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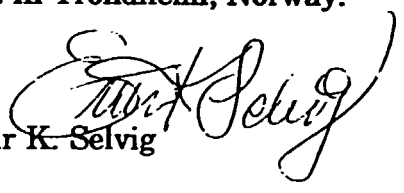
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# A Framework for the Institutionalization of Technological Transfer to Industrializing Countries

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# A Framework for the Institutionalization of Technology Transfer to Industrializing Countries

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## Table of contents

### Section I: Foundation for an implementation

Table of contents .....	1
Chapter 1: Introduction .....	3
Industrialization .....	3
The transfer of technology .....	3
Institutionalization .....	4
Marine industrial technology .....	5
The Caribbean .....	6
Basic assumptions and key conclusion .....	6
Chapter 2: Confronting the market failures .....	8
Power, intervention and rationality .....	8
Accounting for the natural resources .....	9
The economic imbalance .....	10
On the issue of culture .....	11
Statics and dynamics .....	11
Pro-investment strategies .....	12
The information dilemma .....	13
Inherent conflicts .....	14
Overcoming the institutional gaps .....	14
The danger of programs .....	15
The justification of intervention .....	16
Chapter 3: In search of a strategy .....	17
A clean-cut profile .....	17
Possible roles .....	17
Firm-level technological capabilities .....	18
Sisters .....	19
Comparative advantages .....	19
Export orientation or import substitution .....	20
An emerging strategy .....	21
Chapter 4: Preparing for strategy implementation .....	22
Caring for the environment .....	22
Caring for human behavior .....	23
Caring for the infrastructure .....	24

Section II: Suggesting an implementation

Chapter 5: A framework proposition .....	26
Part I: Profile .....	26
Article 1: Independence (26); Article 2: Integrity (26); Article 3: Neutrality (26); Article 4: Adaptivity (27)	
Part II: Governing functions .....	27
Article 5: Organization form (27); Article 6: Existence of a governing board (27); Article 7: Composition of the governing board (27)	
Part III: Human resources requirements .....	27
Article 8: Personnel in staff (27); Article 9: Staffing procedures (28)	
Part IV: Networking .....	28
Article 10: Contacts (28)	
Part V: Information processes .....	29
Article 11: Information generation (29); Article 12: Information dissemination (29)	
Part VI: Infrastructure and other requirement .....	29
Article 13: Information retrieval (29); Article 14: Communications (30)	
Part VII: Roles .....	30
Article 15: The staff (30); Article 16: Negotiation (30); Article 17: Consultant services (31); Article 18: Marketing (31); Article 19: Information collection (31); Article 20: Other functions (32); Article 21: Fees (32)	
Part VIII: Performance evaluation .....	32
Article 22: Evaluation (32)	
 Chapter 6: The case of Costa Rica .....	 33
Existing conditions .....	33
Some specifics on opportunities for intervention .....	34
Some specifics on structure and establishment .....	35
Target area for industrial activities .....	36
 References .....	 39
 Appendix 1: The ocean resources .....	 41
Biological resources .....	41
Hard mineral resources .....	42
Hydrocarbons .....	42
Energy resources .....	42
Space and free surface .....	43
Nature and wildlife .....	43

## Section I: Foundation for an implementation

### Chapter 1: Introduction

With one third of the world's population living at a standard below the poverty line, and with an increasing gap between those who have and those who have not, aid to industrialization is becoming a key issue to nations all over the world. One of the most important forms of such aid is the transfer of technology for industrial development. In this paper we will frequently use the term *industrializing* nation to denote a developing nation, and the term *industrialized* nation to denote a developed nation.

This report is divided into two sections, the first of which brings forth a general discussion of the problem of technology transfer and industrialization, and establishes the premises under which the center will operate. The second section details a suggested framework for the center with a view to the ideas developed in the first and illustrates how one could start an implementation in a selected country; Costa Rica.

#### Industrialization

The present social and political situation in the world is such that two of the basic aims of industrial production; creating employment and implementing equitable distribution of wealth, will increasingly become central issues when discussing future developments. The outcome of the present crisis depends on the qualitative and quantitative answers to these basic problems. No country or region of the world can any longer presume an independent or isolated development, whether the economy is predominantly governed by a free market or by central planning.

It is evident that industrialization and product innovation processes in industrializing countries, where the majority of the world's population live, cannot follow the same paths which was pursued by the industrialized countries. Global energy, environmental, and demographic considerations exclude this possibility. Neither can the process of equalization of wealth come about without some considerable commitment from those who presently have more than sufficient.

Further industrialization is not the only or sufficient measure to resolve the threats to sustenance. However, to the extent that it provides necessary goods for survival and well-being, addresses burdening toil, improves the sustainable use of natural resources, or contributes to an improved distribution of wealth and meaningful employment, it does have strong merits.

Industrialization rests on the successful application of scientific and technical knowledge to create, refine, distribute and market products. The ways in which the platform of such knowledge within a country can be increased include several mechanisms; domestic research and development, education, other domestic transfer as well as international transfer and explicit purchase of knowledge from abroad. We may roughly speak of *generation* and *transfer* of knowledge. It is no simple task to distinguish the two mechanisms - indeed they will coexist in most successful cases of knowledge enhancement. However, given the gap of applicable knowledge between the industrialized and the industrializing nations, the process of introducing and diffusing new products and procedures is primarily based on transfer of technology from the former to the latter, and this is thus the primary concern here.

#### The transfer of technology

An act of transfer will be undertaken when it is in the interest of both the source of the entity and the recipient and under conditions governed by the norms and mechanisms of some market. In this conceptual framework one might start by asking the following questions: What is the exchanged entity; what are the channels; who is the agent; what are the motivations of the parties, and what

are the primary mechanisms of the market?

If we define technology as products, equipment and methods in which scientific and technical knowledge finds a practical use, then a transfer of technology occurs whenever industrial products, processes or methods are transferred from the environment in which they originated to a different one. The entity to be considered here is *industrial technology*. While technological knowledge *per se* may be quite easily accessible, knowledge of its industrialization may include more and be less accessible. It is a quite easy task to read and understand a description of a combustion engine from a book, and even to construct the engine in a laboratory, but an entirely different story to use the knowledge as a basis for a successful industry. The transfer of industrial technology is thus not the simple exchange of a commodity, but a complex process of *interaction between the source and recipient community*.

In terms of transfer of technological knowledge from one party to the other, this knowledge is viewed as a valuable commodity in itself. In this interpretation, the source will surrender the commodity either voluntarily (through use of incitements) or forcefully (through use of threats and sanctions). While technology is a protected commodity in the international market where the use of force is quite inconceivable, we will here disregard this option and rather focus on the inducements a party may offer to "purchase" the knowledge. This market for technological transfer, in particular the question of motivations and constraints, has deep roots in history and is exceedingly complex with regards to international politics and economics.

The principal channels through which the transfer takes place include physical objects (products and equipment), documentation (free or restricted), and people (learning, consulting, and employment). While previous attempts have tended to emphasize the quantifiable transfer of physical objects, there is an increasing awareness of the necessity to include all channels, and perhaps most important; people.

The agents of transfer typically include local users (consumers and industry), local production organizations, agencies of national authorities, trans-national firms, and agencies of international organizations. The necessary conditions pertaining to the agents are an interest in the transfer, power to materialize the interest, and ability to implement it. While the motivation of the recipient often is based on explicit needs, the motivation of the source is frequently of a more mixed and ambiguous nature.

The final issue concern the last question: the mechanisms of the market that governs the exchange of industrial technology. This paper discusses the design of processes, structure and ideology of an institutionalized agent - a new organization for promoting such transfer adapted to the environment in which it will operate.

### Institutionalization

Of particular interests in the establishment of this organization are the bodies of the United Nations (UN), which strives towards disseminating technological knowledge and sustainable industrial development to the developing nations, and a developing nation which has individual needs and desires to achieve such development. The background has been laid out in constitutional objectives and prior studies. [Ross et. al., 1990; UNIDO, 1989; International Ocean Institute, 1988; United Nations, 1983]

The chief mandate of the UN in the field of utilization of marine resources came from the Third United Nations Convention on the Law of the Sea, henceforth referred to as the Convention. It established the rights of states to take commercial control over the ocean up to a distance of 200 nautical miles from land. Furthermore, the Convention explicated the need to take measures to assist the developing countries in attaining technological expertise and establish industries in the maritime sector. These measures are to include establishment of regional and national centers on

marine science and technology.

The United Nations Industrial Development Organization (UNIDO), one body of the UN, has a primary objective of assisting in the industrial growth of developing countries. The organization has recognized several reasons to focus efforts in the marine industrial sector, among which are the mandate from the Convention, the inter-disciplinary nature of marine technology, and subsequent spin-off (synergy) effects into other industries thus making it a useful basis for industrial development.

The functions of the national centers are described in the Convention, section 3, article 275:

1. States, directly or through competent international organizations and the Authority, shall promote the establishment, particularly in developing coastal States, of national marine scientific and technological research centers and the strengthening of existing national centers, in order to stimulate and advance the conduct of marine scientific research by developing coastal States and to enhance their marine resources for their economic benefit.
2. States, through competent international organizations ..., shall give adequate support to facilitate the establishment and strengthening of such national centers so as to provide for advanced training facilities and necessary equipment, skills and know-how as well as technical experts to such States which may need and request such assistance. [UN, 1983, underscored here]

The justification of the centers is thus related to their instrumental function in transforming policy statements on assistance to developing nations into action.

### Marine industrial technology

Marine industrial technology is a wide field, involving a host of various disciplines and activities, and subject to continuous development. The traditional marine disciplines like hydrodynamics, ship-design and machinery are no longer sufficient to describe the field. Electronics and cybernetics are used to control sub-sea vehicles, while accurate positioning systems are needed to perform work tasks in oil and gas field development. Computer aided design (CAD) systems, initially developed in the air-craft industry, are now extensively used in the marine industrial sector to keep up with current demands on efficiency.

The activities of man within the ocean arena are numerous and differentiated. From the original traditional ship technology, extremely complex systems are now needed to locate and extract hydrocarbons from the ocean floor. Marine transportation rarely exceeded 30 knots only 15 years ago but is currently being revolutionized by fast vessels with speeds reaching 60 knots. In Japan, artificial platforms are being increasingly used to alleviate the problem of land shortage for both habitation and industrial uses.

The resources to be harvested from the sea are immense. Ninety-eight per cent of all inter-continental cargo is transported on the oceans (Eylers, March 1990), a large portion of the oil and gas production is extracted from the ocean floor and marine biotechnology and aquaculture are viewed as the most promising ways to address the growing demands on food in a world with diminishing free land space for agriculture. Mineral resources on the ocean floor contain abundant supplies of important metals like manganese, copper, nickel and cobalt, while the energy potential of ocean thermal energy conversion (OTEC) and waves is tremendous. Aside from these questions of economics and sustainment, there is also a growing awareness of the importance of the oceans in affecting the world's climate and in the effect of pollution on sea based life. Thus, it is clear that activities related to the sea are of extreme importance to both the economic growth and survivability of the planet.

It may be useful to view the term marine industry in two ways: it may imply technology aimed at

exploiting or refining marine resources, for instance fish processing technology, or it may imply technology that is marketed for use in a marine context, such as weather observation buoys. Neither category need rely much on any traditional marine discipline or competence, but may rather be a synthesis of known generic technologies into a marine context.

