exploitation operations, including control of access to mineral resources; control of the level of production, as this might affect the prices of metals produced in developing nations; preferential sharing of revenues; determination of location of onshore processing facilities; transfer of technology for recovery and processing of nodules; and assurance of supply of metals from nodules to developing nations.

Rejection of certain approaches to regulation as they might affect the desires of developing nations has not necessarily been based on a proper appreciation of the underlying facts on which a proper choice could be based. It is the purpose of this Article to examine the advantages or disadvantages, real or perceived, of several approaches as they might be viewed by developing nations in terms of what they think they need.

There are several approaches to be examined. One possible alternative is the licensing of an independent operator by a United Nations Seabed Authority. Under this approach, the operator would have access to nodules in a defined area for a specific period of time and under definite terms of payment to the Authority for the rights to access.

For some time the licensing concept was rejected firmly by the developing nations. Most recently it has been given more favorable consideration under a different name—"contract." This contract arrangement is quite different from an earlier version of a "service contract" and is actually more like a license.[2]

Another version is the "contract for services" alternative.[3] This approach would provide for the exploitation of nodules by an Enterprise created by the Seabed Authority under the auspices of the United Nations. The Enterprise would employ the services of a contractor capable of providing the necessary technology and equipment for the recovery and processing of nodules to be marketed by the Enterprise. The contractor would presumably be paid for his services by the Enterprise.

A third approach would involve a joint venture arrangement in which the Enterprise would form a partnership with an independent operator or consortium of operators willing to provide the required technology, equipment, and some or all of the capital investment beyond the value of the nodules being provided by the Enterprise.[4]

A fourth approach would involve either direct exploitation by the Enterprise alone or in association with developing countries.[5] The nodules subject to such exploitation by the Enterprise would be located by a contractor (licensee) and reserved to the Authority. Any proposed contract (license) area must be sufficiently large and of enough value to allow the Authority to choose which half would be reserved solely for exploitation by the Authority at some appropriate time. This project would be undertaken by the Enterprise alone or in association with developing nations.[6] As an alternative, a contractor could offer the Authority the choice between two noncontiguous areas of equal attractiveness. Implementation of these provisions should present no problems because the ocean-bottom areas that will be exploited in the next several years would represent less than one percent of areas already identified by explorations described in public documents as being favorable to nodule exploitation.[7]

2. *See* Informal Composite Negotiating Text, U.N. Doc. A/Conf. 62/WP. 10, art. 151 & Annex II (1977).
3. *See id.*, Annex II, para. 5(i).
4. *See id.*
5. *See id.*, para. 5(j)(ii).
6. *See id.*, para. 5(j)(i).
7. D. HORN, B. HORN, & M. DELACH, FERROMANGANESE DEPOSITS OF THE NORTH PACIFIC (1972) (report).

The ICNT also provides for parallel operations involving independent contractors (licensees) on the one hand and some activity by the Enterprise on the other. The timing of the latter appears to be left open.

This Article will first discuss the real or perceived advantages or disadvantages of the several approaches to regulation of deep-ocean mining that have been described above and will then critically examine those advantages or disadvantages that are deemed especially significant.

ADVANTAGES AND DISADVANTAGES OF THE VARIOUS APPROACHES TO REGULATION OF DEEP-OCEAN MINING

Licensing by the Authority

Licensing by the Authority would provide immediate income to the Authority through license fees, sharing of profits, royalty payments, or through some combination of the latter two that would provide income to the Authority even in absence of profits. This approach would relieve the Authority of the need to provide capital. Licensing would also provide, at no expense to the Authority, immediate application of recovery and processing technology, ships and other nodule recovery equipment developed by a licensee, plus the benefits of prior exploration already undertaken by a licensee. Furthermore, supplementary processing and marketing of nodule metals would be provided for by a licensee through channels already available that would not have to be duplicated by the Authority in competition with existing sources of nodule metals. Finally, licensing would improve the opportunity for a second attempt at recovery if a first trial should be unsuccessful.

