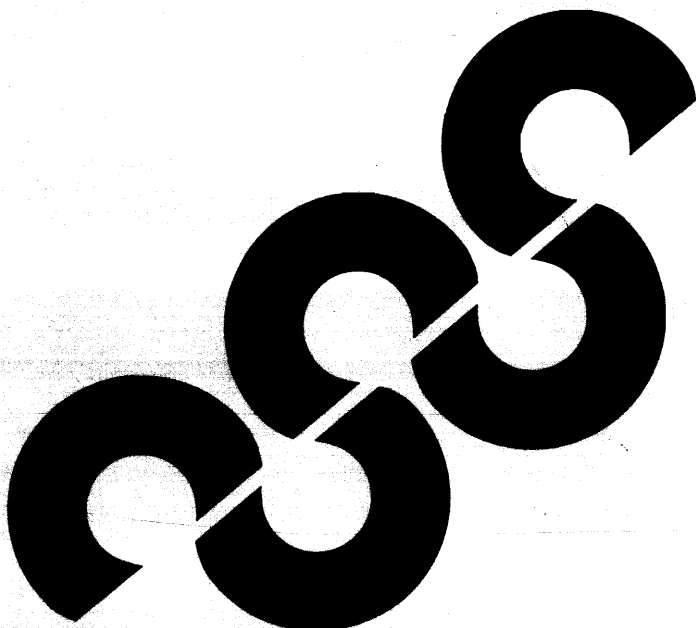


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# A Technology Assessment System

A Case Study of East Coast  
Offshore Petroleum Exploration

by M. Gibbons and R. Voyer

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Science Council of Canada,  
7th Floor,  
150 Kent Street,  
Ottawa, Ontario.  
K1P 5P4

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...a human situation is characterizable only when one has also taken into account those conceptions which the participants have of it, how they experience their tensions in this situation and how they react to the tensions so conceived.

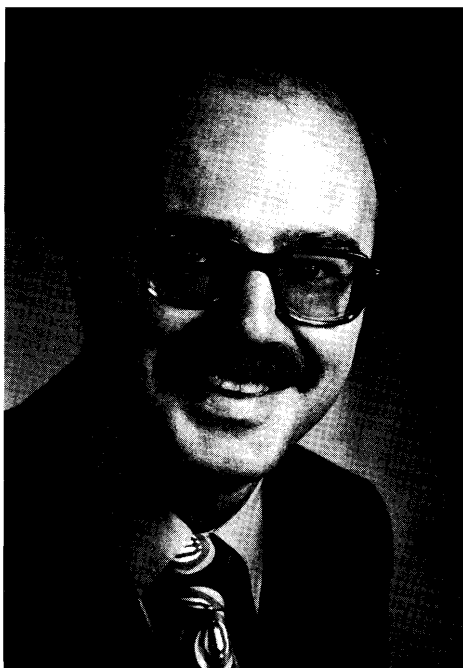
—Karl Mannheim, *Ideology and Utopia*



## **Michael Gibbons**

Michael Gibbons was born in Montreal in 1939. He received his BSc (Maths and Physics) from Loyola College, Montreal in 1959; his BEng (Electrical Engineering) from McGill University in 1961; his MSc (Physics) from Queen's University in 1963; and his PhD (Theoretical Physics) from the University of Manchester, Manchester, England in 1966. He was a Lecturer in the Department of Liberal Studies in Science at Manchester University between 1966 and 1971. He was seconded to the Science Council from 1 August 1972 to 31 July 1973. At present he is Senior Lecturer (Associate Professor) in the Department of Liberal Studies in Science at the University of Manchester.

His research interests at present involve a fairly broad program of investigations into the roles of science and technology in technological innovation; the relationship between science and technology; technology transfer in relation to spin-off firms and some problems of aspects of international cooperation in science and technology. He is the author of numerous articles in scientific journals and co-author of John Langrish, M. Gibbons, W.G. Evans and F.R. Jevons, *Wealth from Knowledge*, Macmillan, January 1972.



### **Roger Voyer**

Roger Voyer was born in Cornwall, Ontario. He received his BSc and MSc in Chemical Engineering from Queen's University, Kingston, in 1961 and 1962 respectively, and obtained the degree of Docteur Ingénieur from l'Université de Grenoble, France in 1965. After spending three years in industrial research he joined the staff of the Science Council in 1968. From 1970 to 1972 he was seconded to the Permanent Canadian Delegation to OECD in Paris.

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## Foreword

This study was carried out by the two authors between the summer of 1972 and the summer of 1973 while Dr. Gibbons was on the staff of the Science Council on a year's secondment from the University of Manchester and shortly after Dr. Voyer had returned to the staff of the Science Council from a period of secondment as First Secretary, Scientific with the Canadian Mission to OECD.

The study reflects the Science Council's growing concern with technology assessment in the broad sense as a focal point of public, political and private concerns about the use or abuse of technological capabilities in Canada.

The study represents, as will several other of the recently commissioned studies by the Science Council, the determination of those working in the area of science policy to come to grips with the key problems at the cutting edge of the interaction of science and society. The backgrounds of the two authors, and the fact that one of their principal consultants, Dr. Silverman, is a political scientist, demonstrates the kind of multidisciplinary approach that is needed to tackle problems of this sort.

The fact that the authors decided to tackle the problem using the case study method needs no apology. The concept of a Technology Assessment System is sufficiently sophisticated that its presentation, through a case study, will, we hope, improve the clarity to the reader of the principles which the authors are enunciating.

Events since this manuscript was completed and had passed the test of external refereeing have underscored the importance of the actual case chosen for the study and it has undoubtedly increased the urgency of the message the authors conveyed.

As with all Background Studies published by the Council, this study represents the views of the authors and are not necessarily the views of the Council. The Council is publishing this study because it thinks it makes an important contribution to our understanding of Technology Assessment Systems in general and to the workings of such a system in the evaluation of potential consequences of petroleum exploitation on the continental shelf off Canada's East Coast.

P.D. McTaggart-Cowan  
Executive Director  
Science Council of Canada

## Preface

The material set out in this study has been selected in an attempt to answer three related questions: What is meant by the phrase technology assessment?, In what situations has this type of assessment been used?, What are the implications of the concept for the development of Canadian technological capabilities?

The first question was set by the Science Council. The second was prompted by the suspicion that technology assessment might be merely an imaginative slogan revealing little. We, therefore, approached our task with some caution and set out to determine if an activity called technology assessment was actually going on in Canada, but perhaps under some other name. Clearly, any recommendations concerning future effort in the area of technology assessment would depend critically upon whether one was envisaging an entirely new form of activity or a modification of existing activities.

Instead of undertaking a full analysis of the processes whereby technology is assessed in Canada – an approach which might very well have resulted in a general study of limited use – we felt that we could more effectively answer the questions posed by means of a case study. The subject chosen for the case study is a contemporary one which should be of interest to Canadians and, hopefully, the information gathered will be of use, not only in raising the general level of awareness, but also to those more immediately involved with the application of the particular technology. However, we *caution* the reader that what is attempted in the following pages comprises an *assessment of technology assessment* with respect to one particular technological capability developing in a Canadian context, and not a substantive analysis of the physical, economic, political, and social consequences of the technology. As the sequel will make clear, the resources required for the latter tasks are substantial and comprehensive, and imply the need for a new element in a Technology Assessment System.

## **Acknowledgements**

As indicated by the title, this is the study of a system. We are extremely grateful to all the individuals in the petroleum industry, the federal and provincial governments and the universities who helped us to piece the system together. In particular we would like to thank Mr. A. E. Pallister, Vice-Chairman of the Science Council, who made our visit to Calgary a success.

We would also like to thank our consultant, Dr. S. Silverman, and the members of the staff of the Science Council for their contributions.

We also thank our secretaries, Mme L. M. Lussier and Mrs. H. M. Routliffe, who had the unenviable task of deciphering our hieroglyphics.

M.G.

R.V.

# Summary

This essay is about the interaction of technology with the physical, social, economic, and political systems in Canada. The growth of consumer and environmentalist movements in recent years has shown that technological innovation is not always beneficial. There is a growing awareness that technological application can have far-reaching effects – effects which fall outside, that is, are external to, the sector in which a technology is applied. While immediate consequences, those internal to the field in which a technology is applied, are usually assessed, the external consequences remain largely unexplored. There is growing public pressure for better assessment of the external consequences of technological developments. This concern has led to development of a concept known as “Technology Assessment” which has been defined in some quarters as “taking a purposeful look at the consequences of technological change”.

Much of the discussion of Technology Assessment to date has focussed on the development of methodologies to obtain more complete and objective information about technological programs. However, technology is applied in society by individuals and groups whose decisions are subjective and value-laden and who have neither the time, the money, nor the inclination to undertake systematically a comprehensive study of all possible consequences of technological programs. The application of methodologies tends, in our view, to separate the informational and the decision-making aspects of the assessment process. On the contrary, the thesis of this study is that information and decision making are not only mutually dependent, but also influenced by the political, economic and physical contexts in which a technological capability is to be embedded. A description of some elements of these contexts – those relevant to our case study – is given in Chapter II. Much emphasis is placed on social context since Technology Assessment is very much concerned with the consequences for society of technological development.

With these considerations in mind, we have defined Technology Assessment as an *“activity to provide information about, and systematic analyses of, the internal and external consequences (short, medium and long term) for a society of the application and diffusion of a technological capability into its physical, social, economic, and political systems. This information and systematic analysis is to be so structured and presented as to aid the decision makers charged with the responsibility of operating those systems.”* (see p. 26) This definition encompasses the two distinct processes of collection and analysis of information and improvement of decision making. It is important to note that the former is a necessary but not sufficient condition for the latter.

Since the aim is to provide information to decision makers, then information must be looked at within a decision-making context in which information influences decisions and decisions in turn lead to new information needs.

To provide a necessary framework for doing this, we have introduced the notion of “The Technology Assessment System” which *“comprises those social groups which are (or should be) concerned with effecting a given technological program. The elements which make up this system may, or may not, be bound together by any formal arrangements: coupling is effected by*

*their mutual interest in the development and diffusion of a given technological capability. In addition, and logically, the composition of the technology assessment system varies with the technology under consideration.”* (see p.34) The Technology Assessment System forms part of the broader political system; however, Technology provides the focus for the discussion.

We have found the notion of a “Technology Assessment System” to be a useful one in analysing the activity surrounding petroleum exploration on the continental shelf off Canada’s east coast. The details of this activity are described in Chapter II. *Further, we believe that it is a sufficiently general notion to be of help to those who are attempting to carry out technology assessment studies in other areas.*

What has been happening off the Atlantic coast? In the late 1950s Mobil Oil of Canada undertook some technical surveys around the Sable Island area. These surveys looked favourable and Mobil subsequently took out exploration permits in 1960. The other major oil companies reacted quickly to the Mobil Oil initiative and by the late 1960s most of the Scotian shelf, the Grand Banks and Georges Bank were under permit. When exploration permits are taken out under the Canada Oil and Gas Land Regulations, the companies are required to perform a certain minimum amount of exploration work each year. The federal Department of Energy, Mines and Resources (EMR) is responsible for the administration of these Regulations. Up to the present time the direction of the development of Canada’s offshore resources was, in large part, explainable in terms of a dialogue between EMR and the petroleum industry.