## The Caribbean

The scene of institutionalization are countries in the Caribbean region. Previously identified common intra-national denominators for the subject countries include 1) major economic difficulties; 2) the opportunity available under the new Law of the Sea regime; 3) the role of the land/sea interface in future economic development, and finally, 4) the vulnerability of the natural habitats. [Ross, 1990] While economic difficulties is a concern to regimes at all levels from the local to the global, the task to find ways to reach sound and holistic environmental development are mostly delegated to the higher regimes.

On the level of particular marine industries, common denominators are not so easily identified. For the purpose of this thesis the above will suffice to support reflections on the design of a general framework. The issue of *choosing* appropriate technologies for solving various tasks cannot be debated without a detailed knowledge of conditions in the region and its States, and are perhaps not quite as important for the task as may be believed. Technology is the tool for industrial development and cannot be used before the *means* to attain it are established.

The Caribbean region has already established, under the auspices of UNEP (the United Nations Environmental Program), a scheme whereby Caribbean countries will cooperate to solve common problems:

The [Caribbean] Action Plan should provide a framework for activities requiring regional cooperation in order to strengthen the capability of each country to implement sound environmental management and thus to achieve sustainable development for the people in the Region. [UNEP, 1983]

The regional perspective implies that national agents, organizations or centers, are to be tied into a network of regional cooperation. This cooperative network should thus be designed to enable maximum joint benefit of shared resources, similar circumstances and common interests.

### Basic assumptions and key conclusion

The key task of this work is to discuss the institutionalization of technology transfer within dedicated organizations as a cooperative means to promote development, and to consider the mechanisms through which such transfer may work. Some of the theses that condition the chosen approach are:

- 1) The degree to which a technology aids industrialization, and industrialization aids development, is determined by the context;
- 2) the act of technological transfer is governed by the mechanisms of a complex and often inconsistent market;
- 3) the entity in question, industrial technology, is not a simple commodity, but rather a complex process of interaction, comprising both tangible and quantifiable assets, as well as less tangible and qualitative conditions;
- 4) relevant technology for marine industrial purposes, need neither be new, other than within the context (or the society), nor marine, in the sense of the traditional marine sciences and industries; and
- 5) the subject nation is one where resources, both know-how and money, are limited.

The report concluded that the center be based on the following "business idea":

The center will be a free-standing and self-sustaining organization which, on a



predominantly commercial basis, offers consulting services primarily to industry companies, financing institutions, governmental agencies, and development agencies. In addition to these consulting services, the center will also deliver qualified assistance in negotiations between various parties, perform impact assessments of existing and proposed industry projects, identify and market domestic investment opportunities, and inform policy makers on issues of importance in achieving increased domestic industrial activity. The center will also be active in promoting general research on the state of the marine environment and propose mechanisms to increase domestic technological and industrial know-how. It will focus on marine industrial activities.

## Chapter 2: Confronting the market failures

The logical sequence of the technology transfer process would typically start with the identification and selection of needs to be satisfied, proceed with the generation, evaluation and choice of solution, and then followed up with the transfer of the appropriate technology and the organizational and educational systems appended to it. This rational approach derives from the strong position of the technological-industrial structure within developed nations, and is likely to generate successful exchanges between related environments; similar in constraints and uncertainty of information - that is, between developed nations.

This is not usually the situation in the case of transfer from a developed country to a developing. On the contrary, the dissimilar environment is both the primary cause of the problem and the primary challenge when establishing a structure to accommodate the transfer. The common failures of previous programs of technology transfer may be regarded as a result of neglecting the full consequence of these dissimilarities, which in the following are addressed as *market failures*. Failures in this sense imply that the considerations discussed prevents "the invisible hand of the market" from achieving the mutual optimal adaption otherwise assumed to result in free markets among equal actors. The market failures addressed here are:

- 1) The prevailing dominant position of the developed nations, as reflected in the possession of wealth and technology, as well as control of information channels and other means to influence public awareness;
- 2) the inherent irrational and contradictory aspects of the market for transfer of technology;
- 3) the failure to price natural resources and the sustenance of ecosystems to their worth in order to maintain or improve living conditions;
- 4) the failure of industrialization *per se* to result in increased independence for the industrializing nation;
- 5) the inseparability of technology from its cultural context and necessary conditions;
- 6) the tendency to transfer static technology without the capability to develop it as the demand changes;
- 7) the strategic moves and counter-moves of multi-national companies and industrialized nations with conflicting interests;
- 8) the inability on behalf of the developing nations to create incentives, caused by lack of information, expertise, means, and norms;
- 9) the difficulties in accounting for inherent conflicts on the use of limited resources, both in terms of environmental, cultural, and socio-economic factors;
- 10) the institutional gaps following from the division and diffusion of responsibility to administer and regulate; and
- 11) the danger of being preconceived and using fixed methodologies to accommodate transfer of technology.

### Power, intervention and rationality

Power may be defined as having something someone wants, or as a relation among social actors in which one social actor, A, can get another social actor, B, to do something that B would not otherwise have done. [Pfeffer, 1981] With either definition, it is obvious that the parties in the process of technology transfer holds very unequal power. In the words of the World Commission on the Environment and Development (WCED):

Two conditions must be satisfied before international economic exchanges can become beneficial for all involved. The sustenance of ecosystems on which the global economy depends must be guaranteed. And the economic parties must be satisfied that the basis of exchange is equitable: relationships that are unequal and based on dominance of one kind or another are not a sound and durable basis for interdependence. For many developing countries, neither condition is met. [WCED, 1987]

The development of equitable and mutually beneficial relations between developing and developed

nations is indeed hypothetical, and this can thus not be a precondition for initiating corrective actions through institutionalization. It is likely that the industrialized world will remain powerful and dominant within the foreseeable future - at best the developing world will gradually increase its relative strength and thus marginally improve the balance of power.

While the developed nations historically have exercised an almost unrestricted power over nations inferior in technology, the present political climate impose considerable constraints on them when exercising their dominance. These modifications have not resulted so much from the strengthening of the developing nations, although this is part of the explanation, as from the economic considerations and self-imposed moral sanctions of the developed nations. Economic power is no doubt a motivating factor in maintaining the status quo, but the process towards equalization is increasingly being pushed by public concerns in the developed countries.

Public priorities and awareness in developed countries is gradually shifting from those concerned with improving material prosperity towards better social services, life style quality, conservation of the environment and the elimination of other threats to sustenance such as the conflict between the "haves" and the "have-nots". Though this shift does not necessarily manifest itself as a market pull transmitted through the dominant channels of society, or as significant changes in individual behavior, it has strong political impact and gives the developing countries a leverage through justifying their cause.

Both ideal institutions and industry experience conflicts and bewilderment as their roles are changing and they need to redesign the way they exercise power. The motivation of the industrialized countries to enter into the process of technology transfer is thus not only economic benefit, but also the need to display moral virtues to satisfy public demand within their own society. Vice versa, the power held by the developing nations is not only based on their possession of comparative advantages, but to a large extent determined by their ability to influence the public consent in the developed nations. The power game is transgressing from one of control of technology and economy to one of control of information and awareness, but with little shift of dominance between the parties yet.

Organizations involved in the promotion of technology transfer receive their mandate through public consent on their intentions, and their power through their success in getting public focus on their particular schemes with which they intervene. Intervention is legitimized primarily by the display of basic needs, but perhaps equally by the display of failures of the prevailing market system to resolve these basic issues. Needs create compassion while failures create guilt. Together these emotions generate the support required for the institutions to intervene.

The historical record of planned interventions to compensate market failures has, however, provided us with a long record of intervention failures. These failures indicate that it is very difficult to intervene without creating new dysfunctions that are likely to be as bad as the ones the intervention intended to eliminate.

In the market of technological transfer, the unequal strength and the diversified, and frequently conflicting, objectives of the interests involved thus constitute considerable challenges to an intervener. The view adopted here is that market failures, that is the apparent irrationality - the discrepancy between intentions, means and results - is the normal and expected behavior of the market. The failures are not to be compensated or eliminated, but are rather to be adapted to and accommodated such that the fulfillment of the intentions with the organization are not compromised.

### Accounting for the natural resources

The economic growth and prosperity of the industrialized nations has predominantly been based on an unrestricted exploitation of natural resources. While the awareness has increased of the

temporary and short term nature of this strategy, attempts to alter it have so far had limited success in changing basic policies. The warnings that economic growth has a high cost have, with few exceptions, been forgotten as new resources were discovered. As it has become clear that the issue is not only one of depletion of the inherited fortune, but also one of loading the ecosystem beyond its threshold capacity, the philanthropists of the world have gained the leverage needed to make responsible governments agree to review policies that often have implied destructive actions. The second condition mentioned by the WCED, the sustenance of the ecosystems, is thus on the agenda while being far from resolved.

In order to differentiate between sustainable and depleting uses of natural resources, the ultimate tool is the proper valuation of these resources in the terms understood by capitalistic market operators. For the developing nations, the pricing of natural resources is the most vital problem. One promising trend is that industrialized nations are introducing more realistic pricing of their own natural resources, both on the exploitation and depletion. Though this may initially increase the pressure on resources in other countries, there is hope that such pricing will be made valid on producers of products to be marketed in the industrialized nations, thus permitting weaker, industrializing nations to operate on equal terms with the developed nations. On the other hand, the trade in natural resources is dominated by the largest international corporations which are economically stronger than most developing nations, and whose influence on world politics often does not benefit equalization of power and wealth.

### The economic imbalance

The urge of developing countries to move towards industrialization has, contrary to its intention, resulted in an increased dependence on exports of raw materials to finance import of industrial tools and manufactured goods. Due to the significant difference in prices between the exported and imported goods, the net capital (resource) flow is out of the developing countries.

Latin-America countries carry more than 30 per cent of the total world debt. Typically, the serving of debts drain five to six per cent of the gross domestic product, around a third of the external savings, and nearly forty per cent of the earnings from exports (figures rapidly changing to the worse). As a result, severe domestic adjustments have been necessary, pressures on the environment have increased and natural resources have been rapidly depleted. The revenue from a rapid overall growth in exports originating primarily from raw materials, food, and resource-based manufactured goods, are used to meet the financial requirements of industrialized country creditors rather than for domestic industrial development or for improving standards of living. [WCED, 1987] Whatever the intention, industrialization has resulted less in equalization than in the creation of new and imbalanced power bases.

Closely related to this problem is the fact that a large part of the national monetary fortune is controlled by a small and wealthy elite who tend to invest its money abroad. The overall effect is a fiscal economy in continuous crisis with inflation, interest rates and currency exchange rates fluctuating dramatically, making long-term planning more difficult and making the economy an uncertain environment for commercial investors.

... the potential return on investment and trade in CCA (Central America and Caribbean) is highly uncertain. [NORAD, 1991, page 39]

The difficulties experienced with regards to the foreign trade sector and the overall growth performances have significantly affected the pace of technological advancement, and hence the capability to effect necessary economic and structural transformations. The lack of essential imported inputs have resulted in contractions of output and downward pressures on levels of capacity utilization. The dependency on international financing organizations significantly reduce the choices available for deciding the course of development. For many of these countries, the control of their international exchange is in effect taken over by a consortium of creditors, whose interests are strictly profit-maximizing rather than in support of long-term development. It is

against this background a new mechanism for acquisition of technology and industry must be designed.