A disadvantage of the licensing approach is that it may not give the Authority its desired role in the management of the activity. For example, the Authority may desire a more dominant voice than the licensing procedure would provide with respect to the scale, timing and continuity of operations in relation to possible effects on the economies of developing nations which are the land sources of nodule metals.[8] Furthermore, fewer opportunities would exist for transfer of technology to developing nations than through other possible approaches.[9] The licensing alternative would not enable developing nations to influence the location of land-based facilities for further processing.[10] Finally, developing nations would not be able to influ-

8. *See* text accompanying notes 22-30 *infra*.
9. *See* text accompanying note 31 *infra*.
10. *See* text accompanying notes 32-33 *infra*.

ence geographical distribution of refined metals in relation to the special needs of developing nations.[11]

Exploitation by a Seabed Authority Enterprise Through Service Contractors

The service-contract approach would enable developing nations to manage the activity with respect to the scale, timing and continuity of operations in relation to possible effects on the economies of developing nations which are land-based sources of nodule metals.[12] This approach could provide more opportunity for transfer of technology to developing nations.[13] And developing nations would be able to determine the location of land-based facilities for further processing of nodule metals[14] and to influence the geographical distribution of refined metals in relation to the special needs of developing nations.[15]

There are disadvantages associated with the service-contract alternative. For one, there might be some difficulty in persuading competent organizations to accept service contracts. There is no assurance of income from operations because recovery costs could exceed revenue. There may also be a potential difficulty in securing capital to cover deficits created by the need to pay the service contractor—whether or not the operations were profitable—and in securing new capital to pay for any major changes in, or replacement of, equipment found to be unsuitable or inadequate.

There are other potentially problematic areas. Arranging for processing and marketing of refined metals may prove to be difficult if the nodules were not to be marketed as such. Capital costs of holding inventory nodules or refined metals off the market for the protection of land-based sources may outweigh the limited utility of the result.[16] Furthermore, if a first attempt at nodule recovery were found to be technically or financially unsuccessful, securing the necessary financing for a second attempt might be quite difficult. Finally, there may be obstacles in implementing the transfer of technology from a contractor.[17]

11. *See* text accompanying note 34 *infra.*
12. *See* text accompanying notes 23-30 *infra.*
13. *See* text accompanying note 31 *infra.*
14. *See* text accompanying notes 32-33 *infra.*
15. *See* text accompanying note 34 *infra.*
16. *See* text accompanying note 35 *infra.*
17. *See* text accompanying note 31 *infra.*

Joint Ventures with the Authority Enterprise

A joint venture arrangement would automatically provide the necessary technology, facilities and management expertise by a partner able to contribute these requirements. It would reduce the amount of capital to be provided by the Authority in addition to the value of nodules in situ, and it would ensure a high level of influence in the management of the activity with respect to (a) the location of land-based facilities for further processing,[18] (b) the timing, scale and continuity of operations in relation to possible effects on the economies of developing nations which are land-based sources of nodule metals,[19] and (c) the geographical distribution of refined metals in relation to the special needs of developing nations.[20]

The joint venture approach may be seen as beneficial in other respects. This arrangement would facilitate the transfer of technology,[21] provide for the sharing of losses from unprofitable operations, facilitate the securing of new capital that might be required for changes identified as being required to make future operations profitable, facilitate arrangements for processing and marketing through potentially existing facilities in the hands of the joint venture partner, and provide an immediate market for nodules through the joint venture partner if the nodules were to be marketed without further processing by the joint venture.

A joint venture arrangement may have its drawbacks. This approach would provide less revenue to the Authority than a licensing system if the operations were unprofitable or only marginally profitable. Furthermore, there may be difficulties in securing partners for a joint venture and in securing an agreement on the division of management power between the Authority and the joint venture partner. Finally, difficulty may arise in obtaining the Authority's share of the required capital, especially if additional capital were required for major changes in equipment found necessary by early stage failures.

Parallel Operations

The advantages and disadvantages of licenses, service contracts, and joint venture approaches would apply under the parallel operations approach as well. However, there may be an added advantage. A deferred parallel operations approach would enable organizations with the necessary capital and technological capabilities to under-

18. *See* text accompanying notes 32-33 *infra*.
19. *See* text accompanying notes 24-30 *infra*.
20. *See* text accompanying note 34 *infra*.
21. *See* text accompanying note 31 *infra*.

take operations initially as contractors (licensees) on their own account and at their own risk. Technical and commercial feasibility can be established only by operations on a scale involving recovery of at least one million tons of nodules per year. Such full-scale operations by a contractor (licensee) would provide the Authority with a sound basis for deciding which of the optional approaches to regulation would be the most advantageous to the Authority along with the timing of the action to be taken.