However, as the exploration activity gained momentum and became more “visible” other groups started to show an interest. For example, the governments of the Atlantic provinces perceived the potential exploitation of petroleum to be one way of converting the Atlantic provinces from “have-nots” to “haves” economically; the Department of Industry, Trade and Commerce (IT&C) saw the opportunity to develop a new industry – offshore technology; the Department of Regional Economic Expansion saw this potential in terms of regional development; industrial interests saw the opportunity of supplying goods and services to the petroleum industry, and so on.

Each of these groups or individuals sees the offshore petroleum potential from his own perspective and collects the information he feels he needs for his own decision-making purposes. This is normal. Unfortunately, the totality of this information – that is, all the information which the actors possess collectively at this time – does not comprise a “Technology Assessment” as we have defined it. Some of the reasons are given in Chapter III, in the section “Information for Decision Making”.

In particular, the information base lacked a longer term perspective, an appreciation of the pervasiveness of consequences of offshore developments, and an appreciation of the consequences of offshore developments on other sectors such as fishing and agriculture which could be adversely affected. In fact, in order to have a *true* technology assessment it is essential that those groups which *should be* involved, but which for some reason, varying from lack of awareness to lack of effective organization, are not, become part of the technology assessment system.

To recapitulate then, the number of groups, or actors, in the technology assessment system has grown from a few, two really, in the early 1960s to a much larger number in the early 1970s. The principal reason for the involvement of these larger numbers appears to be related to the increased levels of exploration activity throughout the decade. The expenditures by the petroleum companies not only increase their visibility with respect to other actors, but also cause these other actors to consider the possible consequences for them of exploration activity. At the same time, it cannot be denied that the evolution of the technology assessment system has a certain air of randomness about it. It is largely because this apparently unco-ordinated behaviour of the actors within the technology assessment system seems to lead, very often, to adverse social effects, that there is a growing public demand for a more complete analysis of the consequences of the development of a technological capability *and* its more effective integration in the decision-making process.

The above situation shows that there is a need to improve the ongoing technology assessment activity. Given that we live in a democratic system built on compromise and consensus, where a plethora of viewpoints have to be taken into account, this is no mean task! (See Chapter IV, the section "Comparison of Decision-Making Models".) However, there exist at present certain mechanisms which can be used to improve the quality of the information on a given subject and in turn, hopefully, decision making in the Technology Assessment System.

As suggested in Chapter IV, it may be possible to introduce into the Technology Assessment System a new element, a Technology Assessment Commission or Task Force, whose main function would be to raise the level of awareness both within the Technology Assessment System and the public at large while preparing a "Technology Assessment" study on the subject; that is, a much needed overview for the political executive. With the help of a Technology Assessment Analyst (see Chapter IV, the section "Overview and Consensus") this could lead to improved decision making not only by the political executive, but also by all other actors within the Technology Assessment System.

To obtain true anticipatory assessments rather than reactive stop-gap exercises, there is a need to identify as early as possible particular technologies which, if applied, could have some significant consequences for Canada. While advice on the potential consequences of a technology can come from a variety of sources within our society, the Science Council seems to us to be the most appropriate body in existence at the present time to institutionalize this function (see Chapter IV, the section "A Role for the Science Council"). This implies that the Science Council should become more steeped in the area of "futures research" than it has to date. (See Chapter I.)

The suggestions we make for improving the present technology assessment activity are few and build, for the most part, on existing mechanisms. Given the nature of our socio-political system, which, as we have tried to show, may be understood using the notion of "mixed-scanning", we feel that if the Science Council were to couple its "scanning" role with an ability to get Technology Assessment Commissions or Task Forces estab-



lished, then it would be contributing greatly toward a better understanding of the physical, social, economic and political processes at work in the society in which a technology is to be embedded. In turn, this would contribute to the improvement of the quality of decision making within the Technology Assessment System.

“In the last century we have increased our speeds of communication by a factor of  $10^7$ ; our speeds of travel by  $10^2$ ; our speeds of data handling by  $10^6$ ; our energy resources by  $10^3$ ; our power of weapons by  $10^6$ ; our ability to control diseases by something like  $10^2$ ; and our rate of population growth to  $10^3$  times what it was a few thousand years ago.”<sup>1</sup>

## Introduction

This quotation offers a rough quantification of technological change. But, whereas only a few decades ago such statistics could be interpreted as indices of Man's power in pursuit of progress, such enthusiasm for technological development has now diminished somewhat. The products of technological activity – the computer, automation, television, oral contraception, etc. – are now perceived to be accompanied by a deteriorating social situation – environmental pollution, urban crises and the threat of nuclear annihilation. Of course, it is arguable that men did not, consciously, intend to create such problems, that the social order is the result of a large number of apparently unco-ordinated decisions by individuals, each of whom was pursuing a course of enlightened self interest. Whether or not one chooses to explain current social problems in terms of the indiscriminate technological expansion that is a consequence of excessive individualism, the fact remains that there is an enhanced awareness in the body social that every technological option need not be exploited and, moreover, that some of the options, if embarked upon, could alter life styles significantly and not always to the good.

The upshot of this would appear to be that societies will have to be more circumspect in their choice and control of technological development. The precondition of circumspection rests on an adequate knowledge of the consequences of the application of technology and this, in our view, is both the kernel and the objective of technology assessment. Governments, particularly, in trying to respond to increased public pressure for more adequate control of technology, are looking for new concepts, methodologies and approaches which will help them to assuage this demand. Although there is a general consensus that if unwanted side effects of a new technology are to be avoided, or at least minimized, governments will have to look beyond the primary benefits and costs of the application of technology to its wider social and political consequences, there is less agreement on the best way to go about determining the side effects. To suggest some ways in which an evaluation of the physical, economic, political and social consequences of technological development might become a more important part of the political process in Canada is one of the principal aims of the chapters to follow.

# I. A Framework for the Study of Technology Assessment

At first glance, technology assessment might seem to be a straightforward concept. After all, everyone possesses at least common sense notions about both technology and assessment so that their conjunction should present no major barrier to understanding what is meant. Unfortunately, this is not the case. Throughout the latter part of the 1960s there has been much discussion of the meaning of the concept and its implications for action. Broadly speaking, there are those, mostly Americans, who believe that technology assessment represents a new methodological stance supported by new techniques, while on the other hand, there are others, mostly Europeans, who assert that technology assessment is, at present, being carried on in various institutions although it may be described by a different name.<sup>1</sup>

While the major part of this chapter will be concerned with clarifying the meaning of the concept of technology assessment with a view to describing its scope and purpose for this study, it will be useful beforehand to discuss some of the terms which will be needed in this clarification. Firstly, "technology" will be used in the fuller sense of *technological capability* and includes the complex of organizational and individual skills which operate on hardware to produce a capability. Secondly, the notion of *impact* is inseparable from that of technology assessment. In fact, it conveys an inaccurate image because the effects that technology assessment seeks to articulate are precisely those which appear only when a technology has become embedded in the social, physical, economic and political matrices of society. As a result, we have chosen to refer to the *consequences*, for physical, social, economic and political processes and trends, of the application and absorption of a technological capability. Thirdly, assessment is taken to mean the evaluation of these consequences: some of these may be good, others bad. It is virtually certain that none will be neutral and so, in the end, judgements must be made. These judgements (or lack of them) will, in turn, reflect and be reflected in the kind of society we want and have.

With these few preliminary clarifications in hand, we will be able, in the following paragraphs, to explicate more fully the notion of technology assessment, its historical origins, its relationship to other forms of systematic analysis and to decision-making processes and, finally, to set out the further notion of the technology assessment system; a notion which plays a central role in the analysis of the case study – the process of technology assessment with respect to the petroleum potential off Canada's east coast.

## **The Development of the Notion of Technology Assessment**

Historically, the notion of technology assessment is linked to political and social development that occurred in the United States during the middle and late 1960s. It was during this period that the cumulative effects of technological developments set in train many years previously emerged into social consciousness. While it is no part of this study to describe these events, it still remains a fact that, from the early 1960s onward, Americans became collectively more conscious of the decay of their cities, the pollution of their environment and the incipient violence of the ghettos. In short,

they became conscious of certain deterioration in their “quality of life”. Rightly or wrongly, the cause of much of their blight was placed on the doorsteps of the large public and private institutions whose technologies, it was claimed, were being implemented without due consideration of possible adverse effects which might occur in the future.

### **Technology Assessment in the U.S. Congress**

From the early 1960s onwards there appeared also a growing concern about the increasingly technological content of the legislation and documentation being presented to Congress. A recent Senate report, for example, has noted that as much as 40–60 per cent of all legislation considered by Congress contains technological components which are often the primary feature of the legislation.<sup>2</sup> Hence, in 1970, Congressman Emilio Q. Daddario introduced a Bill to Congress “to establish an Office of Technology Assessment for the Congress as an aid in the identification of existing and possible impacts of technological application”.<sup>3</sup> The original draft of the Bill went on to point out that “emergent national problems, physical, biological and social, are of such nature and are developing at such an unprecedented rate as to constitute a major threat to the security and general welfare of the United States”.

This Bill, after much debate, became law in October 1972 under the title “The Technology Assessment Act of 1972”. Its purposes are clearly and expressly stated in Section 2 of the Act:

“The Congress hereby finds and declares that:

- a) As technology continues to change and expand rapidly, its applications are –
  - (1) large and growing in scale, and
  - (2) increasingly extensive and pervasive, and critical in their impact, beneficial and adverse on the natural and social environment.
- b) Therefore, it is essential that, to the fullest extent possible, the consequences of technological applications be anticipated, understood and considered in determination of public policy on existing and emerging national problems.
- c) The Congress further finds that:
  - 1) the Federal agencies presently responsible directly to the Congress are not designed to provide the legislative branch with adequate and timely information, independently developed, relating to the potential impact of technological application, and
  - 2) the present mechanisms of Congress do not and are not designed to provide the legislative branch with such information.
- d) Accordingly, it is necessary for the Congress to:
  - (1) equip itself with new and effective means for securing competent, unbiased information concerning the physical, biological, economic, social and political effects of such applications, and
  - (2) utilize this information, whenever appropriate as one factor in the legislative assessment of matters pending before the Congress, particularly in those instances where the Federal Government may be called upon to consider support for, or management or regulation of, technological applications.”<sup>4</sup>

From the point of view of Congress, then, the change in the *scale* and the increasing *pervasiveness* of technological applications, combined with a certain distrust of those organizationally committed to certain technological programs necessitated an independent source of information for the legislative processes of Congress. This information forms the basis of the technology assessment. At this juncture, it is necessary to introduce a definition of technology assessment which has some currency in the U.S.A.: *"Technology assessment is the process of taking a purposeful look at the consequences of technological change. It includes the primary cost/benefit balance of short term, localized, market place economics, but particularly goes beyond these to identify affected parties and unanticipated impacts in as broad and long range fashion as possible. It is neutral and objective, seeking to enrich the information of management decisions. Both good and bad effects are investigated since a missed opportunity for benefit may be just as detrimental to society as an unexpected hazard"*.<sup>5</sup>

This definition comprises the activity of technology assessment as viewed by the Congress. It sees technology assessment essentially as another information input to the legislative process and emphasizes objectivity and comprehensiveness in data collection.