Having thus considered how the power and dominance of the developed nations has shifted, not so much in magnitude as in channels and means, and how the basis for exchange thus remains far from equal, attention is now turned towards the many possible pitfalls of technology transfer, particularly when this process is conceptualized as a rational process.

### On the issue of culture

Industrial development in a national context hinges on development of firm-level technological capabilities (FTC). Such development strongly depends on the incentive structure in which a firm operates; the efficiency of factor markets and the efficient functioning of supporting institutions. Clearly, technology and innovation cannot simply be viewed as assets available at a determined factor price. The development of technology requires, for one thing, the *skill of learning*. Apart from requiring a well-developed information network to gain access to available technology, the process of generation, adaptation, modification and improvement require substantial effort and innovative capability on the part of the recipient. While technologies in industrialized countries have evolved in a continuous process of minor improvements, with competence, supply networks and experience being established along the way, the short-cut attempted by forced adaption will often fail due to the lack of these foundations. Transition towards industrialization is more an *organic process* than an artificial construct - industrial development is evolution rather than revolution.

Particularly in developing countries, labor and capital markets suffer from lack of information and problems of *moral hazard*. The entire structure of industrial activity in developed countries has evolved in parallel with changes in social and cultural structures. Neither of these transitions could do without the other - as concepts of production can not be isolated from concepts of man, technology adaption can not be isolated from adaption of cultural values. The moral dilemma of the intervener taking on responsibility for the exchange of existing cultural values for his own, is therefore not much different from that of the traditional imperialists and missionaries. As history has judged and condemned these early strategies of the entrepreneurial nations, it is necessary to seriously consider the soundness of new endeavors.

In market terms, the difficulty is one of isolating the entity to be transferred in terms that are precise and quantifiable in time or space. Quantitative measures (transfer of technology) implemented to care for qualitative concerns (improved living conditions), thus come to have qualitative impacts (change of values) of uncertain value. The requirements on needs- and impact-assessment, which will be discussed later, are thus subject to qualitative and value-laden considerations.

### Statics and dynamics

One of the questions to be considered in relation to the motivation of the dominant partner, is why anyone should want to transfer anything but such technology that is known to be already obsolete - surpassed by superior competitive products. Is the only technology available outdated or flawed? If answered affirmatively, technology transfer brings with it the danger of promoting just another failure, bringing the recipient one step down the ladder while the source takes two up. Unfortunately, the projects adopted by public benefactors can often be recognized by such lack of commercial value.

Membership in the industrialized world introduces uncertainty and instability at several levels of society. Due to fluctuations in international commodity trade, the very existence of communities can become threatened on very short notice, in particular where this existence is based upon trade with few products. In such cases, society is already grossly committed to the premises of international trade, and the option of protecting the trade with measures geared towards isolation

will not be available. In planning for new activities intended to increase foreign trade, one must therefore be prepared to adapt to a faster rate of change in operating premises than would be the case in a closed economy, for instance adapt through diversification and risk-sharing.

The crucial quality of the developed competitive nation is not necessarily its technological superiority at any given moment, but more its capability to change and learn. This capability has evolved in pace with technological progress and a continuous change in the attitudes of people and society. The change has led towards the adoption of what may be termed a trans-national industrial and market-oriented culture. This, more than the possession of any particular technology at any given time, is why developed nations has maintained and strengthened their share of industrial production, and why transfer of technology alone cannot solve the problems of the developing nations.

Thus, even if the recipient has the ability, and option, to choose relevant updated technology, the success is limited by an ever shorter duration of life of the technology. More likely to succeed are perhaps exchanges which maintains an incentive on the part of the technology provider to contribute to the continuous update of the technology within its new setting.

### Pro-investment strategies

The above indicate the need for some deliberation on the strategies available for the developing nation to adapt to an international market economy, while retaining some control over the quality of its industrialization. One example of such a strategy is the Canadian government's efforts in the early 1970s to regulate the conflicts of interest between authorities and the multi-national corporations. Though Canada was and is a well-to-do nation, its relationship to USA resembled that between a developing and a developed country. The strategy outlined 12 principles for sound business practice, together with their conceived rationale: [Morgan, 1986, translated from Norwegian]

1. Full recognition of the Canadian enterprise's growth objectives and potential. (Planners at central office in US decide on expansions or contractions with no recognition of local plans and wishes.)
2. Make the Canadian enterprise an independent, vertically integrated company with full responsibility for at least one production function. (The Canadian enterprise is mainly a distributor of goods produced elsewhere, such that the business easily may be moved or closed down.)
3. Maximum development of export markets from Canada. (Export orders to third countries from warehouse in the US has a positive effect on the US balance and not on the Canadian.)
4. Expand the utilization of Canadian raw materials in a maximum number of production steps. (Few production steps in Canada minimize political influence)
5. Equal pricing between daughter enterprises and for sale internationally. (Current inter-corporative pricing aims at reducing the Canadian tax load.)
6. Develop Canadian deliveries. (Firms prefer sources in third countries or the US because it fits with overall strategies or the political influence.)
7. Build up R&D and product development. (Concentration of development efforts centrally in the US means that Canada can never develop its own capacity.)
8. Allocate considerable means to further growth. (Profits earned in Canada are not retained to finance continued expansion locally.)
9. Appoint Canadian directors and members of the board. (Use of US directors hinders the development of a local perspective on planning and operations.)
10. Equal access for Canadian investors. (100 per cent owned enterprises hinders Canadian

influence and earnings.)

11. Annual reports to be public. (The Canadian enterprise is incorporated within the mother company such that relevant figures and accounts are not made available.)
12. Support of Canadian cultural activities and charity. (Local demands are not supported while the US office contributes significantly to similar campaigns.)

Similar rules or guidelines were introduced by a number of marginal states in the mid-seventies. Present developments, for instance in the General Agreement on Tolls and Tariffs (GATT), will constrict the opportunities available to the individual nation, but will still provide measures to protect recognized national interests. The process of standardization of international terms of trade is however clearly designed on the premises of those already well adapted to a free-market economy.

### The information dilemma

More than anything else, the rapid advances in information technology has set the pace for industrial development. Though resulting in numerous positive merits, such as the enhanced opportunity for knowledge transfer, it has also vastly increased the threshold for participation in technological development. The technical opportunity available for gathering ever more data and performing sophisticated simulations and interpretations also press decision makers to become dependant on experts and their technologies in the management process. It also results in legislation and regulations within the developed nations to become ever more complex and restrictive.

No matter the extent of monitoring, surveying, studies and evaluations, one ultimately faces the need to make a decision based on insufficient knowledge. The purpose of the decision-making process is not only to ensure better decisions, but also to make these decisions legitimate in the environment from which support is required. In addition, it needs to make the structure, procedures and the delegation of responsibilities visible in order to improve after fiasco and consolidate after success.

Developing nations will often lack both the expertise, means and norms concerning proper decision processes. Shortcomings that have produced opportunities for industrial ventures, permitting actions that would be rejected if all the consequences could be assessed a priori. Such flaws may attract investors, but are hardly suited to attract environmentally sound activities. On the contrary, they may give the initiative to the commercial investor, and may for instance be assumed to further the depletion of critical resources. The dilemma facing the advisor to developing nations may then be that for lack of information new technologies can hardly be advised on, and for lack of technology the information needed for good decision-making cannot be gathered.

Indeed, this flaw is one of the principal competitive advantages of developing nations, whether this is intended or not. While most developed countries are tightening environmental and occupational safety regulations, the laxity in developing countries creates an incentive for hazardous industries to relocate to areas where the danger is not known or ignored for the sake of higher priorities, such as export earnings and new jobs.

Asbestos is [a] distressing example. To stimulate the development of companies that will produce asbestos products, Canada's government sends free samples of the material to a number of poorer countries, where many communities and workers are still unaware of the mineral's danger. (Bangladesh received 790 tons, worth \$600,000, in 1984) Partly as a result of such promotion, Canadian asbestos exports to South Korea increased from 5,000 tons in 1980 to 44,000 tons in 1989. Exports to Pakistan climbed from 300 tons to 6,000 tons in the same period. Canada now exports close to half its asbestos to the Third World. [LaDou, 1991]

This dilemma is not easily resolved through the mechanisms of a free-market economy. It is perhaps one of the area where the intervention of international organizations or bilateral programs

may be both appropriate and successful.

### Inherent conflicts

Industrial activities in the oceans may have effects that adversely interfere with the fulfillment of other objectives. Obvious examples of such conflicts are the need for environmental protection versus polluting industrial activities and resource persistence versus maximal utilization of the same resources. The successful treatment of these inherent conflicts require a good understanding of the natural environment, the operating premises of the concerned activities and proper strategies and administration, to name a few. The key is holistic industry management.

One example of such conflicts is given by the history of the Mexican Border Industrialization Program, which sought to create a climate whereby predominantly U.S. companies would establish industries in Mexico. The program has accomplished its primary goal, having led to the establishment of half a million manufacturing jobs and a 3 billion dollars increase in export revenues. However, the manufacturing companies are mainly engaged in such industries that are subjected to harsh environmental and occupational safety regulations in industrialized countries, and which relocate to Mexico partly due to significantly laxer regulations. Thus, the environment in the areas is gradually deteriorating, the accident rate is exceedingly high and the health of the workers is far worse than in any comparable industries in the industrialized countries. Thus one may say that the jobs and export revenues have been paid for by a deteriorating environment and public health. [LaDou, 1991]

Even more complex interactions may occur as the indirect result of changes in production patterns, for instance changes in the distribution of wealth and power, both locally and on the national level. If resources are exploited to their limit and competition between actors arise, the result may be conflicts caused by a changing socio-economic structure of the community, as well as by changing logistics systems, on-shore manufacturing capability and consumer patterns. Such conflicts of interest and attention to long-term effects are hard to consider properly in a setting where the focus on short-term economical effects outweigh other priorities.

The pitfalls of technology transfer discussed so far have related to the nature of the entity of exchange and the conflicts arising from contradictory objectives between parties largely subjected to the workings of the free-market system of economy. The institutionalization of technology transfer is however mostly a concern of ideal organizations themselves exempted from the market mechanisms.

### Overcoming the institutional gaps

The suggestion of new approaches towards industrial development and the emergence of new concerns, notably environmental concerns, will often provoke resistance from established structures. Citing from the Brundtland report:

The objective of sustainable development and the integrated nature of the global environment/development challenges, pose problems for institutions, national and international, that were established on the basis of narrow preoccupations and compartmentalized concerns. Governments' general response to the speed and scale of global changes has been a reluctance to recognize sufficiently the need to change themselves. [WCED, 1987]

Of the particular concerns discussed and of relevance to the present challenge, the following deserves mention. Institutional separation between those responsible for managing the natural resources, the protection of the environment, the national economy and those responsible for industry, science, research and culture, often hinders the integration necessary to attain a sustainable development. In addition, the growing demand for international co-operation has been met by neither necessary commitment nor ability to co-ordinate efforts aimed at achieving sound industrial development.



The ability to anticipate and prevent environmental damage requires that the ecological dimensions of policy be considered at the same time as the economic, trade, energy, agricultural, and other dimensions. They should be considered on the same agendas and in the same national and international institutions. [Ibid.]

LaDou notes, in relation to the problems experienced with the Border Industrialization Program, that the Mexican Secretariat of Urban Development and Ecology (SEDUE) had difficulties with exercising its role as a watchdog of the companies. These problems were partly caused by a lack of funds, but were also caused by political constraints as well.