The concept of deferred parallel operations by the Authority Enterprise could include provisions for renegotiation after an appropriate period. This could apply to arrangements such as licensing of independent operations by organizations prepared to accept the risks of first stage operations.

COMMENTS ON THE ADVANTAGES AND DISADVANTAGES OF THE VARIOUS APPROACHES TO REGULATION OF DEEP-OCEAN MINING

Effects on the Economies of Developing Countries

A potential disadvantage of the licensing alternative is that it may not provide the Authority with a strong enough voice to effectively manage those operations of a licensee which may affect the economies of those developing nations which are land-based sources of nodule metals,[22] whereas both the service-contract[23] and joint venture[24] approaches enable developing nations to manage these activities. The assumption here is that it might be necessary to limit production of metals from deep-ocean nodules in order to protect the interests of countries that are land-based sources of the same metals. In other words, it is feared that production from the oceans on too large a scale might depress the prices of metals to the distinct economic disadvantage of developing nations. This possibility can be examined with respect to each of the metals involved.

Nickel

Nickel is the most valuable constituent of nodules in terms of concentration, price, and probable future market. These details are likely to determine the scale and rate of development of deep-ocean mining during the next twenty-five years.

22. *See* text accompanying note 8 *supra*.
23. *See* text accompanying note 12 *supra*.
24. *See* text accompanying note 19 *supra*.

As to timing, the interest in establishing another reliable source for large quantities of nickel by Western Europe, Japan and the United States, which do not have substantial sources of nickel within their national boundaries, can be expected to stimulate the initiation of operations as soon as practical on at least the scale needed to establish the technical and economic viability of deep-ocean mining.

Although the technology being developed is likely to be found adequate, the commercial feasibility remains to be established. Whether it is economically reasonable to pursue deep-ocean mining will be determined by the costs and grades of nodules delivered to onshore refineries in competition, for example, with large quantities of readily available lateritic nickel ores. These metals exist in equatorial zones around the world, including Cuba, Guatemala, Indonesia and New Caledonia. In these countries, nickel ore reserves are capable of large-scale expansion of production. There is little reason to expect that the cost of producing nickel from nodules will be significantly less than the cost from ores on land.

Nodules, however, contain valuable amounts of copper not present in lateritic ores. This fact could offset the higher costs of raising nodules from great depths in the ocean and transporting them to land for processing. As a result, the economics of deep-ocean mining will be influenced greatly by future prices of copper as well as of nickel. These prices, in turn, will be responsive to future supply-versus-demand relationships. The supply-versus-demand ratios are more likely to remain in reasonable balance than to encounter any extended periods of production shortages.

In 1976, the world mine production of nickel was 1.84 billion pounds as compared with a 1975 demand for primary nickel of 1.34 billion pounds.[25] In 1977, demand decreased substantially while production capacity increased. By 1980, mine production capacity has been estimated to increase to 2.4 billion pounds, with small further increases possible by 1985.[26] There is also a possibility of an additional 300 million pounds from ocean mining. Thus, total capacity could reach 2.7 billion pounds by 1980.

Consumption of primary nickel in 1972 was estimated to be 1.25 billion pounds. This figure is consistent with previous longtime growth projections. The compounded rate of growth of nickel markets has been variously estimated from three to six percent. Recent

25. *See* UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-4 (July, 1977). *See also* ENGINEERING & MINING J., Mar., 1973, at 18 (showing total 1972 value of nodule metals at $9,600,000,000).

26. UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-4 (July, 1977).

experience suggests that the actual rate of growth in the next several years is likely to be closer to three percent rather than six percent. At the three percent growth rate from 1972, the 1985 requirements would be 1.84 billion pounds or about 600 million pounds less than the projected 1980 land production capacity. At the six percent growth rate from 1972, the 1985 requirements would be about 2.6 billion pounds or about 200 million pounds greater than the 1980 land capacity; in other words, 100 million pounds less than the total capacity if 300 million pounds were to be provided by ocean mining.