### **Technology Assessment in the Executive Branch**

A slightly different view of technology assessment, but one which in the last analysis may be more relevant to the Canadian context can be gleaned by examining the views of those concerned with establishing the activity of technology assessment in the executive branch of the United States government. The American political system, it should be remembered, is composed of three branches: the legislative branch (Congress), the executive branch (containing the Office of the President) and the judicial branch (containing the Supreme Court). For the purpose of this discussion one needs to keep in mind that all programs involving the expenditure of public funds (and these, of course, include some with a large technological component) are presented by the executive branch to Congress which acts as the final arbiter on whether resources will be voted to them. It can happen, as in the case of the supersonic transport program, that expenditures requested by the President are subsequently thrown out by the Congress.

In the Canadian context, decisions concerning expenditures on large technological projects are taken by Ministers at both the federal and provincial levels (usually with the advice of top civil servants) in Cabinet and *not* in Parliament. Because of this, it is perhaps more germane to ask about the effectiveness of the Executive in assessing technology before one concedes the necessity of legislation to create a separate body like the Office of Technology Assessment parallel to, or at least, independent of the Executive. The views discussed in the following few paragraphs, then, tend to be based on the premise that technology assessment is an adequate description of much that is already going on within the departments and agencies of the executive branch and like many of the European institutions mentioned earlier, the emphasis is more directed toward improving existing procedures than to creating new structures.

An important and fundamental notion of this aspect of the discussion concerns the nature of governmental decision making. From the point of view of the executive branch a technology assessment system should provide the administrative and procedural framework for *continuing* assessment within the everyday process of program formulation, review, decision, and implementation. The policy-making process, it is contended, involves a continuous interaction of each of these activities and could not function as efficiently if an outside, or parallel, body or agency attempted to evaluate the program. The argument is based upon the premise that no outside group or agency would have the resources to assess the magnitude and complexity of the information with which the executive branch is organized to deal. Any such external agency would be required to make a technology assessment on only partial information and would inevitably introduce unnecessary delays in the due execution of government policy.

None the less, it is freely admitted that the executive branch suffers from serious drawbacks in its attempt to perform, adequately, the tasks of technology assessment.<sup>6</sup> Firstly, most assessments of the consequences of introducing a technology are incomplete if not superficial. Commonly, they include few external consequences (those lying outside an agency's program interests or statutory responsibility) and only technical and economic analysis of internal consequences (those lying within those interests and responsibilities). Good assessments should consider the interactions of population, environment, technology, society, and the economy. Secondly, the resultant information is not consistently used in relevant federal program and policy decisions because technology assessment is not recognised as a continuing responsibility of most agencies. Thirdly, prevailing assessments are often inadequate because they are conducted by agencies committed to a particular technology or industry: they are vehicles of advocacy rather than impartial analyses. Negative or undesirable effects tend to be discounted, overlooked, or dismissed without the same intense examination devoted to favoured courses of action. Fourthly, because no agency has any responsibility, nor is appropriated any money, to deal with problems outside its legislative charter, "full impact" assessments of the broadest public interest and importance are neglected. The range of consequences is not significantly broadened by the establishment of interdepartmental or interagency committees. These committees only seem able to press for a review of a department's technical and economic analysis rather than insist that that analysis be extended to a wider range of considerations.

In the light of these remarks, we can now put forward a second definition of technology assessment. Technology assessment describes "*the activity or the means by which information now available can be used, within a given decision-making structure, to increase the perception and wisdom of decision makers with respect to the consequences of technology.*"<sup>7</sup>

With these two definitions in mind, we shall now attempt to round out our discussion of technology assessment by making more explicit certain other aspects of that activity. Firstly, technology assessment is concerned with information about the internal and external consequences of a technological application. Throughout this study, internal consequences

will be used to describe those effects which a technological application might have within the area or sector where an assessment is carried out. External consequences will refer to those effects which a technological application might have outside this sector or area. For example, a technology assessment of a supersonic transport program carried out under the Department of Industry, Trade and Commerce (IT&C) might be expected to explore not only the economic costs and benefits of government investment in Canadian industry, but also the effects of such investments on the current organization of that sector of industry as well as the imperative for special training programs. Logically, these consequences should be explored by IT&C and are described as internal. On the other hand, the consequences which such an investment might have on the subsequent investment pattern in Canadian industry, the flow of manpower from other parts of industry, and in the longer term, the consequences of increased noise levels on the populations of Canadian cities and on the migration patterns of wildlife, all illustrate the pervasive nature of external consequences. Secondly, there are the individuals, groups and organizations with an interest in some aspect of a technological application. Thus, it should be part of the function of technology assessment to bring together as many constituencies as possible with an interest to be represented and ensure that their viewpoints are incorporated as part of the assessment's information base. There are some who feel that the pluralistic nature of modern democracies allow those who are in favour of a technological application to so organize themselves that all the reasons for going ahead with the program are not only brought to light but even over-exposed. The same cannot be said, often, about the reasons for *not* going ahead. Consequently, it has been argued that a principal function of technology assessment should be that of an adversary – of putting forth all the reasons why a certain program should be stopped.<sup>8</sup> In this way, technology assessment could become a kind of countervailing force against indiscriminate technological expansion. This is not the place to enter into the pros and cons of such a proposition except to point out that it has been this sort of stance that has given to the activity of technology assessment a certain anti-technology connotation. The final point to be made about technology assessment has already been discussed to some extent and concerns the contribution of technology assessment to decision making. This aspect has been stressed in both of the definitions given above. The question is, "How does one structure an assessment so that it is possible for decision makers, many of whom will be nonspecialists, to make the optimum use of its findings?" This is as much a problem of language as of the mode of presentation and its importance cannot be over-estimated. We will return to discuss this question in Chapter IV.

On the basis of this preliminary exposition we now set out the definition of technology assessment which will be used in this study. *Technology assessment is defined as an activity to provide information about, and systematic analyses of, the internal and external consequences (short, medium and long term) for a society of the application and diffusion of a technological capability into its physical, social, economic, and political systems. This information and systematic analysis is to be so structured and*



*presented as to aid the decision makers charged with the responsibility of operating those systems.*

This definition encompasses two distinct processes: the collection and analysis of information and the improvement of decision making with respect to technological programs. It is important to note that the former is a necessary but not sufficient condition for the latter. To make the content of these two activities more explicit, we will attempt to relate the information and analysis aspects to other forms of systematic analysis and the decision-making aspects to some current ideas about the decision-making process.

## **Relationship to Other Forms of Systematic Analysis**

In certain descriptions of technology assessment – though not the one adopted in this study – the impression is given that one has at one's disposal a novel procedure for assessing the consequences of a technological application. It therefore seems useful to describe some of the main types of systematic analysis that have become part and parcel of the evaluation, if not the assessment, of technological projects. We shall restrict our review to the period since the end of World War II and discuss briefly cost-benefit analysis, systems analysis, operations research, and futures studies. The objective of this brief descriptive exercise is to highlight the differences between that which goes on within the execution of a technology assessment and that which goes on in the execution of these other forms of systematic analysis. A useful outline of these differences has been presented by Coates in his study of technology and public policy and our discussion is derived, in part, from it.<sup>9</sup>

As in technology assessment, each of the activities implied in cost-benefit analysis, systems analysis, operations research and futures studies, is intended to aid the decision maker in his evaluation of a given technological project. We cannot, here, discuss the mechanisms by which this information is rendered useful for decision makers, but we can describe what types of information each activity *ideally* intends to provide.

The traditional tool for the evaluation of any major program, technological or otherwise, has been cost-benefit analysis. Historically, it is true to say that economic considerations have formed the basis of much executive decision making in both the public and private sectors and it is with such "profit and loss" type reasoning that the methodology of cost-benefit analysis has been most developed. Unfortunately, the range of possible consequences, say of a given technological application, which can be quantified in economic terms is restricted; so cost-benefit analysis may be considered a useful but limited tool in the performance of a technology assessment. Attempts are being made under the rubric of *risk/benefit analysis* to include estimates of the probability and weight of other potential consequences of proposed technological programs. However, according to a recent survey of U.S. government departments, "the emphasis is still on the significance and probability of tangible advantages and disadvantages.... That is an attempt is made to assign a monetary value to intangible secondary social benefits.... However decisions are

likely to be based firmly on the primary benefits (performance criteria) and direct costs”.<sup>10</sup>

Both systems analysis and operations research were developed during World War II, the former in engineering and the latter in the planning of military operations. Systems analysis is a technique for analysing the performance and effectiveness of a system (originally hardware) in terms of a pre-set system goal. The accent in the analysis is on quantification and effectiveness is measured in terms of the relationship between performance, cost, efficiency, maintenance, reliability, and compatibility with the external environment. Since the early days of systems analysis the concept of effectiveness, or sometimes efficiency, has been gradually broadened to include social, economic and political factors as well as technological ones. Consequently systems analysis is now described in much more generalized language as:

“a systematic approach to helping a decision maker choose a course of action by investigating his full problem, searching out objectives and alternatives, and comparing them in the light of their consequences, using an appropriate framework.... Three sorts of enquiry are required .... first of all ... a systematic investigation of the decisionmaker’s objectives and of the relevant criteria for deciding among the alternatives that promise to achieve these objectives. Next, the alternatives need to be identified, examined for feasibility, and then compared in terms of their effectiveness and cost, taking time and risk into account. Finally, an attempt must be made to design better alternatives and select other goals if those previously examined are found wanting.”<sup>11</sup>

Such a rational approach can be useful where one or a few agreed upon economic or technological goals are to be achieved (i.e., landing a man on the moon) but found wanting when the complexity of social systems has to be introduced (i.e., reducing unemployment). Systems analysis is very much concerned with the allocation of resources. Technology assessment, on the other hand, must deal with the regulatory as well as the allocative side of decisions relating to technological developments.

Operations research, like systems analysis, is used in governments and industrial organizations to analyse the potential effectiveness of proposed policies and programs. It relies, more than systems analysis, on the development of predictive mathematical models and highly quantified measuring techniques and is defined “as an experimental and applied science devoted to observing, understanding and predicting the behaviour of purposeful man-machine systems”.<sup>12</sup>

Despite the general language in which the activities of systems analysis and operations research are described, both focus on the performance characteristics of a system in terms of its *intended or planned* effects. By contrast, technology assessment is an attempt to evaluate *all* potential impacts or effects, particularly those consequences which are unplanned by-products of the primary intent of a technological innovation, application, or intrusion into society. Also, while technology assessment is not methodologically opposed to the drive for numerical measures that

characterizes the activities of systems analysis and operations research, it nonetheless recognizes that many kinds of social change can be evaluated only qualitatively and comparatively because either the requisite social indicators have not yet been developed or they are inherently unquantifiable.