Should SEDUE become too aggressive in its efforts, the government might withdraw the meager environmental funds the agency does receive.

In addition, the municipal governments were reluctant to impose harsh conditions on the companies.

If they complain about hazardous waste dumpings or unsafe working conditions - or if they press for higher taxes to support better sewage treatment facilities, schools, and medical care - the owners might move the plant to other cities or even other countries. [LaDou, 1991]

Whether agencies of national authorities or of international organizations, the actors on the scene of technology transfer suffer from limitations in their mandates. In lack of cooperation on higher levels, it becomes necessary for the individual organization to take responsibility for the holistic evaluation of its activities, even if it means duplicating efforts performed elsewhere.

### The danger of programs

Previous experiences with transfer of technology to developing countries have unveiled several failures in achieving the intentions. Although the compilation and generalization of the sum of experiences is a task beyond the scope of the present thesis, it may be worthwhile to direct attention to some common violations of procedure that have occurred, and give this an angle towards transfer of marine industrial technology.

Breton [1991] list the following common characteristics of development programs that to most ends have failed their intentions (implemented in Costa Rica fisheries).

First (1), they were based on interventions that international institutions wished to export to underdeveloped nations in order to enhance their political visibility. Second (2), they were filtered through a national bureaucracy or internal agencies whose members have never thought about fishermen's values, since most staff members in these institutions are trained in academic fields dominated by formalist approaches that inevitably lead to the "naturalization" of the producer as an economic variable. Third (3), they constantly seeked to promote a cooperative model, itself stereotyped without verifying whether it was the most appropriate avenue in a given regional or community context.

Thus, the adviser has a big problem: The methodology that may have proved successful in other settings does not work because it fails to consider specific circumstances of the current situation. - even if you have a hammer, everything does not become a nail.

Another problem is that while development agencies may have the purpose of supporting projects addressing certain local needs, their main channels of information and influence remain at the level of the national government. Thus, in spite of the good intentions the aid tends to be directed towards large projects of national interest. Gran makes the following observations on the work of NORAD (Norwegian Agency for Development) in a developing country (Tanzania):

NORAD's foreign aid projects have been integrated into the government's plans for development. ... But these plans have been the plans of the bureaucracy and the party. They have not been formed by or met the needs of the entrepreneurs in the farming communities ..., among traders in the cities, private skippers and fishermen along the coast, and smaller (private) actors in industry. ... In that

way, NORAD came in a bind, tied down in unrealistic public projects and without the opportunity to get in touch with entrepreneurs outside of the bureaucracy. [1992, translated from Norwegian]

The conflicts of planned change are many. However, in spite of the many examples of failures, some projects do succeed. If the lessons learned are kept in mind, the probability of future success may be enhanced.

### The justification of intervention

The experience of attempts to introduce industrialization in developing countries mainly sums up to a history of good intentions and bad results, at least for the subject countries. It is necessary to address even the very fundamental objectives of the activity before establishing the premises for a particular scheme. With regard to the institutionalization of technology transfer, the subjects discussed indicate the need to ensure:

- 1) Recognition of the respective power bases, with special attention to the control of information;
- 2) recognition of the irrational and political aspects of the process;
- 3) proper concern for the environment, including pricing of natural resources;
- 4) positive overall effect on the distribution of wealth, extending the short term merits of industrialization;
- 5) concern for the change in cultural premises and corresponding effects;
- 6) concern for the acquisition not only of the appropriate up-dated technology, but also for the provision of development opportunities;
- 7) recognition of the available strategies for both multinationals and nations;
- 8) proper information and expertise to enforce regulations of harmful activities similar to those enforced in developed nations;
- 9) consideration of long-term and indirect consequences, and their inherent conflicts;
- 10) institutional integration of these concerns to avoid diffusion of responsibility; and
- 11) awareness of own objectives and limitations.

It is important to remember that intervention by an organization should have as a prime purpose to assist in overcoming, or by-passing, these conceived market failures - not actually intervene with the driving market forces. In doing so, the role of the organization have to be subordinated the national government which has the dominant role in determining the incentive environment in which industrial ventures will exist. The organization thus is expected to adjust to the surroundings rather than the opposite.

## Chapter 3: In search of a strategy

The purpose of the preceding chapters was to set the stage on which an organization engaged with transfer of technology may act. The present chapter initiates a search for a strategy to guide on the selection, priority and execution of roles and functions. The case is argued from the position of being in the process of establishing a new organization, or center, essentially independent in the implementation of policy, and with no large means at its own disposal.

The proposed center, intentionally designed to intervene in the market for technology exchange, will act primarily as a *caretaker* of the interests of the developing country. There is however a need to resolve the fundamental issue of how the center should delineate between its separate role as a caretaker of marine industries and related technologies, and the other important priorities of the society as a whole. The functions of the centre may for this purpose be viewed as a combination of different possible roles. The centre will unavoidably have a strong political character, and thus be subject to more scrutiny of its intention than of its achievements. However, it should aim primarily to reduce inherent conflicts and to be capable of efficient action.

### A clean-cut profile

The issue of profile - how the organization presents itself and how it is perceived in its environment - is implied in the following citation, which also sums up many of the concerns discussed in the preceding chapters:

The relatively few cases that exist of very successful intervention suggest that, in the presence of market failures, improved forms of intervention are worth striving for. The few simple rules that experience suggest are: first, high levels of human capital are needed to formulate and implement policies, just as they are needed for technological development; second, the rules should be clear, consistent in terms of objectives and also over time, and perceived to be stable and credible; third, they should be limited to remedying market failures (taking long-term objectives and dynamic/external effects into account) rather than by-passing or going against markets altogether; fourth, remedies for market failure should be institutionalized and hived off from bureaucratic/political processes, with the institutions being oriented to economic objectives as far as possible. [Lall, 1990]

These observations support that the center should display an un-compromised profile consistent with the environment in which it operates, it should be simple to recognize and should reflect consistency in intentions, decisions and actions. Though such consistency is hardly common in institutions like the proposed center, the choice of an acceptable profile may reduce the level of conflict and politics within the structure, and thus help to promote action capability.

### Possible roles

The identity of the center serve to distinguish it from other institutions and to reflect its purpose, legitimacy, and credibility. The identity could either be as a policy agent, subordinated to some well known authority, such as the UN or the national government, or as a separate and independent organization, subordinated to more than one authority. In the following, the latter is assumed.

The Convention lists the following functions of a regional center, section 3, article 277:

- (a) training and educational programs at all levels on various aspects of marine scientific and technological research, particularly marine biology, including conservation and management of living resources, oceanography, hydrography, engineering, geological exploration of the sea-bed, mining and desalination technologies;
- (b) management studies;
- (c) study programs related to the protection and preservation of the marine environment and the prevention, reduction and control of pollution;
- (d) organization of regional conferences, seminars and symposia;

- (e) acquisition and processing of marine scientific and technological data and information;
- (f) prompt dissemination of results of marine scientific and technological research in available publications;
- (g) publicizing national policies with regard to the transfer of marine technology and systematic comparative study of those policies;
- (h) compilation and systematization of information on the marketing of technology and on contracts and other arrangements concerning patents;
- (i) technical co-operation with other States in the region.

The above functions may be considered as guidelines and objectives, but reflect neither a very visible profile, nor explicit priorities or values. An effective profile is one that brings consistence between actual organizational objectives and the perception of the organization in its environment. The functions suggested in the Convention correspond in sum to the roles of: Marketing agent; Door opener; Advisor; Informant; Negotiator; Researcher; Educator; Coordinator; Initiator; Benefactor; and Investor.

These roles which, when executed, will condition the profile, basically fall into three categories: 1) Impartial business services (profile of independent consultant); 2) production of knowledge (profile of university); and 3) agency (representative of authorities). These categories are basically incompatible and often mutually exclusive in terms of institutional profile. Impartial services can hardly be combined with the role of an agency, and education and science will not match well with either business consulting or representation of authority. Within the developed nations, these functions are most often stringently separated, and there is little reason to assume that their integration is likely to succeed within the setting of developing countries.

One exception to this separation is perhaps governmental export agencies tied up to the embassies. There are examples of such institutions working efficiently to serve business establishment abroad, and to communicate information from foreign markets as well as give courses on strategies for investments. The case of promoting technology transfer is in many respects the reversal of this function; working to import technology rather than to export it.

The rationale for choosing one of the conceived profiles at the expense of the others is based on the considerations of the previous section. The profile of an impartial business advisor is the one perceived to fulfill those considerations most satisfactory. It should primarily be directed at getting foreign investors interested in participating in domestic investments in, or establishment of, industry at conditions beneficial to the recipient community. The focus on the profile of business consultant does not mean that the other functions should be disregarded, only that they should not be directly incorporated within the same institutional framework. The functions of a marketing agent and negotiator are further singled out as being compatible and interesting in this respect. They will in part entail the functions of door opening, advisor and information centre, but suggest a slightly modified profile. In particular, we modify it to also establish the center as a lobbyist aiming to advice authorities to improve conditions for industrial establishments.

This choice, which will be further elaborated in the following discussion, raise some questions: Why the business perspective? Marketing of what and for whom? Negotiating between which parties and for what purpose? These questions will be attempted answered in the following.

### Firm-level technological capabilities

The final manifestation of a nation's industrial capabilities is the competitiveness of its industry in the international market. The conditions for development of such competitiveness, or *firm-level technological capability* (FTC), are based on at least three sorts of capabilities (Lall 1990):

- 1) Entrepreneurial: The ability to conceive a new project, organize the resources needed to carry it out, push the concept to completion and set up the institutional base for its continuation.
- 2) Managerial: The ability to establish/enact all the organizational, financial, operational

(non-technical), marketing, personnel and related functions needed for the firm to achieve and maintain commercial success.

- 3) **Technological:** The ability to execute all the technical functions needed in setting up, operating, improving, expanding and modernizing the firm's productive facilities.

While the latter capability remains the primary focus of the present paper, the presence of the others are also crucial in order to achieve the present development aim. The primary motivation for a firm in building up FTC arises simply from the need to get a plant into operation. Thus, firms will tend to mobilize necessary skills if available, and develop it if needed, in order to acquire sufficient technological mastery. Once this is achieved, however, the external environment, particularly in the form of competition, asserts itself as a major determinant of FTC development.

In a world of competition, the inducement to gain mastery quickly, may equally well turn into resignation and wipe out emerging ventures in need of a period of learning and consolidation. There are, however, means at disposal of a nation: It may offer partly protected domestic markets to absorb learning costs while inducing firms to enter into export markets; and technological development may be subsidized through direct funds, tax incentives or public works contracts. For developing nations, there will often be an option of funneling development aid into exactly such new industries that need a kick to enter competitive markets. Regardless of these measures however, there is no more sure way to acquire FTC than to get established successful corporations to take responsibility for carrying the new establishment forth to maturity, provided the incentives are sound and local considerations are duly accounted for.

### Sisters

One successful model for industrialization in developing countries is that of small industry companies in industrialized countries establishing domestic sister companies. This model has several attractive features.

In such a case, where a company already operate in another country, be it developed or developing, the company would need incentives in order to be willing to adapt the technology to local conditions. Such incentives could be anything from resource availability and protected domestic markets to direct investment from national interests or development agencies.