As shown in Table 1,[27] only about twenty-seven percent of land production capacity in 1980 would be in developing countries. Furthermore, organizations planning to undertake deep-ocean mining of nodules are already concerned with production of nickel from sources on land.

27. *See* Table 1 *infra*.

TABLE 1

Projected Land Sources of Nickel (1980)*

Location	Mine Production Capacity Millions of Pounds	Percent
Canada**	600	25
USSR**	400	17
New Caledonia**	340	14
Australia	210	9
Western Europe	182	8
Other Central and South America	148	6
Cuba	104	4
Philippines	96	4
Indonesia**	84	3
Dominican Republic	74	3
South Africa	50	2
Botswana	40	2
Guatemala**	28	1
Rhodesia	26	1
USA**	16	1
Poland	4	Less than 1
Total	2,402	100.0

* UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-4 (July, 1977).
** Ocean mining projects being considered by organizations located or engaged in production in these countries.

It can be expected that these organizations will take their interests in land-based activities into account in distributing their efforts between production from the ocean and production from their operations on land. It could very well be that the short-term interest in deep-ocean mining by organizations having expandable productive capacity on land will be based principally on the need to establish the technical feasibility and commercial viability of deep-ocean mining. This information is required to enable a proper choice to be made between extended operations on land and in the ocean. It is needed also by organizations not presently engaged in the production of nickel which could use the seabed as a source of this metal. In the long-term, depleted land-based ore reserves could make it necessary to go to the ocean as a supplementary source.

So far as nickel is concerned, there appears to be no need for a Seabed Authority to put more or less arbitrary limits on production from the ocean. Such production could very well be limited by a number of considerations to lower levels than have been proposed. These factors would include the costs of production from the ocean, the need for supplies from an additional source, and the availability of capital beyond that already committed to additional production on land.

Regarding the availability of additional capital, it may be noted that during the past few years nearly two billion dollars have been committed to finance 400 million pounds per year of increased production capacity for nickel from sources on land. Three-quarters of this total investment have been for projects in developing countries in Africa, Latin America, and for projects in Indonesia and the Philippines. A projected capacity for production of 300 million pounds of nickel from the deep ocean by 1985 would require additional capital to the extent of at least 1.5 billion dollars.

The several factors that have been described support a conclusion that the extent to which different approaches might facilitate imposition of controls on the production of nickel by the Seabed Authority need not be given much weight in choosing the desired approach.

Copper

The extent of copper production from deep-ocean mining during the next twenty-five years will be determined by a scale of operations related to nickel rather than to copper. This would probably limit production of copper to not more than 300 million pounds per year by 1985. It would represent only 1.5% of the total production and could not have a significant effect on copper prices or the economies of developing countries which are sources of land-based copper.

The demand for copper could double between 1985 and the year 2000, but the increase in production from deep-ocean operations compared with increased production from land sources is not likely to change significantly the percentage that would come from the ocean. The latter, as noted previously, will be determined principally by potential markets for nickel rather than by any increased demand for copper.

Here again, any need for protecting developing nations' sources of copper need not be a major consideration in choosing an approach to the regulation of deep-ocean mining.

Cobalt

The greatest potential impact of deep-ocean mining on revenues will be felt by countries producing cobalt. This result is due to the fact that the cobalt content of nodules is relatively high in relation to nickel as compared with relative levels of consumption of these metals. Nodules to be recovered can be expected to contain about twenty-five percent as much cobalt as nickel, whereas the current and anticipated consumption of cobalt is only about five percent the level of nickel consumption. The rate of market growth for cobalt is not likely to exceed the rate of market growth for nickel at present prices of these metals. The price of cobalt has been traditionally twice that of nickel.

A rate of cobalt production geared to markets for nickel would create a considerable surplus of supply over demand, with a consequent depressing effect on the price of cobalt. No doubt this would stimulate increased consumption which, in turn, could be aided by desirable efforts to find new markets at a price attractive to sources on land.