“Futures studies” go further in their attempts to outline the full panoply of consequences of technological applications than either systems analysis or operations research, and so may be expected to be more closely related to technology assessment. Futures research includes such diverse activities as socio-economic forecasting, economic projections, market analysis, corporate planning, and technological forecasting. Futures research is generally taken to include “the projection of present trends into the future, prediction of future events or of the state of society at some future date, and long range planning for organizations, institutions or societies”.<sup>13</sup> The most widely used technique for accomplishing this task is that of scenario-writing. Scenario-writing refers to a description of a possible state of future events; the description may or may not be developed historically. Coates gives a survey of the wide range of techniques currently being employed in futures research:

Scenario building	Objectives trees
Delphi technique	Operations research
Simulation/gaming	Survey research
Trend extrapolation	Causal models
Dynamic modelling	Decision matrices
Cross-impact analysis	Growth curves
Correlation plotting	Interviewing
Expert position papers	Operational gaming
Relevance trees	PERT adaptation
Analogy	Role play gaming
Economic projection	Speculation (disciplined)
Morphological approach	Values analysis

Of these, we select two for somewhat closer examination: the Delphi technique and its use in cross-impact analysis. The latter technique has recently become directly linked with the activity of technology assessment.<sup>14</sup> The Delphi technique attempts to predict or indicate future events by drawing on the informed opinion of experts. Empirically, it seems that after one or two iterations of the problem the experts are able to reach a consensus about the probable outcomes of the interaction of events which they have been given. Hence, the Delphi technique is described as a form of consensual forecasting.

Cross-impact matrix analysis is a derivative form of consensual forecasting in the sense that decisions about the outcomes of a complex of events are based on the judgments of experts. Explicitly, cross-impact methods “furnish a means of exploring the effects of interactions between different kinds of potential events associated with technology assessment . . . The aim of the cross-impact approach in technology assessment is to form a wholly explicit model which is useful in testing policies designed to diminish or improve the probability of occurrence of events associated with the technology being considered. Cross-impact analysis is based on the concept that the occurrence or non-occurrence of a possible event or the

enactment of a particular policy may affect the probability of a host of other events and policies. The method requires that such interactions be defined and their strength estimated. In the absence of hard data about these future interactions, opinion and judgment are used. With these judgments about interactions in hand, a large number of scenarios can be analyzed (again usually by computer) to identify pivotal events and policy consequences.”<sup>15</sup>

Unlike the Delphi technique, the cross-impact matrix method is still in a relatively undeveloped state. At the same time, it is not clear just how much improvement, in terms of methodological rigour, may be expected from a technique which, at its root, depends on individual judgments about changing probabilities of interrelated, future events. On the other hand, the cross-impact method does possess some novel aspects, particularly with respect to the multidisciplinary mix involved and the range of consequences considered. The multidisciplinary aspect is a common ingredient in most forms of systematic analysis, but the cross-impact approach when used in technology assessment acquires a different mix of disciplines – one oriented more in the direction of social than technical or economic consequences. As a corollary, technology assessment must concern itself with a broader range of issues and cross-impact analysis provides a framework, albeit a rudimentary one, in which the inquiry may be organized.

One of the biggest advantages of such techniques is that it makes experts aware of larger contexts and makes them appreciate the difficulty of prediction. All the approaches described here can be used in various facets of a technology assessment to assemble as much information as possible in a coherent fashion.

## **Technology Assessment and its Relationship to Decision Making**

Having described some of the ways in which the information aspect of technology assessment differs from other forms of analysis, we turn now to a brief discussion of the ways in which such information might be used to influence or even enhance the decision-making process. It must be admitted that the simple availability of information of whatever kind is no guarantee that it will be used, or that it will be used in the way the analyst intended, when a group of decision makers is engaged in the complex process of choice. Nonetheless, there is an overriding belief that the more complete the information about a given prospect the better will be any decision about it. This belief in its most articulate form gives rise to what is sometimes called the *rational* approach to decision making, the main elements of which exhort the decision maker to:

- 1) identify, scrutinize and put into consistent order those objectives and other values which he believes should govern the choice of a solution to the problem;
- 2) comprehensively survey all possible means of achieving those values;
- 3) exhaustively examine the probable consequences of employing each of the possible means;
- 4) choose a means – that is a particular policy or combination of policies –

that will probably achieve a maximum of the values or reach some acceptable level of achievement.

This normative description usually presumes that it is desirable to gather as much information as possible that might be relevant to a given decision but also assumes that the decision makers possess both the intellectual capacity and the time to process it in some meaningful way. Further, it overlooks the fact that information about consequences is, at best, partial. Finally, rather than helping the decision maker to limit the universe of relevant consequences, it forces him to face an open system of variables, a world in which all consequences should, but cannot, be surveyed. A decision maker, attempting to adhere to the tenets of a rationalistic model, is likely to become frustrated and exhaust his resources without coming to a decision when without an effective decision-making model to guide him. The inherent limitations of the rational model prompts one to review critically any activity such as technology assessment which stresses the need to investigate *all* the consequences of a given technological application.

A less demanding and, from the decision maker's viewpoint, more realistic description of decision making has been outlined in the strategy of 'disjointed incrementalism' advanced by C.E. Lindblom. Disjointed incrementalism seeks to adapt decision-making strategies to the limited cognitive capacities of decision makers and to reduce the scope and cost of information collection and computation.

Lindblom has summarized six primary requirements of the model in this way:

- 1) Rather than attempting a comprehensive survey and evaluation of all alternatives, the decision maker focuses only on those policies which differ incrementally from existing policies.
- 2) Only a small number of policy alternatives are considered.
- 3) For each policy alternative, only a restricted number of "important" consequences are evaluated.
- 4) The problem confronting the decision maker is continually re-defined. Incrementalism allows for countless ends-means and means-ends adjustments which, in effect, make the problem more manageable.
- 5) Thus, there is no one decision or "right" solution but a "never ending series of attacks" on the issues at hand through serial analysis and evaluation.
- 6) As such, incremental decision making is described as remedially geared, as it is more to the alleviation of present concrete social imperfections than to the promotion of future goals.<sup>16</sup>

This model is believed by Lindblom and others, to be a more realistic description of what actually goes on when a decision maker is faced with a problem which he must solve more or less quickly; he moves incrementally making adjustments to existing policies at the margin. According to Lindblom a measure of co-ordination among a multiplicity of decision makers is accomplished through the mechanism of "partisan mutual adjustment".<sup>17</sup> This mechanism, in effect, compensates on the societal level for the limited capacities of the individual incremental decision maker *and* for the society's inability to make decisions effectively from the centre. In summary, Lindblom, among others, believes both that incremental decision

making is a realistic account of how most pluralistic societies decide policy issues and that it represents the most effective approach to social decision making.

Needless to say, any model such as Lindblom's which appears to justify the inherent conservatism of the democratic ideology may expect sharp criticism; Lindblom and his circle have not been disappointed. This is not the place to review the debate which has gone on between the pro-inertia, anti-innovation forces which have gathered around Lindblom and the dynamic, progressive planners who support the rational model. Suffice it to say that, if the rationalist and incremental models represent two ends of a spectrum, the discussion is now being carried on over the contours of the middle ground by policy analysts such as Y. Dror and A. Etzioni among others.<sup>18</sup> Perhaps the most succinct expression of a viewpoint which tries to weave what seems both credible and possible in the extreme positions into a coherent model of the policy-making process belongs to Etzioni who has developed the notion of mixed scanning. It is necessary for us, at this point, to introduce this notion because it will form an integral part of our model of the technology assessment system which will be introduced in the next section.

Basically, the notion of mixed-scanning is derived from the empirical observations that societies, represented in the policy-making process by governments, do from time to time initiate major changes. While it would be true to argue that these initiatives do not derive from the sort of comprehensive analysis suggested by the rationalist model, neither are they derived simply from the incremental process of give and take which Lindblom describes as partisan mutual adjustment. According to Etzioni, it is necessary to distinguish fundamental decisions from incremental ones:

"Thus while actors make both kinds of decisions, the number and role of fundamental decisions are significantly greater than incrementalists state, and when the fundamental ones are missing, incremental decision making amounts to drifting – action without direction. A more active approach to societal decision making requires two sets of mechanisms: (a) higher order, fundamental policy-making processes which set basic directions and (b) incremental processes which prepare for fundamental decisions and work them out after they have been reached".<sup>19</sup>

The process whereby this is accomplished is described by Etzioni as mixed scanning. As a strategy for decision making, it involves two distinct but related activities. Firstly, fundamental decisions are made by "exploring the main alternatives the actor sees in view of his conception of goals but . . . details and specifications are omitted so that an overview is feasible." Secondly, "incremental decisions are made but within the contexts set by fundamental decisions (and fundamental reviews)."<sup>20</sup>

When we come, in Chapter III, to analyse the ways in which the technology assessment system has performed its function with respect to internal and external consequences for the Atlantic Provinces in particular and Canada in general, of the development of a technological capability in the exploration, exploitation and production of the oil potential off

Canada's east coast, we shall revert to the mixed-scanning model of decision making to describe the situation. There is some evidence for assuming that the mixed-scanning model is an appropriate one. In his review of recent changes in the philosophy of policy making in Canada, G. B. Doern has shown how, under the Trudeau administration, policy making has taken another step in the direction of the rational model of decision making. Discussing the various policy reviews which Trudeau has initiated, Doern notes that:

"In other areas such as welfare, housing, Indian policy, and foreign ownership of Canadian industry, studies and task forces were launched to gather basic data and to conduct thorough reviews of past programmes, present and future goals . . . . The above approach stands in relative contrast to the early years of the Diefenbaker and Pearson régimes, the latter launching an implusive "sixty days of decision" approach and the former developing its early policies as a direct response to the grievances of particular groups and regions which had helped to put it in power. While it is inaccurate to *absolutely* pigeon-hole the Diefenbaker and Pearson régimes as non-rationalists or incrementalists, and to label that of Trudeau as rationalist, the relative difference does seem to be an accurate statement about their respective *philosophies* and models of policy making".<sup>21</sup>

As evidence to document this relative move toward a rational policy-making philosophy, Doern discusses the introduction of Planning, Programming and Budgeting (PPB) systems to the operations of the Treasury Board; the creation of the Prime Minister's Office and the setting up of the Science Council of Canada. The inadequacies of an overly rationalist orientation are revealed in a further study of the impact of PPB system. Doern concludes that:

"In their (i.e., the federal government's) eagerness to avoid the incrementalist trap inherent in the classical approach [to the budgetary process], there was a lack of rationality about how the PPB system would relate to these realities. More recently, however, these problems have been openly acknowledged. Incrementalism has come to be characterized less as an unfortunate aberration from PPB principles and more as an inevitable and even necessary element of a policy and budgeting philosophy".<sup>22</sup>

To justify our choice of the mixed-scanning model of decision making, one would hardly do better than to record the reflections of the Secretary of the Treasury Board, A. W. Johnson, on the relationship between the rational and incremental models in decision making.

". . . it must be recognized that incrementalism remains a central element in the decision-making process. This is how a large proportion of public policy decisions are made and must be made, given the scale of government and given the very nature of social change. It is a matter of integrating and harmonizing the PPB (i.e., the rational) approach with this more traditional approach to decision making".<sup>23</sup>

## The Notion of the Technology Assessment System

At various places in this discussion, we have used the phrase technology assessment system. The time is now ripe to clarify this notion and distinguish our usage from that adopted in the report of the National Academy of Public Administration, *A Technology Assessment System for the Executive Branch*. In our usage of technology assessment system, a specific technological capability stands at the centre as a focus for a number of groups more or less loosely coupled. Thus, *a technology assessment system comprises those social groups which are (or should be) concerned with developing a given technological program. The elements which make up this system may, or may not, be bound together by any formal arrangements: coupling is effected by their mutual interest in the development and diffusion of a given technological capability. In addition, and logically, the composition of the technology assessment system varies with the technology under consideration.* Since a technology assessment system forms part of the broader political system, one of the principal objectives of this study has been to attempt to circumscribe the boundaries of the system and to delineate the perception of the individuals and groups comprising it: the criterion of selection being that these individuals and groups are (or should be) concerned and involved with the development of a technological capability in petroleum exploration and exploitation off the coastline of the Atlantic Provinces. This system is described in detail in Chapter III.