Note also that it may be that small scale industrialists are more likely to accept an idealistic challenge - using other criteria for evaluating the opportunity - under the auspices of an international organization than are large ones. Successful schemes have also focussed on sisters in its verbal meaning; promoting solidarity and values associated with the female sex.

The role of the organization will in such instances be to identify interesting small operating industries in these countries and prepare a framework to attract their interest in participating: The center functions as a marketing agent out to address selected segments of established industry to promote the opportunities of the nation, and as a negotiator (between domestic and foreign interests) to trade off the incentives with conditions desired by the domestic interests. The business-to-business perspective is here viewed as one of the strategies most likely to succeed, particularly if the developing nation takes the initiative. It is important to note, however, that the centre cannot be considered a competing business itself - it will only take on this role in negotiations by demanding acceptable "return on incentives" on behalf of the national authorities.

### Comparative advantages

Technological knowledge is not explicitly given a role in traditional international trade theories, which mostly describe a country's trade potential in terms of specialization in production by taking advantage of natural resources and other basic factor inputs. In other words, it is not treated as a basic production factor. In the case of developing countries, export trade essentially consists of

natural resources and products incorporating abundant cheap labor inputs.

With the rapid development of technological solutions and the increasingly important role of technology in transforming production patterns, several economies have undergone dramatic growth founded in the application of technology to add value to imported raw materials and exporting manufactures. This has particularly been experienced in several Asian countries where the changing trade patterns reflect the pace of technological progress and, one may say, vice versa.

The danger of depending solely on *traditional* comparative advantages, such as natural resources or cheap labor, has roots in unstable export value and ultimate depletion. The problem of pricing natural resources has been discussed earlier. Basing industrial growth on cheap labor is not a much more durable advantage, since both internal events like inflation and external events like the emergence of automated production methods, can rapidly eliminate such advantages. The comparative advantage reached through cheap labor will be significant only as long as the nation remains at a relatively low development level and, arguably, high unemployment. Thus, the strategy of focussing exclusively on labor-intensive industries is likely to fail in the long term.

The above said, it is important to stress that the possession of valued natural resources or other factors indeed are advantages in terms of industrial development. Initially primitive and narrow industries may become seeds for more differentiated and stable firms - the resources can be utilized to give a head start. However, such a development requires means and motivations to adapt. Thus, one of the aims of the industrialization should be to increase the value of the export without increasing the volume, that is, gradually transfer the value-adding between raw material and finished product to domestic industries.

### Export orientation or import substitution

Export-oriented strategies (E-O) are argued to induce faster and more efficient technological learning than import-substituting strategies. In addition, E-O brings with it a more efficient utilization of industrial capabilities as it is being established. Lall [1990] brings forth the following argumentation for this:

- 1) Innovative efforts in firms tend to be more specialized under E-O, and firms try to master production engineering more quickly and make changes only when these are required for export markets;
- 2) under E-O regimes, plants tend to be of minimum economic sizes and focus on responding faster to changing markets and lowering production costs;
- 3) E-O firms have greater incentives to economize on the import of expensive technology, thus forcing domestic development;
- 4) the process of exporting itself generates information that helps minor innovation and FTC growth;
- 5) since E-O regimes tend to promote higher rates of growth, acquired FTC can be exploited faster; and
- 6) finally, as firms mature technologically, E-O provides greater stimulus to developing advanced in-house innovative capabilities.

Although import substitution may be a matter of survival and self-sufficiency, E-O strategies appear to be preferable towards reaching the overall development aim, which is to acquire domestic industrial and technological capabilities. The critical issue is to keep foreign investments under control (or domestic investments high) and still achieve flexibility in production aimed towards international markets. Lall concludes:

- *Export orientation emerges as a powerful force for industrial and national technological capability development. The incentives and signals that E-O implies clearly provides stimuli to healthy and rapid technological learning. However, this by itself is not sufficient. An expanding supply of trained manpower, protection of activities involving difficult learning, and interventions to promote technical effort and to set up institutions to*

overcome market failures are all required.

- *Human capital development* is another critical element, the importance of which grows as the utilized technologies become more advanced.
- *Technological strategy* assumes greater importance as industrial technologies develop. Specific policies and institutions are needed to ensure: 1) That the import of foreign technology is efficient and economical, 2) that local technological efforts increase so as to master and improve on foreign technology; 3) that technology diffuses through to the industrial structure via linkages; 4) that "infra-technology" to support effort is adequate; and 5) that specialized agents for creating and disseminating technology come into existence.

### An emerging strategy

The above discussion lead to some applicable guidelines for the selection, priority and execution of roles and functions.

- 1) A straight-forward, stable, and consistent organizational profile will be beneficial towards promoting action capability.
- 2) The profile proposed to be the most efficient is that of providing business services; the combined role of an agent for marketing domestic comparative advantages abroad, and negotiating the trade-off between necessary incentives and the interests of the recipient community.

The questions previously posed; why the business perspective, marketing of what, and negotiating between whom, are in sum answered by the following arguments:

- 1) Holistic firm-level technological capabilities, which are crucial to successful industrialization, are most effectively acquired through the direct involvement of companies already established within, or similar to, the desired industry. The concept of sister companies provides several examples of beneficial transfer of technology.
- 2) The involvement of existing industrial partners require efficient marketing of comparative advantages and local incentive structures. Rather than to passively await enquiries, active promotion of opportunities for selected sectors is suggested.
- 3) Export strategies are considered the more durable ones. The marketing effort should therefore focus on companies, most likely to be found abroad, that are already well-established within the international competitive industrial climate.
- 4) Apt negotiation is required in order to ensure that local interests are fairly balanced towards the incentives offered.

The proposed strategy is thus to attempt to understand both the political aspects necessarily present, the desire for generating action, and the means of intervention that do not conflict with predominant market forces.

## Chapter 4: Preparing for strategy implementation

So far the task has been to identify important constraints and opportunities related to industrial development to account for these in developing a possible strategy for the organization institutionalization. The discussion so far has intentionally been kept at a high level of abstraction. Before implementing this strategy, however, there are certain characteristics of its day-to-day operating environment, or premises, that begs for investigation.

Public or private investors in developing countries often confront three basic problems in the work towards ensuring efficient technology acquisition. These are:

- 1) *Information constraints*, or difficulties in determining which products or services to produce, and in investigating which methods and technological ingredients are available domestically and internationally;
- 2) *practical development constraints*, or difficulties in determining whether imported technologies will be efficient in a developing country environment, where the required supporting structure, such as specialized skills, workshops for maintenance, communications, and transportation, may not be available; and
- 3) *evaluation, selection and negotiation constraints*, or difficulties in evaluating alternative technology mixes, selecting the most appropriate one, assuring the corresponding financial package (domestic or foreign) and negotiating the terms and conditions of finance as well as for the acquisition, absorption and further development of technologies. [UNCTAD, 1990]

To this listing it seems appropriate to add a *decision constraint*, referring to the problem, discussed earlier, that even if information were sufficient to support rational choices, rationality is subordinated to the achievement of consent from the many diverging interests involved. A major problem in this respect is to deal with irrational needs and demands, that is, those that apparently are not logical or beneficial, or that are contradictory. Such needs and demands may be perfectly legitimate and rational from the point of view of the individual interests, and a major problem becomes to resolve these conflicts of interest without alienating from the process the subjects expressing them.

Throw together ... law enforcement officers, ecological researchers, ... statisticians, policy planners, resource biologists, administrative personnel, and perhaps quite a few others. Call this a management agency. Now "interface" it somehow with its constituents, ranging from politicians who worry about the next election, to concerned conservationists, to careful business entrepreneurs, to "cowboys" out to take the biggest catch this year.... Finally, consider the resource itself, a complex ecological system that is too expensive to monitor thoroughly, changes unpredictably in response to environmental factors, and generally offers all sorts of conflicting signals that are open to every interpretation from imminent disaster to grand opportunity. There you have the modern management situation. [Walters, 1986]

Though the center is clearly political in its intention, and need to account for the diversified interests of its environment, we repeat that its focus should primarily be to market opportunities - not change or administer this environment. Thus, it will take responsibility only for those initiatives it can handle within its limited resources and competence - to the extent that it influences the system this is more done through information and lobbying than through direct action. It is vital for the centre not to enter into policy formulation, thus opening the floodgates for all kinds of interest groups and risking to be made impotent by conflicting interests or excessive political pressures.

### Caring for the environment

The ultimate goal of environmental monitoring of all kinds - compliance, model validation and verification, and investigation of trends - is to protect well-being of the environment, living



resources, and human health. These needs have all high priority for a nation seeking sustainable development, and environmental monitoring thus becomes a crucial task in the preparation for industrial growth. Bearing this in mind, the preparation for the center implementation should also include:

- 1) Constructing, adjusting, and verifying predictive models to be the basic tool used in evaluating and selecting management strategies;
- 2) determining compliance with regulations and conditions set by permits and thus get signals as to the effectiveness of intervention in this arena;
- 3) providing the information needed to evaluate pollution abatement programs;
- 4) early warning of future problems such that they can be addressed easier and at a lower cost than if left unattended;
- 5) improving knowledge of marine ecosystems, their sensitivity, and the impact of human activities on them; and
- 6) engendering a better understanding of the general health of the marine environment.

The economic, social, and political costs of failing to detect and deal with environmental problems in the early stages can be enormous. If the introduction of new technology implies altered patterns of exploitation, depletion or environmental degradation, proper impact assessment is imperative, and such assessments should thus be performed by the center. The task of general environmental monitoring is primarily a task of the science and research community, and is thus not directly compatible with the role of the center. However, in view of the importance of such monitoring in establishing the premises for the work of the center, it is only natural that it takes on a responsibility to push, and maybe even generate funds, to initiate and give inputs to such activities. Indeed, the importance is such that the support of these activities should be given higher priority than uncritical industrial expansion.

Since environmental monitoring is increasingly recognized internationally as a central activity in the preparation towards sustainable development, there are several international organizations involved in it, such as the Food and Agriculture Organization of the UN (FAO), the UN Environmental Program (UNEP), UNIDO, and even increasingly the World Bank. In addition, there are several regional programs involved, like the Caribbean Action Plan, the Mediterranean Action Plan and the North Sea Convention (?). In fact, most major oceanic regions have regional programs for environmental monitoring. It thus is crucial for the center to open communication paths to programs that are of interest in the planning of activities in the adjacent waters, both in order to ensure good quality of the work and to receive funding.