Table 2[28] shows the location of sources of cobalt. It is evident that Zaire and Zambia would encounter the greatest impact on their revenues from any substantial scale of mining of deep-ocean metals. It should be noted, however, that in Zaire and Zambia, cobalt is produced in conjunction with copper mining operations only. In Zaire, for example, there is a choice of copper ores influenced by markets for cobalt. It is possible to adjust the extent of mining of the ores richer in cobalt. In recent years the production of cobalt has

28. *See* Table 2 *infra*.

been well below maximum capacity. Although an over-supply of cobalt from deep-ocean mining would likely reduce the revenue from cobalt production in Zaire and Zambia, it need not have any serious effect on their much greater revenue from copper.

Therefore, in relation to production of cobalt from deep-ocean mining, a question arises as to the weight that should be given to the protection of the contribution of cobalt to the economies of two developing countries in relation to total world considerations in determining the optimum approach in the regulation of deep-ocean mining.

Manganese

The effect of mining ocean metals on the economies of developing countries which are land-based sources of manganese is made uncertain by a remaining question: Will the manganese content of nodules be marketed or will the nodules, from which nickel, copper and cobalt have been extracted, be disposed of as waste or reserved for processing at some future date?

The principal market for manganese is in the form of ferromanganese used in the manufacture of steel. Its extent, therefore, is determined by the scale of production of steel. There is a very limited and not readily expandable market for manganese metal as such or for refined manganese oxide such as is used in electric dry cells.

Nodules contain a rather low grade of manganese ore, consisting of only about twenty-five percent manganese as compared with the forty

TABLE 2

Sources of Cobalt (1975)*

Country	Production in Millions of Pounds	Percent**
Zaire	38.4	52.9
Zambia	6.5	8.9
Australia	5.4	7.4
Morocco	4.3	5.9
New Caledonia	4.2	5.8
USSR	3.9	5.4
Cuba	3.6	5.0
Canada	3.0	4.1
Finland	2.8	3.9
Philippines	0.3	0.4
Botswana	0.2	0.3
Total	72.6	100.0

* UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-5 (July, 1977).

** Percentage from developing countries: 73%

percent manganese in commercial ore from land sources. The nodule "ore" is of questionable suitability for other than metallurgical uses such as battery grade manganese oxide.

In any event, the recovery of nodules on a scale geared to nickel—for example, ten million tons of nodules per year by 1985—could generate as much as fifty percent of the production of manganese from land on a total tonnage basis, or about thirty percent of the production on a manganese content basis.[29]

If deep-ocean nodule miners were to throw the treated nodules onto the market for whatever price they could obtain, the result would be a substantial depressing effect on the price of manganese ore. The developing countries which could be affected by such action are shown in Table 3.[30]

In view of the uncertainties regarding the extent to which manganese from deep-ocean nodules will be marketed and the relatively few developing countries which might be affected, it would appear that here, again, possible effects of ocean mining of manganese on the economies of developing countries as a group should not be a decisive factor in the choice of how deep-ocean mining should be regulated.

29. UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-7 (July, 1977).
30. *See* Table 3 *infra*.

TABLE 3

Geographical Distribution of Manganese Production from Developing Countries (1975)*

(Thousands of Short Tons, Manganese Content)

Country	Production	Percent of World Mine Production**
Gabon	1,233	11.4
Brazil	875	8.1
India	624	5.8
Ghana	183	1.7
Zaire	167	1.5
Mexico	131	1.2
Morocco	77	0.7
Thailand	13	0.1
Total	3,303	30.5

* UNITED STATES BUREAU OF MINES, MINERAL COMMODITY PROFILE MCP-7 (July, 1977).
** World Total: 10,810

Transfer of Technology

As noted earlier, an important aspect of each regulatory approach—licensing, service contract, joint venture or parallel operations—is the transfer of technology from the operator to the developing nation.[31] The weight that should be given to opportunities for transfer of technology should take into account not only the provisions that would facilitate the transfer but also the ability of developing nations to absorb transferred technology and to make independent use of it in the future. In the case of deep-ocean mining, the most advanced technology will be related to the means for gathering nodules and raising them from the ocean bottom. It seems likely that this technology will have been developed before there will be any agreement on arrangements for regulating deep-ocean mining. Later participation in the operation of previously developed and manufactured equipment will not enable much transfer of technology to personnel from developing nations engaged in the operation of equipment in which they have not participated in development or manufacture.