By contrast, the technology assessment system implied in the report of the U.S. National Academy of Public Administration refers firstly to the extension of a technology assessment function to all levels of the executive branch, the working level, the Bureau level and the Departmental or Agency level. This extension is intended to go part way, at least, toward meeting the requirement set down by law and incorporated in the Environmental Protection Act, that requests for support for resources for all new federal programs be accompanied by an estimate of the likely environmental impact of the proposed program. Thus, what is implied here by technology assessment is an extension of the normal evaluative procedures of the executive branch to include a wider range – mostly environmental – of consequences. The report refers also to the extension of the Planning-Programming and Budgeting System (PPBS) to include, formally, technology assessments thus transforming it into a Planning-Programming-Assessment-Budgeting System (PPABS). In so far as PPBS itself has not been very successful, partly because of its technical inability to handle problems of wide scope and partly because it ignores the political reality and response of institutions to the planning process, it seems doubtful whether the system as it currently operates could be extended to cover the objectives of technology assessment.<sup>24</sup>

While we will attempt to identify and describe the operation of the technology assessment system in practice, we are supposing an ideal system as well – one that performs its function of adequately controlling the embedding of some technological capability in the Canadian social, economic and political matrix. It is part of the task of Chapters III and IV to highlight any discrepancies which may obtain between the ideal and its practical realiza-



tion and to suggest ways in which this gap may be closed.

In the light of these remarks, it should be clear that we are not attempting a substantive assessment of the physical, social, economic, and political consequences for Canada of the full embodiment of the technological capability of petroleum exploration and exploitation. Indeed, this would draw us more closely into the technology assessment system than we would want. Essentially, what we are attempting is an *assessment of assessment* and a grasp of this focus is necessary for the clearest understanding of the remainder of the study.

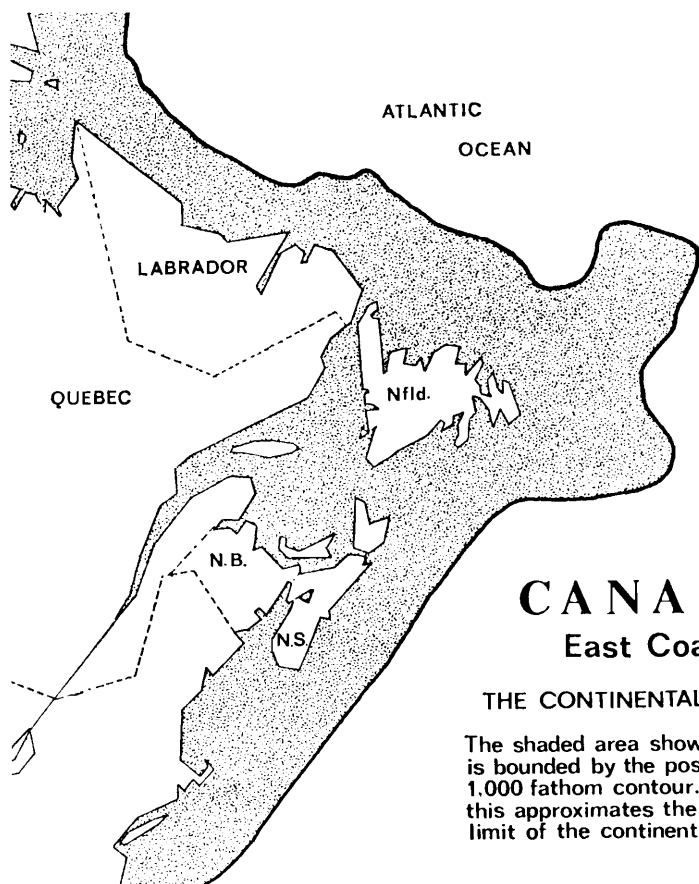
Therefore, it seems appropriate to end this Chapter with a description of the *aims* of the study. They are three-fold:

- 1) to demonstrate, through a case study of the application of a technological capability for the exploration and possible future exploitation of petroleum on the continental shelf off the Atlantic provinces, the existence of a technology assessment system and how it functions;

- 2) to discuss the potential consequences of the application of this capability – as perceived by the participants in the technology assessment system – on the Atlantic provinces in particular and Canada in general;

- 3) to delineate those areas in which the technology assessment system appears to be functioning inadequately and to suggest means by which its operation might be improved. In other words, to suggest some ways in which an evaluation of the physical, economic, political and social consequences of technological development might become a part of the wider political process in Canada.

## II. The Case Study – A Description



## CANADA East Coast

### THE CONTINENTAL MARGINS

The shaded area shown on the map is bounded by the position of the 1,000 fathom contour. In most areas this approximates the geophysical limit of the continental mass.

## **Criteria for Selection of a Case Study**

To illustrate the operation of the Technology Assessment System described in Chapter I, a case study approach was chosen. At a time when the concept of technology assessment itself is in a state of flux and empirical evidence is badly needed, it was felt that this approach would be more fruitful as a first step than a full analysis of decision-making processes.

The criteria for selecting the case study included the following:

- 1) The study should deal with the application of a technological capability, the potential physical, economic and social effects of which could have *major* consequences for Canada as a whole or for some region of the country.
- 2) The study should be timely. Although it should have some historical perspective it should focus on contemporary issues.
- 3) An information base should be readily available. It appeared advantageous to try to build upon some previous work carried out by the Science Council of Canada.
- 4) The study should lead to the elucidation of some aspects of decision-making processes at various levels of government (federal and provincial) as well as in industry, concerning the application of a technological capability.

With these criteria in mind we chose a study of the potential consequences of petroleum exploitation on the Continental Shelf off Canada's east coast.

## **The Potential Consequences of Petroleum Exploitation on the Continental Shelf off Canada's East Coast**

### **Introduction**

The East Coast offshore is regarded as "one of the most geologically promising petroleum prospects in the world".<sup>1</sup> Recent finds in the area are creating great excitement and the "tempo of exploration will reach a new high this fall [1972] in an area close to the largest and most starved oil and gas market in the world".<sup>2</sup>

As presaged by the Science Council<sup>3</sup> and by Stewart and Dickie,<sup>4</sup> offshore exploration is gaining momentum and, if exploitation follows, it will surely have some profound effects on Canada in general and the Atlantic provinces in particular. The potential effects are heightened by the hostility of the offshore environment which will perforce require the development of new types of technology to cope with problems associated with cold sea-water and ice.

Technological effects are already being felt; semi-submersible exploration rigs are being built in the Halifax area. In the future, the demographic shifts and work reorientation which might come about would certainly affect the cultural as well as the economic life of the Atlantic provinces.

Because of the potential magnitude of the consequences of petroleum exploration and exploitation off the east coast of Canada on the social fabric of an established maritime culture as well as on the industrial

economic life, this development is ideally suited for our purposes. The reader will find that much attention is devoted to illustrating the social, political and economic contexts of the Atlantic provinces. Knowledge of these contexts is essential for the evaluation of the consequences of the application of this particular technological capability.

### **Historical Development**

Geological surveys of the Atlantic Continental Shelf appeared in the open literature in the mid 1950s. In 1959, the petroleum industry began to show interest. Mobil Oil undertook an air magnetic survey of the Sable Island area and in 1960 took up federal and provincial permits\* on 1.1 million acres.

The founding of the Bedford Institute of Oceanography in 1962 heralded a new era of government involvement in scientific surveys off Canada's east coast.

In 1963, Shell Canada took up 20 million acres covering a large part of the Scotian Shelf. By the late 1960s, most of the Scotian Shelf, the Grand Banks and Georges Bank were under permit to a handful of concerns, largely major multinational oil companies. So far, there are more than 4 000 permits currently outstanding for more than 300 million acres of land which go as far out as 425 miles on the Flemish Cap area and as deep as 4 000 metres – depths much beyond present day exploitation capability.

Following initial reconnaissance geological surveys (e.g., seismic), exploratory drilling began in 1965 and has been escalating ever since. One good indicator of the present interest in the area is the level of expenditures on exploration. When exploration permits are taken out, the companies are required to perform a certain minimum amount of exploration work each year. These obligations increase from year to year and the cumulative cost ranges from \$2.65 to \$2.70 per acre for the full twelve-year life of a permit. For example, in 1973 the minimum work obligation was \$46 million (see Table VIII), assuming that no acreage was relinquished to the Crown.<sup>5</sup> However, the current level of expenditure is approximately \$75 million per annum<sup>6</sup> and it has been estimated that from \$130 million<sup>6</sup> to \$260 million<sup>7</sup> has been spent to date. Some of this money has gone directly into the economy of the Atlantic provinces. For example, Halifax Shipyards has constructed drilling rigs<sup>6</sup> (costing approximately \$25 million each), supply ships are being built at Pictou, some foreign companies have established themselves in the Halifax area to service offshore exploration rigs<sup>8</sup>, and, of course, supplies and services are bought locally by the exploration companies. It has been estimated that about \$5.5 million of the annual \$12 million cost of operating an offshore drilling rig off Nova Scotia is spent in that province, with \$2.5 million spent in other parts of Canada, the remainder being used for imported equipment and supplies.<sup>9</sup> As can be seen from Table I, Canadians are finding employment in this industry.

While there have been no commercial finds to date off the east coast,

\*Details on the issuance of permits are given in Appendix A.

the industry seems encouraged by the initial drilling results; and exploration in the area remains a high priority for the Canadian petroleum industry. Mobil Oil has recently applied to have its exploration permits converted to leases. (See Appendix A.)

**Table I—Labour Estimates for the Nova Scotia Offshore Oil Industry**

Industry	Employment		
	Canadian	Other	Total
Radio Positioning Stations	112	50	162
Seismic Vessels	27	223	250
Helicopter service	7	—	7
Supply vessels	110	10	120
Well-Logging	13	—	13
Oil Rigs*	65	—	65
Land-Based Oil Rigs†	90	—	90
Food Catering (Oil Rigs)	13	—	13
Drilling Mud Service	11	—	11
Warehousing	111	—	111
<b>Total</b>	<b>559</b>	<b>283</b>	<b>842</b>

\*Presently only one oil rig is working off Nova Scotia and three are off the coast of Newfoundland. Figure includes only the rig off Nova Scotia.

†Rig operating on Sable Island.

Source: Nova Scotia Department of Labour, March 1973.

### **The East Coast Offshore in an International Context**

World offshore oil production is now approaching 20 per cent of the world's total output. Offshore oil production could rise to about one-third of the world's total production by 1980. Subsea oil reserves are now more than 20 percent of the world's total reserves.

As can be seen from Table II, Canada is but a speck on the international petroleum map — as far as proven reserves are concerned. However, Canada has significant potential reserves. As shown in Table III, all estimates indicate important potential reserves off Canada's east coast. In the event of commercial finds on the East Coast Continental Shelf, the oil and/or gas would logically find their way into the eastern Canadian and U.S. markets. Such finds would certainly have an effect on some of the international imports and exports shown in Table IV.