### Caring for human behavior

The previous discussion has repeatedly stressed the importance of the context in determining the success of new technology or industries. It is important to note that when we talk of marine industrial activities, we talk of an interaction between the human actors and the natural habitat with technology as a tool. Thus, while the preceding section stressed the role of environmental monitoring, so is "human monitoring" crucial in order to prepare for successful industrialization. In this context, it is useful to note the observations made by one sociologist:

... in almost all national contexts, there exist more information on the types of fish species, their reproductive mechanisms, ... , the types and lengths of boats, the types and sizes of fishing gear, the range of capital assets and the volume and value of catches than there is information on the people using the gear and catching the fish. Except for few statistics on the number of fishermen, there exist almost no data on their age, the number of their dependents, their migration patterns, technical qualifications, access to credit, social coalitions and links with other branches of production... Quite simply, we possess a lot more information on marine species than we do on marine producers. [Breton, 1991]

Among the many possible levels of investigation, Breton points out the following as useful towards improved understanding and decision making. Some of his findings are useful here as a

supplement to the other proposed investigations that are essential in the process of strategy implementation:

- 1) Investigate the *social ramifications of the activity* in question, taking into account the nature of the resources, equipment, labor force and the institutions in charge of the promotion of the activity.
- 2) Investigate the *relative importance of the activity* in question within the total occupational structure of the communities themselves. From an anthropological point of view, the availability of the pool of labor force at any given period with respect to agricultural, industrial, or tourist activities, may significantly influence planning of industrial activities.
- 3) Understand the *internal features of the domestic conditions* involved, as expressed in cultural patterns, gender relationships and the social recognition and appeal of the activity in question.
- 4) Investigate the presence or absence of *structured coalitions* at the community or regional level through which the producers' aspirations and claims are channeled.
- 5) Get familiar with the communities' *degree of familiarization* with national and international institutions, as influenced by the geographical location and communication facilities. Such familiarization greatly affects peoples' conception of bureaucratic actions.
- 6) Investigate whether formal boundaries correspond with *ethnic or cultural boundaries*. A mismatch may in some instances explain reluctance to engage in regional coalitions and other cooperative activities.

### Caring for the infrastructure

There is an increasing recognition of the importance of infra-structural services to enable healthy industrial development. Such services include transportation and communications systems, social services, essential financial services, necessary domestic supporting industry, and academic institutions. Industrial development strategies of developing countries will have to include a mapping of the available infrastructure and establish ambitions accordingly. For instance, it is quite hazardous to singularly focus on developing aquaculture facilities in locations where there are inefficient transport services or where there are no supporting industries, such as feed production or fish processing.

If well-developed and diversified services are available to a small or medium-sized enterprise within a developed country, the amount of initial capital required to establish it and to consolidate the ability to adapt and remain competitive once established, is reduced. A rapid growth in producer services thus directly affect the structural adjustment process, and make firms able to adjust to changing market conditions, to acquire and apply new technologies, thus improving quality or increasing output, and to penetrate new markets.

The infrastructure in a developed country will normally be in constant change - a change that brings new opportunities for an industry firm. Thus, the task is therefore not only a matter of having access to stored and recorded information, but also to establish contact with sources that are tightly integrated into the industry - maintaining good regional contacts and networking with industry actors in related fields is one of the center's most important assets. Again, the business-to-business role of the center has the benefit of instituting such contacts.

An additional benefit from such direct linkages is one gets an additional source to publicly available information on technological solutions, which frequently describe products (industrial information) or technologies (scientific sources) in a manner that makes it difficult to assess the value or relevance to a particular task or context. Thus, repeating an earlier argument: the *description* of a product or a technology is quite easy to access, whereas *implementing* the knowledge for industrial purposes is a process that cannot immediately be read from specifications and theories. This implementation knowledge can best be harvested through direct contact with industrial companies.

The strategic focus on industrial services may contribute significantly to improving domestic FTC, stimulating domestic investments, creating an environment conducive to innovation and creativity, and directly providing employment and business opportunities. Though the center can do little to improve major infra-structural shortcomings, it can make two significant contributions: 1) It can market and promote "packages" of opportunities, or programs, that aim at building the required industrial infrastructure within a sector; and 2) it can lobby domestically for a national effort to improve conditions that hinder general industrial development.

## Section II: Suggesting an implementation

### Chapter 5: A framework proposition

In this chapter we implement some key conclusions of this report in an attempt to make our views visible in a practical context. It is however not to be seen as a rigid implementation scheme for the center - such an activity would anyway be inconsistent with one of our primary conclusions, namely that the center must be implemented with particular concern to the particular environment in which it will exist. We feel that to bring a presentation like this one, we will trigger a discussion that we presume will be performed with a view to the more substantial discussions in part I. Some of the articles are not direct consequences of the preceding discussions, and are included here to indicate our position on these less central subjects. However, they all evolved from the central ideas developed in part I.

The main "business idea" behind the center is captured in the following statement:

The center will be a free-standing and self-sustaining organization which, on a predominantly commercial basis, offers consulting services primarily to industry companies, financing institutions, governmental agencies, and development agencies. In addition to these consulting services, the center will also deliver qualified assistance in negotiations between various parties, perform impact assessments of existing and proposed industry projects, identify and market domestic investment opportunities, and inform policy makers on issues of importance in achieving increased domestic industrial activity. The center will also be active in promoting general research on the state of the marine environment and propose mechanisms to increase domestic technological and industrial know-how. It will focus on marine industrial activities.

#### Part I: Profile

Crucial for this center, being established with considerations of multiple objectives, is to create and maintain a clear identity, or profile. This profile should be such that the customer, or constituent, is familiar with its functions and is confident that these functions are executed as expected. Engagement by the center should be in conformance to the desired profile. Thus, whenever a project is proposed that endangers it, the project should be delegated to others or not be accepted.

#### *Article 1: Independence*

The center, and thus the staff of the center, should ensure 1) that there is no possibility that it or they may be conceived as being an active instrument of public authorities or private corporations, and 2) that the customer is convinced that the tasks delegated to the center will be performed according to the intentions of the customer.

#### *Article 2: Integrity*

The center and its staff should ensure that integrity is established and maintained, thus demanding that 1) the work undertaken is of high quality, 2) that the staffing is competent, 3) that the work is performed as objectively as possible and 4) that the center not compromises the confidentiality of contract work while disseminating information that is of public interest and pertaining to public concerns.

#### *Article 3: Neutrality*

For several of the functions of the center, operating in an environment of conflicting interests, it

is important that the center and its staff not be conceived as being partial in favor of any actor or political direction. Care must be taken to avoid compromising this perception, particularly in selecting staff members from industry companies.

#### *Article 4: Adaptivity*

Due to the inherently changing environments in an industrializing or industrialized country and an international economy, the center must be able to change in all respects, including its roles and functions, its staffing, and its contact network.

#### Part II: Governing functions<sup>1</sup>

The maintenance of the profile as suggested demands particular considerations of who should control the activities of the center. The key issue is to ensure that no one actor has authoritative influence. Noting, however, that strictly objective parties are difficult to identify, the control seems to be most satisfactory if the center is governed by actors from several sides.

#### *Article 5: Organization form*

The center should be organized in one of two forms:

- a) as a foundation: or
- b) as an incorporated (responsible) firm.

#### *Article 6: Existence of a governing board*

The center must be overseen by a governing board, where care must be taken to avoid dominance by any one party that is among the customers of the center.

#### *Article 7: Composition of the governing board*

- a) In case of an incorporation, the governing board will be composed according to existing domestic legislation. The investors should discuss what is a feasible distribution of power, bearing in mind that tilting the power-base exceedingly to one side might compromise fundamental premises for the center.
- b) In the case of a foundation model, the representatives should be selected among the following groups: major contributors of capital, the government, industry actors, and independents, such as the academia. See also 7. a).

#### Part III: Human resources requirements

The center is more a collection of people than a physical entity. Thus, the staffing procedures are important in all respects, including demands of competence and knowledge, and less tangible qualities as outlined in part I.

#### *Article 8: Personnel in staff*

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<sup>1</sup> The centre needs to be free-standing of two reasons: 1) because it is to be seen as impartial, i.e., providing equal terms to equivalent companies; and 2) because it must be isolated from direct influence by interest groups in order to be efficient. It will, however, be exercising functions to fulfill national policies. Thus, it seems natural that the center is governed by a board where governmental interests are represented, albeit not in majority.

The personnel should be composed such that the center is qualified to:

- a) provide legal and financial consulting;
- b) provide consulting services in the relevant engineering disciplines;
- c) efficiently do marketing of investment opportunities;
- d) assist in negotiations regarding industrial cooperation and establishment;
- e) provide investment analysis both for external partners and internal planning;
- f) commission studies assessing the impact from industrial activities based, among others, on environment<sup>1</sup>, cultural and anthropological considerations; and
- g) manage the center as an independent responsible and commercial corporation.

#### *Article 9: Staffing procedures*

- a) Day-to-day administration (manager), continuous monitoring of the industry, and information services should be performed by regular (full-time) employees.
- b) Where feasible, the center should use association and part-time manning rather than fixed term contracts and large internal staff.<sup>2</sup>

#### Part IV: Networking

The center operates in an environment that is changing and complex, and where human relations play an important role. It is thus important to ensure that the network where the center is to be included is organized at an early stage.

#### *- Article 10: Contacts*

The center should ensure regular contacts with:

- a) Domestic actors, such as:
  - i) major players in the marine industrial establishment.
  - ii) academia,
  - iii) financing institutions.
  - iv) government agencies. and
  - v) policy formulators:
- b) regional actors, such as:
  - i) industries in neighboring countries, in particular where there are reciprocating centers,
  - ii) regional funding organizations, and
  - ii) regional programs in the marine sector; and

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<sup>1</sup> Some of the personnel must be full-time, but it seems appropriate that some are only associated and are used upon demand. This has three advantages: 1) It will reduce the danger that people are put to a task that others might do better simply in order to fill up their work-days; 2) it gives an organization that is flexible in times of fluctuating demands; and 3) it reduces the danger of inbreeding in an organization that must adapt to changing environments.

- c) international actors, such as:
  - i) marine industrial companies, in particular those located in countries granting foreign aid,
  - ii) international ideal bodies, in particular the bodies of the United Nations, and
  - iii) international financing institutions, such as the World Bank, the International Monetary Fund, and the International Development Bank.

#### Part V. Information processes

All the activities of the center are based on access to information at several levels, including knowledge of the industrial and other infrastructures, of technology, of the legal and political framework, and of the environment - physical and human - that is influenced by industrialization. The processing of information is thus crucial.

#### *Article 11: Information generation*

The center should aim to:

- a) Commission environmental impact studies related to areas for potential industrial activity, and commission studies to investigate the effect of industrialization on social and cultural structures;
- b) commission studies to investigate the required industrial infrastructure for industrial activity to start and to what degree incentive structures fail or succeed;
- c) seek to identify fruitful areas for industrial expansion, and attempt to prioritize such areas for internal use and for national policy formulation; and

#### *Article 12: Information dissemination*

- a) The center should seek to convey information gained through its commissioned studies to the regulating and legislating bodies and to the industrial establishment. when this may lead to increased awareness of problems and opportunities.

The center shall publish:

- b) A periodical bulletin to market the opportunities for domestic industrial projects. aimed primarily towards domestic and foreign private industries; and
- c) a regular newsletter aimed towards the same actors as in a), but also towards domestic policy makers and academia reporting on the development of the domestic industry and on the general business climate.

#### Part VI: Infrastructure and other requirements

All industrial activity requires an infrastructure that can support it. This may be other supporting industries, roads, electricity and other communication facilities, and educational or research establishment. So to for the center, which must be located with a view to the functions it is to perform.

#### *Article 13: Information retrieval*

The center should:

- a) Have a library and subscribe to major international publications and newsletters from

neighboring countries; and

- b) have access to computer networks.

*Article 14: Communications*

The center shall be located:

- a) In the proximity of an international airline terminal, such that a visit from abroad can be accomplished in one day;<sup>2</sup>
- b) such that satisfactory telecommunication networks exist for telefax and computer networks;
- c) in the proximity of major actors in industry, government and finance: and
- d) in safe surroundings to attract international competence?

Part VII: Roles<sup>4</sup>

The center will be established to execute certain roles, and will necessarily need to be barred from roles that may compromise its integrity.