Location of Land-Based Processing Plants

Another important element in choosing the optimum regulatory approach is the ability of developing nations to influence the location of land-based facilities for further processing.[32] A contractor (licensee) can be expected to want to make his own choice of location of a land-based plant for processing nodules. Factors that would influence this choice would be proximity to the location of nodule recovery, proximity to markets for the nodules or for metals refined from them, supply and cost of power and reagents needed for processing, availability and cost of labor, a favorable political climate, and so forth. The same considerations would apply to arrangements involving service contractors or operations conducted by the Authority Enterprise itself.

In the case of joint ventures with the Enterprise, the most likely candidates will be companies from different countries which are already associated in consortia organized to cope with the uncertainties of a risky venture in ocean mining. Each of the countries represented would probably try to have processing undertaken in that country. This competition among nations would complicate the choice of location for processing regardless of which procedure of regulation may be adopted.

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31. *See* text accompanying notes 9, 13, 17, & 21 *supra*.
32. *See* text accompanying notes 10, 14 & 18 *supra*.

Provisions for the regulatory authority to influence the choice of processing location could be included in contracting (licensing) arrangements. Such a clause is provided for in the ICNT.[33]

Control of Distribution of Refined Metals

Developing nations desire a dominant role in determining the geographical distribution of refined metals.[34] There has been a feeling that some assurance is needed that a proper share of the additional supply of metals which would come from deep-ocean mining will be made available to developing countries to support advances in their industrialization. This consideration would assume importance only in the event of a deficiency in world supply as related to world demand for the metals involved. As noted previously, this situation is not expected to arise in the future. Consequently, this consideration need not be given substantial weight in the choice of approach to the regulation of deep-sea mining.

It does not appear to be realistic to provide for delivering metals from ocean mining to developing nations at a price lower than the world market price. Such a provision could lead to diversion of the lower-priced metals from developing nations which might prefer to profit on the sale of the diverted metals in preference to their use at home. This situation could arise especially with developing countries marketing the same metals from land-based ores which would not need the additional metals and which might claim to be qualified for special treatment on the basis of possible effects of ocean mining on their economies.

A better approach would be to deal with the latter problem by special consideration in the distribution of revenue from ocean mining to developing countries qualified for such special consideration in some appropriate way. Developing countries qualified for help from the Authority and needing ocean metals could conceivably receive contributions from the Authority in the form of metals, or, better still, by using funds provided by the Authority, developing countries could buy the metals they need in the open market.

33. *See* Informal Composite Negotiating Text, U.N. Doc. A/Conf. 62/WP. 10, art. 151 & Annex II, para. 3(c)(ii) (1977).
34. *See* text accompanying notes 11, 15, & 20 *supra*.

Capital Costs of Withholding Ocean Metals from the Market to Protect Prices

Holding in inventory nodules or refined metals to protect land-based sources[35] is not likely to be useful in the case of nickel and copper because the amounts of these metals to be recovered from the ocean in relation to the total supply-and-demand effects would not have a significant influence on prices. This is certain in the case of copper, and probable in the case of nickel.

There could be incentives to withholding in the case of cobalt, but there is likely to be a continuing excess of land-based supply-over-demand situations that would complicate any temporary withholding of metal from the ocean. Recovery of the cobalt value of nodules might represent the difference between the commerical success or failure of nodule mining.

The situation with respect to manganese would be about the same as with cobalt, ameliorated by the probability that marketing of manganese from nodules may not amount to much in the first place.

SUMMARY

It may be concluded that such considerations as the possible effects on the economies of developing nations, the transfer of technology, the location of land-based processing plants and the control of distribution of metals from nodules need not be considered as critical factors in the choice of approaches to the regulation of deep-ocean mining, at least not for the next twenty-five years. Early arrangements could be made, subject to amendment—for instance, after twenty-five years—on the basis of experience applicable to the various approaches that have been discussed. However, the immediate need is for a system of regulation that would encourage future operations on the scale required to establish technical feasibility and commercial viability. This approach would be in contrast to regulatory restraints related to situations that may never be encountered or considerations that are not sufficiently well-founded.

35. *See* text accompanying note 16 *supra*.