**Table II—World "Published Proved" Oil and Gas Reserves at end 1971**

Country/Area	Thousand Million Tons	Share of Total	Thousand Million Barrels	Gas Trillion cu. ft.	Share of Total
U.S.A.	5.9	6.8%	45.4	269.6	15.6%
Canada	1.3	1.5%	10.2	54.4	3.2%
Caribbean	2.4	2.8%	17.1	5.0	0.3%
Other Western Hemisphere	2.0	2.3%	14.5	67.7	3.9%
<i>Total Western Hemisphere</i>	<i>11.6</i>	<i>13.4%</i>	<i>87.2</i>	<i>396.7</i>	<i>23.0%</i>
Western Europe	2.0	2.3%	14.8	163.2	9.5%
Africa	7.8	8.9%	58.9	193.0	11.2%
Middle East	50.1	57.6%	366.8	343.9	19.9%
U.S.S.R., E. Europe and China	13.4	15.4%	98.5	558.0	32.4 %
Other Eastern Hemisphere	2.1	2.4%	15.6	69.8	4.0%
<i>Total Eastern Hemisphere</i>	<i>75.4</i>	<i>86.6%</i>	<i>554.6</i>	<i>1 327.9</i>	<i>77.0%</i>
World (excl. U.S.S.R., E. Europe and China)	73.6	84.6%	543.3	1 166.6	67.6%
<b>World</b>	<b>87.0</b>	<b>100.0%</b>	<b>641.8</b>	<b>1 724.6</b>	<b>100.0%</b>

Source: Cazenove & Co., *The North Sea, The Search for Oil & Gas and the Implications for Investment*, London, September 1972.

Table III—Comparison of GSC, CPA, and CSPG Estimates

	Oil Potential in billions of barrels				Gas Potential in trillions of cubic feet			
	CPA 1969	GSC 1972 (Estimate I)	GSC 1973 (Estimate II)	CSPG(A) 1973	CPA 1969	GSC 1972 (Estimate I)	GSC 1973 (Estimate II)	CSPG(A) 1973
Arctic Islands and Coastal Plain (North)	43.5	49.3	20.3	28.6	260.7	327.4	242.0	208.8*
Beaufort Mackenzie	47.4 }	14.7	6.2	8.0	283.8 }	117.2	93.5	64.0
Western Canada		28.6	22.2	25.0		207.4	120.3	155.5
Offshore East Coast	24.8	38.5	47.5	22.1	149.9	229.6	307.1	132.6
Hudson Platform	2.9	1.5	1.5	*	17.4	8.7	7.3	*
Eastern Canada Onshore	2.3	1.8	1.5	1.5	13.0	15.8	12.7	16.6
<b>Totals</b>	<b>120.9</b>	<b>134.4</b>	<b>99.2</b>	<b>82.5</b>	<b>724.8</b>	<b>906.2</b>	<b>782.9</b>	<b>577.5</b>

\*Potential for Hudson Platform included in Arctic Islands and Coastal Plain (North).

Notes: Estimates are based on 1973 GSC regions.

Estimates all have slightly different basis in that areas considered, limit of depths of sediments or depth of water on continental slopes are not the same in every case.

GSC – Geological Survey of Canada

CPA – Canadian Petroleum Association

CSPG – Canadian Society of Petroleum Geologists

Source: Department of Energy, Mines and Resources, *An Energy Policy for Canada, Phase I*, Information Canada, Ottawa, 1973. p. 91.

**Table IV-Imports and Exports in 1971 of Crude Oil and Products**

	Million tons				Thousand barrels daily			
	Imports				Exports			
	Crude	Products	Crude	Products	Crude	Products	Crude	Products
U.S.A.	83.25	115.50	-	12.25	1 680	2 195	-	225
Canada	32.50	6.00	35.50	3.75	640	160	720	80
Caribbean	11.00	3.75	51.75	113.00	225	75	1 025	2 125
Other Western Hemisphere	28.00	3.75	-	1.00	570	90	-	30
Western Europe	633.25	34.75	0.75	15.25	12 875	680	15	320
Middle East	6.25	-	691.25	64.25	130	-	13 920	1 330
North Africa	4.00	4.00	183.50	2.25	75	80	3 820	50
West Africa	0.25	1.00	78.75	0.50	5	25	1 610	10
E. & S. Africa, S. Asia	36.50	6.50	-	0.50	745	140	-	15
South East Asia	35.25	15.00	32.25	9.75	710	305	650	205
Japan	189.50	41.50	-	1.00	3 810	805	-	20
Australasia	15.00	3.75	0.75	0.75	300	85	15	10
U.S.S.R., E. Europe & China	5.25	0.75	28.25	27.50	105	15	570	250
Destination not known*	23.00	15.50	-	-	475	285	-	-
<b>Total</b>	<b>1 103.00</b>	<b>251.75</b>	<b>1 103.00</b>	<b>251.75</b>	<b>22 345</b>	<b>4 940</b>	<b>22 345</b>	<b>4 940</b>

\*Includes changes in stock and quantities in transit, transit losses, minor movements not otherwise shown, military use, etc.

Source: Cazenove & Co., *The North Sea, The Search for Oil & Gas and the Implications for Investment*, London, September 1972.



Offshore petroleum would be expensive to produce because the expense in exploration and development of an offshore oil or gas field is much greater than that on land. However, the world demand for petroleum is increasing rapidly and the main petroleum exporting countries are intent on obtaining more control over their natural resources and getting higher return on petroleum exports. This means that the international oil companies will be operating in conditions of declining control over production and increasing prices. The threats to the security of supply and price escalation are of great concern to the major importing countries, such as the U.S.A.

The oil business is global, and the international oil companies are competing in several areas around the world – Australia, the Middle East, the China Sea, the North Sea, as well as the Canadian Arctic and the east coast offshore. To date, the major oil companies have relied on production from a wide range of countries. The range is narrowing, and so apparently are the profits<sup>10</sup>. The companies are therefore forced to look at promising new areas. The areas such as the Atlantic offshore which lie near major consumption centres and near politically stable regions are special attractions.

## **The Jurisdictional Situation**

### *The Domestic Situation*

Opinions differ between the Federal Government and the Governments of coastal provinces concerning respective rights to offshore resources.

A step toward resolving these differences was taken when the question of the jurisdiction and ownership of the submerged resources off the West Coast was referred to the Supreme Court of Canada in April 1965. The Court gave an advisory opinion in November 1967 that was unanimous in finding in favour of the Crown with respect to the resources of all submerged lands lying offshore from the “ordinary low water mark” and outside “harbours, bays, estuaries and other similar inland waters”. Since the principles forming the basis of this opinion would appear to be substantially applicable to the East Coast as well as to the West Coast, the main problem became one of delineating the areas of federal and provincial interests. However, there are practical difficulties regarding the application of provincial jurisdictional limits as indicated by the Advisory Opinion of the Supreme Court. Firstly, the geographical position of the low-water mark is shifting and thus uncertain; and secondly, the seacoasts are complicated by deep indentations, straits and inlets of various configurations, and the seaward limits of inland waters at the time a coastal province entered Confederation are not known.

On 2 December 1968 The Prime Minister made a comprehensive announcement in the House of Commons on the offshore situation, and followed this with a further statement on 4 March 1969. In brief, the announcements involved the establishment of mineral resource administration lines to divide areas of federal and provincial administration. The areas seaward of the lines would continue to be administered by the Federal Government. Mineral resources between the lines and the shore would be administered by the appropriate Provincial Government, which

would receive all revenues accruing therefrom. The Prime Minister further announced that the Federal Government is prepared to share with the Provinces on a basis acceptable to them half the revenues accruing from mineral resource exploitation within the federally-administered areas off provincial coasts, that is, off the East and West Coasts and in the Hudson Bay region.

Since the Prime Minister's announcements in December 1968 and March 1969, there have been many meetings and a great deal of correspondence between the Federal Government and the Provincial Governments in the hope of resolving the offshore situation, if possible, without the necessity of the extensive litigation that would be required to legally resolve questions of ownership and jurisdiction. However, the situation is extremely complex. For example, Newfoundland is claiming full ownership and jurisdictional rights over the resources of her Continental Shelf, stating that these rights arise from Newfoundland's constitutional status at the time of union with Canada in 1949.<sup>11</sup>

In August 1972 the four Atlantic Provinces and Quebec reached an agreement with the Federal Government to set aside, for the time being, the ownership issue. Instead they agreed to set up a joint task force of federal and provincial officials which would try to work out a formula for the administration of offshore mineral activity. At that time the Prime Minister announced that the Federal Government was prepared to consider allocating to the coastal provinces a share of the mineral resource revenues from federally-administered offshore areas greater than the 50 per cent share originally offered.

### *The International Jurisdictional Situation*

Offshore mineral resource activities have also raised a number of international problems for Canada. Firstly, there are bilateral international problems involving Canada's offshore boundaries with other nations. It is the accelerating interest in offshore minerals in recent years, specifically the issuance of offshore oil and gas permits, that has given rise to the necessity for defining Canada's offshore boundaries vis-à-vis adjacent and opposite foreign nations.

Off the East Coast, France has claimed jurisdiction over the resources of a relatively large area of the continental shelf south of Newfoundland because of her ownership of the St. Pierre-Miquelon Islands. Canada has rejected the claims of France as excessive and negotiations with France have been going on for some time regarding the delimitation of respective areas of continental shelf jurisdiction. However, Newfoundland, the province which will be most affected by the result of these negotiations, does not want Ottawa to settle the division of offshore rights around the islands of St. Pierre and Miquelon unilaterally with France.

Offshore boundaries must also be established between Canada and the United States in the Gulf of Maine region.

Apart from bilateral international problems, there is the additional, broad, international problem of the seaward extent of Canada's national limits of jurisdiction over the natural resources of the seabed and subsoil. Here again, this is a problem that has reached its present prominence due

primarily to the increased interest in the potential of offshore mineral resources, with the interest expressed in this case by the world community as a whole. This is a fundamental question, directly affecting not only Canada but every other coastal State as well.

The 1958 Geneva Convention on the Continental Shelf is the present conventional international law regarding seabed resources. The Convention came into force on 10 June 1964, upon ratification by the requisite number of States. Canada ratified the Convention effective 8 March 1970.

The Continental Shelf Convention provides that the coastal State "exercises over the continental shelf sovereign rights for the purpose of exploring it and exploiting its natural resources" (Article 2.1). The Convention defines the continental shelf as extending "to a depth of 200 metres or, beyond that limit, to where the depth of the superjacent waters admits of the exploitation of the natural resources . . ." (Article 1).

Thus, the limits of national jurisdiction over seabed resources under the Continental Shelf Convention definition are dependent upon the exploitability test, that is, they are dependent upon technological progress. The limits of the juridical continental shelf are, therefore, not the same as those of the physical or geological continental shelf. As technology allows seabed resource exploitation to take place in deeper and deeper water depths, so the limits of national jurisdiction over these resources move correspondingly oceanward under this flexible definition. This is not to say, however, that each coastal State must itself develop technological capabilities in order to confirm its offshore claims and establish its jurisdiction over adjacent offshore areas.

Through the issuance of offshore oil and gas exploration permits covering extensive areas of our submerged continental margin, on the continental shelf and on the continental slope beyond, Canada has taken a leading role in the establishment of State practice in this regard. Canada's jurisdictional claims in the offshore have been established by the issuance of Canada Oil and Gas permits covering extensive areas of the continental shelf and of the slope beyond, as well as by statements in Parliament, at the United Nations, and in other forums.