*Article 15: The staff*

The staff should:

- c) commission liaison officers (attaches) to reciprocating centers, and admit equivalent officers (attaches) from the reciprocating center(s);<sup>4</sup>
- d) be responsible for maintaining international and regional contacts;
- e) be responsible for locating sources of finance and potential venture partners for the customer.

*Article 16: Negotiation*

- a) Between private parties:
- i) The center should offer legal and financial advice to private parties negotiating a joint project.
- b) Between a private party and public (regulating) bodies:

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<sup>2</sup> This arises from the fact that a required overnight stay may double the cost of a visit, and thus may be an obstacle to international exchange of information.

<sup>4</sup> In the course of discussions, several roles of the center were identified. To avoid conflict of interest and to assure integrity, the center was excluded from having direct investments in any venture. Furthermore, the center can have only an advisory, evaluating, and supporting role - it can not be involved with legislating or regulating the industry. In its role as a negotiator, the center is not a separate party - rather it is a link between the parties that assists both parties in reaching a settlement that is beneficial to both.

<sup>5</sup> One underlying assumption is that the center can be reciprocated by neighboring countries. In that case, it seems feasible for the center to represent the host country through a liaison officer in the reciprocating center, and to admit a representative from that center in exchange.



- i) The center should be capable of identifying what measures should be taken to ensure that the government is satisfied that it may offer the investor incentives to establish in the country, and
  - ii) should be capable of resolving the proposed industry venture with existing regulations and laws as specified by the host government.
- c) Between a private party and funding agencies:
- i) The center should give support to the parties in the case that foreign aid or domestic grants are allocated to promote industrial development, that is, to resolve specific issues regarding the demands put forth by the funding organization.

*Article 17: Consultant services*

- a) To industry actors, the center should be capable of:
- i) acting as any separate consultant, providing legal, financial, and technical advice;
  - ii) linking the actor(s) to funding institutions or possible joint investors;
  - iii) providing impact assessments of the proposed venture, in case this is required or desired; and
  - iv) driving through any paperwork that requires particular knowledge of local conditions and lobbying.
- b) To funding institutions, the center should be capable of:
- i) assessing the feasibility of proposed ventures; and
  - ii) identifying feasible opportunities and locating potential co-investors.
- c) To public (governmental) bodies, the center should be capable of:
- i) ranking industry venture proposals in terms of the value they will have in fulfilling the main objectives;
  - ii) giving impact analyses of proposed industrial ventures;
  - iii) advising on the effectiveness of existing incentive structures and proposing new ones; and
  - iv) giving analyses of infrastructure requirements for desired industries.
- d) To other regional and international programs and institutions.
- i) ranking industry venture proposals in terms of the value they will have in fulfilling the main objectives;
  - ii) giving impact analyses of proposed industrial ventures;

*Article 18: Marketing*

The center should:

- a) Actively market such domestic investment opportunities that the center may benefit from through consultant or other services.
- b) Be open for engagement by public authorities in promoting domestic investment opportunities that not necessarily is directly beneficial to the center.

*Article 19: Information collection*

The center should, on a commercial basis, offer to execute studies in the following areas:

- a) Project feasibility;
- b) environmental assessment;
- b) human and social impact from industry;
- c) infrastructure requirements for proposed industrial expansion;
- d) the general investment climate; and
- e) the effect of incentive mechanisms.

*Article 20: Other functions*

The center should:

- a) Propose programs in research and development, education, and training as it finds feasible to increase domestic know-how, but should not take any active part in administering them; and
- b) regularly organize general seminars, for instance on how to start industry ventures domestically and abroad.

*Article 21: Fees*

- a) In general, the center will charge consultant fees on a commercial basis.

Fees may be waived when:

- b) There is a view to industrial development in particularly prioritized (desired) areas; and
- c) when the party is an ideal organization.

Part VIII: Performance evaluation

*Article 22: Evaluation*

- a) The activities that the center promotes or finances should be evaluated regularly.

## Chapter 6: The case of Costa Rica

In the prior chapter, a center structure was proposed for a general implementation. It is however clear that the exact implementation must be determined with a view to the specific needs and opportunities in the country and region where the center is to function. The current chapter is an effort to highlight exactly such needs and opportunities in Costa Rica. However, it must be clear that it is beyond the scope of this work to be specific and detailed as to what structure and areas of work should be implemented - this must be done by actors located in and familiar with the situation in the country. Thus, the following is more to be seen as a possible starting-point of a discussion rather than a proposal for a solution. In addition, we view this as a short illustration of the method with which we seek to establish a focus for the center's activities.

Costa Rica seems to have reasonably good operating conditions for a center as the proposed one. The country has established several investment incentives that are administered by a government agency called CENPRO. It is clear that the center will be in the position of actively marketing these incentives towards the outside world. Aquaculture is identified as being a promising industry - an industry which also opens up for regional cooperation.

This chapter contains four parts: 1) a survey of general economic conditions in Costa Rica; 2) a brief summary of the investment climate; 3) some comments on the structure of a center based in Costa Rica; and 4) possible industry activities on which the center can focus.

### Existing conditions

Costa Rica has implemented some mechanisms for attracting industrial ventures to the country, notably Zona Franca (Corporation de la Zona Franca de Exportation, a free trade zone) and CENPRO (Costa Rica Export and Investment Promotion Center, Ministry of External Trade, Costa Rican Export Directory) to administer the various mechanisms. These incentives currently only apply to activities in so-called "non-traditional exports."

In addition to membership in the Caribbean Common Market (CACM), a mechanism for regional cooperation is (potentially) found in the Caribbean Action Plan (CAP), which

... should provide a framework for activities requiring regional cooperation in order to strengthen the capability of each country to implement sound environmental management and thus to achieve sustainable development for the people in the Region. (UNEP, 1983)

All states and territories in the Caribbean region participate in the CAP.

Costa Rica has historically used devaluation of the pesos as an economic tool. This is traditionally viewed as a danger to commercial enterprises, in that the value of capital investments then may wither away. Thus,

... the potential return on investment and trade in CCA (Central America and Caribbean - Costa Rica, Guatemala, El Salvador, Nicaragua) is highly uncertain. (NOPAD, 1991, page 39)

Table 1 gives an overview of the most important merits of measure for the Costa Rican economy.

The traditional exported products from Costa Rica are coffee, bananas, beef, sugar, and cocoa, amounting to USD 1.01 billion in 1986. The so-called non-traditional exported products are textiles, chemicals, plastics, cement, paper, industrial metals, and most recently ornamental flowers. The most productive sector has been agriculture, with a good part of the produce being exported. Imported products include manufactures, machinery, transportation equipment, chemicals, fuels, foodstuffs, and fertilizer, totalling USD 1.16 in 1986. The most important trading partners are the United States, the United Kingdom, the CACM (Caribbean Common Market), Germany, and

Japan. [Ross, 1990]

### Some specifics on opportunities for intervention

Prior to establishment of the center and subsequent engagement in any field of industrial activity, there should be an assessment of the climate in which the center shall function. The following is a starting point for such investigations.

The general investment environment in Costa Rica may be seen to be influenced by the following assets:

- Particular incentive structures, including taxation and currency exemptions, under the Zona Franca and CENPRO. See table 2.
- Stable political conditions.
- There is a comparatively low illiteracy rate - 6 per cent - giving good terms for labor training.
- There are good domestic telecommunications, in addition to one Atlantic Ocean Intelsat satellite station giving high-quality international and maritime communication services.

Measure	Value
Gross Domestic Product (GDP)	USD 5.3 billion (1989)
GDP growth rate	5 per cent (1988-1989)
Budget deficit	5 per cent (1989)
Inflation rate	29 per cent (1990)
Nominal interest rates	35-36 per cent (1990)
Real interest rates	6-7 per cent (1990)
Foreign debt	USD 4.6 billion (1990)

Table 1 Various measures of merit for Costa Rica. [NORAD, 1991]

- A major port at Puerto Limon (Atlantic side), which is a prioritized development project, and which has a Zona Franca in the proximity.

In addition, Costa Rica has established certain additional incentive programs, such as: Resident investor's papers; company visa program for allowing increased foreign labor share; incentives for tourism; and incentives for reforestation. Costa Rica is also a CBI (Caribbean Basin Initiative) country, meaning that imports to the United States from the Central America and the Caribbean (CCA) signatories of CBI are exempted from import duties, provided that at least 35 per cent of value adding takes place in the CBI country. This has proved to be an additional asset in terms of attracting foreign investors. [NORAD, 1991]

Important liabilities are:

- High real interest rates.
- Danger of devaluation.
- High inflation.
- Slow and hampering bureaucracy.

The level of domestic interest rates imply that the opportunity cost of money is very high and that only very good investments show a positive return. In addition, devaluation and inflation tends to eat away at any capital investments. The slow speed of the bureaucracy will tend to bar enterprises from pursuing investment opportunities. In addition, the use of "tea money", or unofficial fees, is prevalent in the country. [ibid.]

Potential for (commercial) marine industrial activities and associated technologies are found in the following areas:

- Potential for tourism due to undisturbed coastal areas.
- Prawn and lobster fishing inside the Exclusive Economic Zone, the EEZ.
- Sustain the livelihood of threatened tuna fisheries by pollution combatting.
- Improve the yield of coastal fishing in North-East Costa Rica.
- Shrimp farming.
- General aquaculture activities.
- Transportation of meats, aquaculture products, fresh fruit, and flowers at sea. Most of these time-critical products currently reaches Europe by air.

### Some specifics on structure and establishment

Incentives	Zona Franca <sup>1</sup>	Export Contract	Temporary Admission
Import duties on raw materials	100 % exemption	Exemption proportional to export sales	100 % exemption
Export taxes	100 % exemption	100 % exemption	100 % exemption
Local and excise taxes	100 % exemption	Exemption proportional to export sales	100 % exemption
Taxes on profits	100 % for 6 years, 50 % for following 4 years	Exemption proportional to export sales	100 % exemption
Taxes on profit repatriation	100 % exemption	15 %	15 %
Capital repatriation	Guaranteed after 4 years operation	Guaranteed after 4 years operation	Guaranteed after 4 years operation
Management of foreign currency (USD)	Independent	Through the Central Bank	Through the Central Bank
Customs service	Expedited on site	Through the Central Customs House	Through the Central Customs House
CAT (Tax Credit Certificate)	Not applicable	15-20 % of the FOB (free on board) export value, renewed bi-annually	Not applicable
Sales to locals	Up to 49 % of production	No restrictions	Not allowed
Time limitation	10 years from issuance of permit (renewable)	All contracts expire in 1996	5 years permit, automatically renewed
Eligibility requirement	Product must undergo substantial transformation	Product must have at least 35 % value added in Costa Rica	Not available

<sup>1</sup> The incentives under Zona Franca varies dependent upon whether the establishment is inside or outside the central area.

Table 2: Investment incentives in Costa Rica. Information from NORAD, 1991.

Due to the central position of CENPRO in the Costa Rican industrial environment, it is crucial to ensure a clear interpretation of the roles of the center. It may be questionable whether it is desired to have government participation at all, but in any case the separation of the center from the government agencies must be ensured. Thus, the control possessed by the government should be minimized.

In any model of implementation (financing, ownership, and control), one might aim to finance the activities of the center that cannot get a commercial investor from any of the following sources, aside from national programs:

- The World Bank.
- The International Development Bank.
- The International Finance Corporation and its Caribbean Project Development Facility.
- The Caribbean Development Bank.
- UN programs, such as CAP.
- Bi-lateral development aid.

Such activities may be environmental and social impact analyses and infrastructure assessments. In this case, one would see the financing institution as a customer and the center as providing consultant services, still on a commercial basis.

Among the international contacts to be established may be:

- The institutions named above, as well as the Latin American Association of Financing Institutions for Development (ADIBE) which is established in order to help locate possible investors to development projects.
- Members of the Caribbean Common Market.
- CAP, UNEP, UNIDO, United Nations Development Program (UNDP), and other relevant UN bodies.
- Major trading partners, notably the United States, the United Kingdom, Germany, and Japan.
- Donors of development aid.

The problems facing the investor that are directly associated with the economic conditions in Costa Rica may be resolved through special agreements under the Zona Franca arrangement, such as allowing loans to be made in the international market and in a stable currency (USD). The rules governing these structures are quite complex, and the negotiations regarding establishment are time-consuming. "A foreign investor considering a venture in Costa Rica should have a long-term perspective. Considerable time is normally required to negotiate a contract. Even though a new business contract shows a positive attitude from the very beginning, final decisions are slow. ... To handle red tape by way of local laws, regulations, etc., a foreign investor should take care to choose a local partner that is capable of penetrating the bureaucracy when required." [NORAD, 1991, page 29]

To a fresh foreign investor the center should offer three specific services to alleviate these problems: 1) Consulting on what kind of venture implementation is most likely to benefit from the incentive mechanisms; 2) support during and possibly taking care of the negotiations with CENPRO and other involved parties; and 3) be responsible for speeding the process through which the applications are evaluated and decided upon.

### Target area for industrial activities

By focussing on statements of needs like "improve domestic food supply" and "increase export earnings" work might focus on the fishing sector. There are several of the identified opportunities that are consistent with these statements.

The first step should be to identify the potential in coastal fishing, in securing the tuna fisheries, and in culturing fish, prawn, and lobsters. Exports of these goods presupposes an efficient transportation system which incidentally is also needed for other important exports from Costa Rica.

Adjacent countries are involved in aquaculture activities, notably Colombia, Ecuador, and Venezuela culturing fish, and Nicaragua in culturing prawns and lobsters. Aquaculture also brings the potential for use of by-products, such as using waste as fertilizer for agriculture, alternative uses of lobster shells, fish skin for leather industry, and feed from waste in meat industry. This industry is also using adaptable (existing) hardware, but needs to be operated with a view to local contexts. Thus, aquaculture seems a good starting point for focus.

In Costa Rica shrimp farms with surface areas larger than 200-300 hectares are permitted to obtain shrimp post-larvae from the wild only during the first year of operation, after which seed-stock must come from hatcheries. [ibid., page 10]

The basic requirements for aquaculture activities may be self-evident, but are access to land-space and to salt water.

Aquaculture has proved to be a quite complex industry that, if administered wrongly, bears the potential of significant failure. We propose that the center, before any decisions are made or any actions are taken, investigate the inherent and essential conflicts through impact studies. Among the more important of these conflicts are:

- Intrusion on coastal sites - occupation of land.
- Intrusion on shore from infrastructure requirements.
- Waste production and subsequent disposal.
- Introduction of medicines in seawater.
- Escape of cultured organisms and subsequent mingling between species.
- Undesired biological (algae/bacteria) production in vicinity of plants. and subsequent danger to the surrounding environment.

After this, studies should be performed to map the required supporting industrial activities for a producer, including:

- Supply from hatcheries and/or "seed" collection from the wild.
- Supply of feed.
- Gear (hardware) manufacturers.
- Gear (hardware) maintenance.
- Production facilities.
- Fish processing and marketing.
- Transportation of feed, fry, and finished product.
- Waste management.

The supporting general infrastructure should also be assessed in terms of:

- Transportation network.
- Electricity.
- Telecommunications.
- Skilled and unskilled labor.
- Fresh water.

The required or desired R&D services to develop new technologies, probably to be provided by general (public) R&D institutions:

- Disease control.

- Species development.
- Quality control.

It may be feasible for the center to finance these initial activities through international funding institutions, or donor nations like Canada and Norway, which both have significant knowledge of opportunities and problems relating to aquaculture



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## Appendix 1: The ocean resources

The following brief roundup description may be considered as a base reference wherefrom subsequent detailed assessment can start in particular situations.

### Biological resources

The biological resources include everything from the primary producers through the food chain to large mammals like whales. It is common to distinguish between *pelagic* (in open ocean or sea), *benthic* (adjacent to the bottom), and *demersal* (at the sea floor) life. Furthermore, one distinguishes between oceanic and coastal living organisms. Several species, particularly of fish, will migrate between these zones. Lastly, one can distinguish between *primary producers / micro-organisms, algae, plants, crustaceans, fish, and mammals*.

The primary producers are not at present utilized resources, although there is a number of experiments which aim towards making such micro-organisms usable as human foods. There is also experimentation that focusses on using them for other purposes, such as metal leaching and production of hydrogen. Despite the lack of utilization, however, the indirect benefit is tremendous, since all marine life depends on the primary producers. The abundance of living resources in a region is thus directly affected by the production rate of these organisms, a rate which varies greatly between oceanic regions. Among the most productive regions are found the Barents Sea and the Eastern Atlantic.

Marine algae are interesting both to the medicine industries and as a food-supplement. There is, however, quite a lot of work to be performed until such resources are indeed possible to exploit on a commercial scale. There is also a growing awareness of the problem that algae-growth may lead to, for instance red tides that tend to kill life in the oceans. Thus, research is performed in finding ways to combat such algae growths, which stands as a danger to both fishing industries, mari- and aquaculture facilities, and the tourist industries.

Some sea plants are to a certain extent used for commercial purposes, particularly in the health food and medicine industries. However, they are hardly utilized for food, although they are abundant and rich in important nutritional ingredients. The greatest obstacle to utilization is the particular taste that products from such food-products have, and there is some effort vested into making them more palatable.

Among the commercially most important crustaceans are shrimps. However, krill is growing increasingly interesting as a separate resource, and the catch has been steadily increasing in size. Several kinds of crabs, lobsters, and shell-fish are also commercial resources, and still more are used for foods without being sold at a market. In addition to being a food-supply, the crustaceans also have properties that may increase their worth - in particular chitosan in the protecting shell. The chitosan has a number of various areas of use, including ingredients in medicines, in polymers, in textiles, and as additives to prevent deposits in spill water pipes from chemical industries.

Fish is by far the most important living resource in the oceans. The number of species currently being exploited commercially is sizable, but there is a still larger number of species that are not utilized. In addition, while some stocks of fish experience a heavy depletion due to over-fishing, others experience a great under-utilization, that is to say that the potential catch far exceeds the actual catch. Several species of fish are also cultured in coastal aquaculture facilities and at artificial fishing grounds.

Some marine mammals, in particular whales and seals, are utilized by certain indigenous peoples in the arctic, and dolphins are used for food in some areas. However, few, if any, marine mammals can currently be regarded as commercial resources. The historically most important resource, whales, experienced a total halt in 1988 due to decisions made by the International Whaling

Commission (IWC). Furthermore, the second most important catch, seals, has been subject to a dwindling market due to increased public concern. There are, notwithstanding moral argumentation, indications that the size of the population of some whales is growing enough to permit catch in the future.

## Hard mineral resources

Most areas of the ocean contain abundant mineral resources other than oil. We talk of three classes; Inside the Exclusive Economic Zone, that is in relatively shallow waters, in international waters, or in deep waters, and dissolved in the sea-water.

Inside the Exclusive Economic Zone (EEZ) the metalliferous sands have in some places, for instance in Egypt, been successfully exploited, while in Nome, Alaska, gold is extracted from the sea-floor. [Sea Technology, March 1990, page 35] Other such minerals are sands for construction materials, coal-deposits, placer deposits, and phosphor deposits.

Among the deep sea minerals are found manganese nodules, poly-metallic crusts, and metalliferous sulfides. Of these, the manganese nodules have received the most attention. These are found at depths of 5,000 meters or deeper and contain abundant supplies of manganese, copper, nickel and cobalt. Areas in the Indian Ocean and the Pacific Ocean are identified as the most likely areas for industrial exploitation. The technological challenges in producing a reliable and environmentally acceptable system are tremendous, but the payoffs may be virtually endless supplies of these metals. The poly-metallic crusts and sulfides mainly contain the same metals.

Finally, from the water are extracted several products, such as magnesium, hydrogen, and salt. Fresh water is also extracted from the oceans and is in some areas, for instance the Arabian peninsula, the sole source.

## Hydrocarbons

The most important non-living resource exploited from the ocean today is hydrocarbons. In 1989, 1.1 billion m<sup>3</sup> per day of natural gas and 14.8 million barrels per day of crude oil were extracted from the ocean floor. However, there are still unexploited fields, for example in West Africa where over 230 undeveloped discoveries have been identified. [Offshore, incorporating the Oilman, June 1990, page 5] Most of these are crude oil reserves, but about 4.7 trillion m<sup>3</sup> of natural gas reserves are virtually un-utilized. Of the oil produced offshore, approximately 43 per cent is produced in Africa, Latin America and Asia. The corresponding number for natural gas is 22 per cent. [Ibid, page 33]

Most of the ocean hydrocarbon resources are found inside the EEZ, at the continental shelves, and is primarily located in areas in the South China Sea, the east coast of South-America, the west coast of United States, the northern coast of Alaska, West Africa, the Persian Gulf, and the North Sea.

## Energy resources

The possibility of harvesting energy from the sea is receiving increased attention. Energy from waves is the opportunity that has experienced most development, and several pilot-plants have been made. Examples of such plants are large buoys utilizing the vertical motion of the waves, and land-based power plants based on reservoirs to be filled with water.

Tidal power plants are used in some areas where the difference in tides is large. However, there are few locations where the tidal difference is large enough to permit such energy production.

In straits where currents are strong, there is a potential of using this to produce energy. This is suitable at few locations, and the facilities are large and complex.

Ocean thermal energy conversion (OTEC), benefiting from the temperature difference between deep and surface waters, is a possible source of energy in several locations. Some pilot plants are made, for instance outside Hawaii and in Japan. OTEC is interesting also because the cold bottom water is often rich in nutrients, and such plants can therefore be operated in conjunction with aquaculture or mariculture facilities.

There are primarily three reasons for the interest in ocean energy; it is renewable, it is virtually non-polluting, and it is to some extent accessible for any coastal region.

### Space and free surface

We have chosen to view both free surface and space as resources. Free surface is to mean the large areas that can be used for transportation. In contrast to land-based transportation, which demands heavy investments in road or railway systems, at-sea transportation require, aside from port facilities and vessels, few capital resources. The resources that are required may be navigation systems and measures to combat pollution from ships or to assist in emergencies.

The oceans may also be used for building artificial islands for population or industrial activities, or for building platforms for industrial or leisure activities.

### Nature and wildlife

There is a growing interest in the ocean as a recreational resource, which has led to a booming tourist industry. Such activities include coastal recreation, where people have access to both land-based activities and swimming and diving. Cruise activities are more geared towards using the open-ocean in conjunction with certain attractive coastal resorts. Industries, such as tourist submarines, utilize the world beneath the oceans as an exciting and unknown attraction.