The matter of national limits of jurisdiction over seabed resources came into the open with the introduction of the so-called Maltese Resolution at the United Nations in 1967. This Resolution resulted in the establishment of the United Nations Committee on the Seabed in the latter part of that year. The Maltese proposal called for the United Nations to undertake the "examination of the question of the reservation exclusively for peaceful purposes of the seabed and ocean floor and the subsoil thereof, underlying the high seas beyond the limits of present national jurisdiction, and the use of their resources in the interests of mankind". Thus, attention was focussed on the crucial question, What are the "limits of present national jurisdiction" over seabed resources? This issue will be discussed and hopefully settled at the Law of the Sea Conference in 1974.

### **The Technology**

The basic methods used by the oil companies in the search for petroleum and the development of a petroleum field are the same around the world.

However, in certain difficult “frontier areas” such as the Canadian East Coast Offshore and the North Sea, the contemporary technology is being pushed to its limit.

### *Exploration*

Before a decision is made to commit large expenditures to drilling for oil and gas, it is necessary to carry out preliminary surveys to determine the geological formations and to pinpoint possible oil or gas bearing structures. Magnetic, gravimetric and seismic methods are used for such surveys. The geophysical operations carried out in the Atlantic offshore have been mostly seismic surveys carried out from ships. The first seismic exploration for oil and gas took place around Sable Island in 1960, and since that time about 150 000 miles of marine seismic profiles have been obtained at a cost estimated at \$70 million.

Even if initial geophysical surveys look promising, the presence of oil or gas can only be proven by drilling a well. There are four basic types of mobile drilling rigs for offshore operations:

- the floating vessel; a specially-designed, ship-shaped vessel, up to 400 feet long with a derrick amidships and a drill well in the centre of the hull. Recently completed drilling off the Labrador coast used a vessel of this type;
- the bottom-supported submersible type rig; once the rig is in place, the lower part of the structure is filled with water and the rig settles on the bottom, giving good stability. Water depth and weather conditions limit the use of such rigs;
- the semi-submersible rig; this type, which is being used in the Atlantic offshore, is capable of operating in deeper waters. When on location it does not contact the ocean floor but floats on the surface with a large substructure below the wave action, resulting in minimum movement;
- the jack-up rig; this type is essentially a platform supported by a number of legs, usually three or four, which are jacked down to the sea bottom. Once the feet have been firmly planted, the platform is then jacked up above the water. This type of rig is limited to depths of less than 200 feet, and to relatively sheltered waters.

The semi-submersible rigs used in the Atlantic offshore are expensive to build (approximately \$25 million each) and to operate (up to \$74 000 per day).<sup>12</sup> These massive rigs, which can drill, through water depths of 800 feet, to depths of 25 000 feet in the earth’s crust, carry a complement of about 65 persons. The operating costs are high, in part because the rigs must be serviced from a shore base which could be more than 100 miles away. Supply ships and helicopters ferry personnel and materials back and forth continuously. It has been estimated that the total cost of drilling a hole offshore in the Atlantic can be in the order of \$2 million.

Drilling rigs are normally owned and operated by drilling companies that contract their services throughout the world to companies engaged in oil and gas exploration. Companies in the Atlantic offshore are competing for rigs with other companies operating in comparable areas, such as the North Sea. As an isolated example of the global nature of this business, an offshore drilling unit that was built in Victoria, B.C., and

that carried out a two-year drilling program off the West Coast of Canada from mid-1967 to mid-1969 has been working its way around the world from Canada to New Zealand to the North Sea, and may wind up drilling off the East Coast of Canada sometime in the near future. It was scheduled to come to the East Coast last year, but with the discovery of oil in the North Sea its contract for drilling in that area was extended.

### *Development*

An initial discovery must be followed by further drilling to establish the extent of the field and to assess whether the find is commercially viable. Such wells are drilled with exploration rigs.

If a pool is found to be commercially viable, then a permanent fixed platform is brought out to the site and fixed to the seabed. The development wells are drilled from this platform. The number of development wells drilled from a single platform is variable and can total more than thirty.

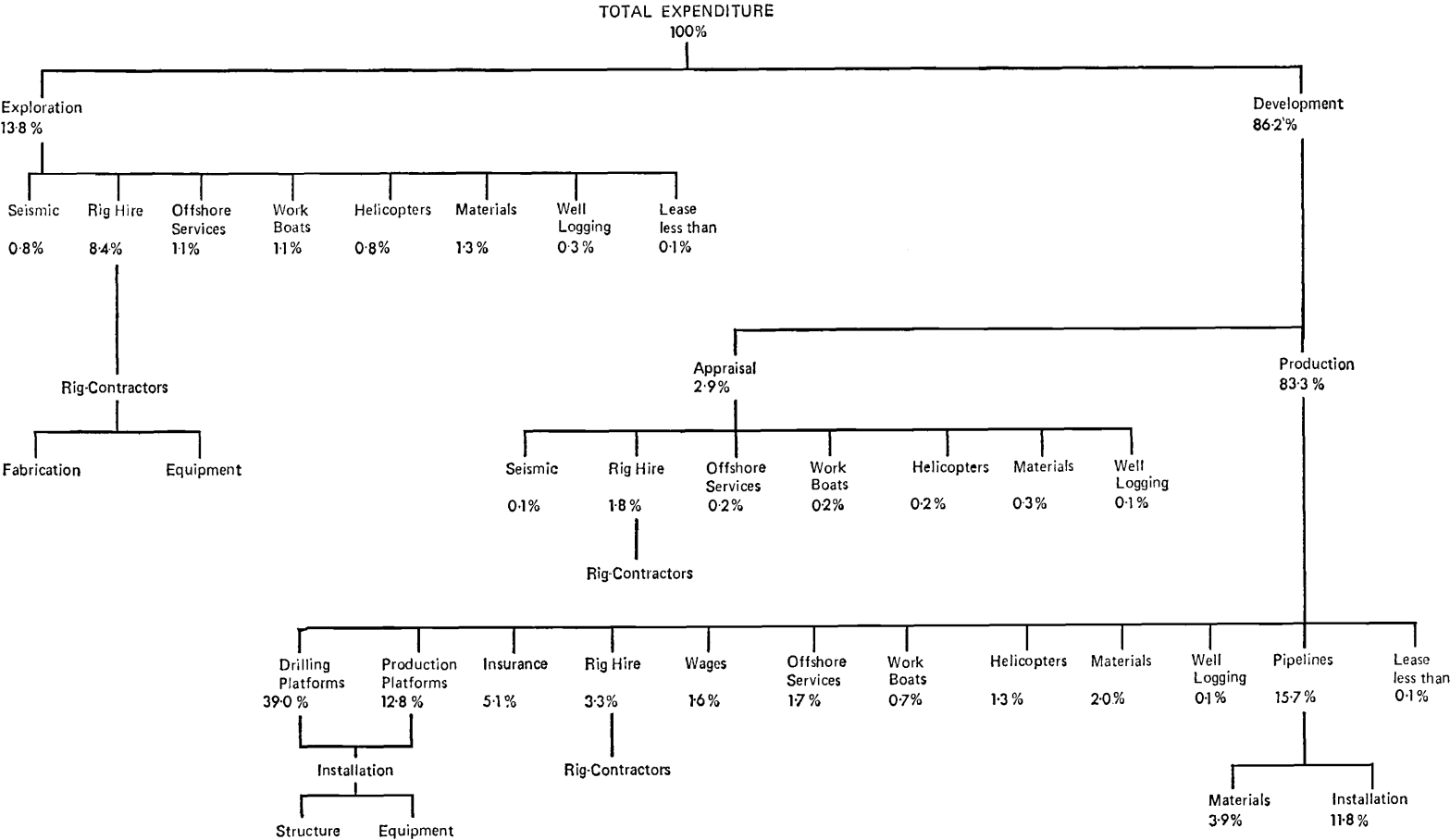
Severe environmental conditions in some areas are pushing this type of technology to its limit. For example, to develop the "Forties Field" in the North Sea, British Petroleum is having fixed platforms constructed which will stand some 700 feet above the seabed. Each platform will consist of a main substructure weighing 18 000 tons, plus a 3 000 ton deck section which carries the drilling rig. Such massive platforms are necessary to cope with water depths of over 400 feet and the expectation of winds of over 130 miles per hour and waves of up to 94 feet. The industry is presently exploring in depths far beyond current production technology, but it seems confident that if petroleum is discovered at great depths, the appropriate technology will be developed.

To get away from such a harsh sea surface environment some preliminary engineering development work is presently underway to construct a sea bottom completion system, whereby oil or gas is piped directly from the well head to seafloor processing units and then on to shore. The system is dependent upon a service capsule operating at atmospheric pressure, in which operators can be lowered to the seabed and can carry out needed operations under dry conditions, obviating the need for highly skilled divers.

The last stage of the development sequence is to bring the product to shore. This can be done either by pipeline or tanker. The choice is dependent on several factors including whether the product is gas or oil, the size of the field, the topography of the ocean floor, the number of wells in an area, the limits of pipeline technology.

High though exploration costs are, they are dwarfed by development costs. For illustrative purposes Cazenove & Co.<sup>13</sup> have broken down the expenditures required to bring in an hypothetical oil field to produce 300 000 barrels per day, using current technology (see Figure 1). As can be seen, development is by far the most significant expenditure, with platforms and pipelines as the costliest items. Another illustration of the relative costs of developing an offshore oil field is given in Table V.

Figure 1-A Possible Breakdown of Future Expenditure



Source: Cazenove & Co., *The North Sea, The Search for Oil & Gas and the Implications for Investment*, London, September 1972.

**Table V—Development of an Offshore Oil Field in the North Sea (250 000 barrels/day)**

	Exploration	Construction	Production
	Surveys – 2 000 to 4 000 km.	Planning/design Construction of production facilities	Build-up – 3 to 5 years Plateau – 5 years Decline – 8 to 10 years
	Exploration drilling – 5 to 30 wells	Drilling production wells Construction of transport facilities	
Time	2–6 years	5–6 years	16–20 years
Direct Employment	200–400 men	1 000–2 000 men	300–400 men
Capital Investment	£10–60 million	£250 million	£50–100 million
Operating Expenditures			£250–300 million

Source: "North Sea Nightmare", *Petroleum Press Service*, November 1972. p. 410.

### *Safety and Environmental Considerations*

The Oil and Gas Production and Conservation Act and the Canada Oil and Gas Lands Regulations give the Federal Government's Department of Energy, Mines and Resources (EMR) responsibility for ensuring that all operations in the offshore meet certain standards to protect those working in offshore activities and to protect the marine environment from the risk of pollution arising from offshore petroleum exploration and exploitation activities. The Ministry of Transport is responsible for administering the Canada Shipping Act concerning safety regulations on rigs.

The blowout which poured some 3 500 000 gallons of crude oil on the beaches of Santa Barbara, California in 1969, pointed to the need for strict standards. Moreover, it must be remembered that California waters are more placid than those off the Atlantic coast. Even if rigid safety precautions are taken, such as the installation of a blowout prevention (BOP) stack on the sea bottom which is supposed to close the well automatically and prevent oil and gas from escaping, such precautionary devices are like all complex pieces of machinery operating in an adverse environment – they are not completely reliable and blowouts do occur. Hence, a Pollution Prevention Plan must be developed for every operation off Canada's east coast and daily patrols must be scheduled to fly over the area to check for oil spills.<sup>14</sup> The Department of the Environment has also identified "sensitive" areas; that is areas where exploration permits have been issued which overlap with known fishing grounds, migratory bird routes and ship navigation routes.<sup>15</sup>

It is important to assemble as much information as possible on physical and biological processes, in order to obtain an appreciation of the elements, of the physical-biotic environment which could be affected by offshore petroleum development activities. Examples of the type of information required are shown in Appendix B. It is only through comprehensive analysis of data of this nature that the potential consequences of offshore petroleum development on the marine environment can be fully appreciated.

In analysing a proposed drilling program, one of the first items looked at by EMR is the stability of a drilling unit. The criteria used to assess the suitability of any drilling unit are the abilities to do the following:

- to remain stable in heavy seas;

- to remain in position in high winds and seas;
- to withstand heavy icing;
- to carry out drilling and control operations in high wind and sea conditions;
- to survive in extreme (hundred-year-storm) conditions.

Despite such considerations, incidents occur. For example, in September 1971, an exploration drillship operating off the Labrador coast had to be pulled off a hole in a hurry because of an iceberg.<sup>16</sup> The BOP System apparently worked in this particular instance. However, if commercial production follows exploration, the risk of environmental pollution will escalate. As President Nixon's Panel on Oil Spills has stated:

"as offshore development continues to expand at the present rate and the frequency of accidents remains the same, we can expect to have a major pollution incident somewhere every year. It is noteworthy that the possibility of oil leakage and gas leakage from offshore oil production must never be completely discounted, for the probability of blowouts cannot be reduced to zero."<sup>17</sup>

In addition to the risk of pollution from an oil spill from the sea bottom, offshore drilling operations can also be a hazard to navigation. Despite the fact that the location of rigs is recorded and reported in navigation bulletins, their anchoring systems can extend out to 5 000 feet from the rig thus providing a hazard to large supertankers and small fishing vessels alike. An added hazard is created when exploration rigs are moved from one location to another. It is interesting to note that a Committee of the Senate of the State of Massachusetts, which investigated offshore oil drilling, recommended in September 1972 that Massachusetts oppose any offshore oil development until a number of conditions were met, including waiting "until blowout and spill prevention technology have sufficiently improved to be clearly fail-safe and until oil spill technology can adequately cope with an ocean spill in adverse seas and weather conditions so as not to cause any damage to the marine environment and public health from its own effects".<sup>18</sup>

In Canada, the Federal Government through EMR, is applying strict standards to offshore operations.<sup>19</sup> The industry is also concerned. For example, Mobil Oil which is operating on Sable Island "has requested and accepted a rigorous set of environmental guidelines drafted by the Nova Scotia Resources Council, a citizen's group concerned with and expert in environmental matters".<sup>20</sup>

### **Related Developments**

The Science Council recognized the opportunities that exist in marine science and technology in general and offshore petroleum technology in particular when it recommended that a Crown corporation – a Canadian Ocean Development Corporation (CODEVCo) – be established to develop a strong Canadian capability in Canada in the marine field.<sup>21</sup> More generally, the Science Council recommended that, in order "to meet the challenges and profit from the opportunities presented by the marine



environment, there is a need for a national program – a Major Program in Marine Science and Technology, which would focus on the Canadian continental shelves, their superjacent waters, ice-cover and the open oceans.” As evidence of current government interest in this sphere of activity, it is interesting to note that in the recent Speech from the Throne mention was made of marine science technology:

“The Ministry of State for Science and Technology, in cooperation with the Department of the Environment and other interested departments, will recommend a national program of research and development in the field of Marine Science and Technology”,<sup>22</sup>

An interdepartmental Task Force has been appointed to undertake a study which is to lead to an ocean policy. The terms of reference of this Task Force on Ocean Policy and Provisional Planning are to examine federal government expenditures in marine and science technology, and from this to set up guidelines about future expenditures and indicate how they are likely to impact upon the development of a Canadian ocean industry. The Task Force will address itself to defining what an “adequate” Canadian capability in the Canadian offshore might be. A first statement on Ocean Policy – largely one of intent – was made on 12 July 1973. Some elements of the policy provide that:

- Canada stimulate development and effective participation of Canadian industry in the plan to see that Canada controls the essential industrial and technological ingredients to exploit offshore resources.
- Special emphasis be given to a wide range of marine science and technology programs relating to management of marine environment, renewable and non-renewable resources, development and maintenance of ocean engineering at universities and in government laboratories, and better forecasting of weather, currents, ice and similar atmospheric and oceanic factors.
- Canada, within five years, achieve world-recognized excellence in operating on and below ice-covered waters.
- Canada stand equal or superior to foreign governments or large multinational corporations in developing and maintaining a current information base about its renewable and non-renewable offshore resources.

The Canadian Committee on Oceanography, presently composed of senior government science managers and representatives from universities and industry, is charged under the new policy with the co-ordination of activities in marine science and technology. The Committee will report to Cabinet through the Minister of the Environment.

The Department of Regional Economic Expansion (DREE) has also recognized that opportunities in the marine field as well as in other areas could help make Halifax a significant growth centre. DREE is sponsoring the establishment of a profit-making organization in the private sector, the Halifax Corporation, to seek out commercial opportunities where it can. The Halifax Corporation, also known as Metropolitan Area Growth Investments Ltd.,<sup>23</sup> is intended to be a multi-functional company operating somewhat like the Canada Development Corporation. The philosophy

behind the Halifax Corporation concept is that there are limited opportunities in the Halifax area, which promise perhaps less return on investment than similar opportunities elsewhere in Canada; the objective is to find a mechanism – in this case via the profit motive – for selecting those areas in which Halifax already possesses some capability and to build on them. The marine field is an obvious area where a new capability could be developed on existing strengths.

Both the Science Council Report, *Canada, Science and the Oceans*, and the Darling Report, *The Coasting Trade of Canada and Related Marine Activity*,<sup>24</sup> have recognized the lack of co-ordination between government departments in the marine field. As Darling noted, “offshore permits have been granted since 1961 without any reference to the shipping interest involved. . . . As a result, while the revenue from permits and the amounts spent in maintaining the permits in good standing seem impressive in so far as they represent expenditures for shipping services ... they have been made largely to non-Canadian ships, companies and personnel.” Darling recommended that the Canadian coasting trade should be reserved to Canadian flag vessels and that “the provisions regarding the reservation of the coasting trade to Canadian-flag vessels should extend to the other marine activities of dredging, salvage, seismographic, supply and support vessels in offshore drilling, excluding drilling platforms or rigs, unless self-propelled.” The Darling report is still under review.

There also exists a Federal Government Task Force on Maritime Oil Exploration, Exploitation and Transport. This task force is mainly concerned with the environmental impact of offshore petroleum activities. This group has commissioned a study which will describe the implications of a series of hypothetical incidents that would be associated with activities involving oil exploration, exploitation, export and import, coastal movement and marine transportation activities and facilities.<sup>25</sup>

### **The Socio-Political and Economic Contexts of the Atlantic Provinces\***

#### *Some historical considerations*

In considering the development of Atlantic Canada up to the present time, it is more useful to view the provinces as a rim area of a broader Atlantic world, related to Europe, the Eastern seaboard of the U.S.A. and the Caribbean, rather than in terms of its relationship to the North American interior. In effect, with the exception of Newfoundland's relationship to Labrador, none of the Atlantic provinces has a hinterland *per se*. For most of their history, they have been oriented, economically and socially, to patterns of influence that are transoceanic or that are related to the contiguous east coast of the United States. There is some truth to the assertion that Confederation with Central Canada constituted an artificial, politically-induced, interruption of “natural” patterns that had evolved, over time, and that had reached their peak of significance in the middle decades of the 19th century. On the other hand, given the technological and economic changes that were becoming significant in the 1860s and 1870s, and the political realities of the time (British disinterest in main-

\*This section is based extensively on a report prepared by Dr. S. Silverman, consulting political scientist.

taining separate colonies in British North America, coupled with the apparent threat from the United States) it is difficult to see what alternatives to Confederation the Maritimes might have had in the 1860s. Notwithstanding these historical realities we may ask, at the present time, whether developments in technology (offshore oil and gas, significance of deep-water ports for supertankers, etc.) and in world politics (increased significance of a North American orientation for the U.S., expansion and politicization of the European Market, etc.) might not open up new alternatives for Atlantic Canada that in the long run will be more in harmony with persistent geo-historical patterns and that could enhance the region's bargaining power in the Canadian federation.

From the time of the Napoleonic Wars through to the dawn of Confederation, the Maritime provinces enjoyed considerable prosperity. This prosperity was associated with their role in the international economy (dominated by the British imperial economy of which they were a part) and by the prevalence of technologies which were compatible with their resource and skills. Within the British imperial trade system, Nova Scotia and New Brunswick functioned in the early mid-19th century in a manner analogous to New England prior to the American Revolution. Fisheries, the New Brunswick export trade in squared timber and naval stores, shipbuilding (Nova Scotia's registered shipping accounted for some 600 to 700 vessels in the mid-19th century) and their participation, particularly that of Nova Scotia, in the carrying trade to and from the British Isles and with the West Indies were the dominant features of the Maritime economy in that era. On the other hand, the type of economy that had emerged possessed some inherent weaknesses that were to affect the long-range future of the region. Such industry as did develop was largely devoted to the production of goods for the local market (e.g., clothing, furniture, food processing, tools).

By the middle decades of the 19th century, supplies of accessible big timber, the foundation of the boom in the economy, were nearing exhaustion; at the same time, high wages and demand for labour in lumbering and shipbuilding were in conflict with agricultural development and, in New Brunswick in particular, helped to inhibit the transition to larger scale, commercially viable agriculture. (An agricultural transition which, had it occurred, might have helped foster a more rapid development of secondary manufacturing.)

The Maritime economy was vulnerable to external influences and policy decisions. Factors such as whether Americans were to be allowed to participate in inshore fisheries (allowed by treaty in 1783, barred in 1818, allowed again under the 1871 Treaty of Washington) or the degree of American participation in the West Indies carrying trade (significant by the 1830s, but compensated for by concessions to Nova Scotia shipping in the wider imperial traffic) had a major impact on the region's economy. Both the Maritime colonies and Canada were adversely affected in 1846 when the British parliament revoked the preferences given to Canadian and other colonial producers of grain and opted to rely on free trade to feed its mushrooming urban population at a lower cost. This led to negotiation by the Canadian leaders of a reciprocity arrangement with the United States.

The Maritime colonies were covered by the agreement and their agricultural economies boomed during its lifetime (1854 – 1856). The American decision to abrogate the treaty was one of the reasons that Canadians and Maritimers turned to Confederation and to anticipation of domestic development as a possible solution to their problems. But the attraction of the American market remained particularly strong in Atlantic Canada even after Confederation. They chafed under the tariff system imposed by Ottawa, a system which they regarded as designed particularly for the benefit of embryonic central Canadian industry and one which made it more difficult to sell their products south of the border while at the same time raised the price of the manufactured goods which they imported. Shifts of technology away from wind-driven and wooden-hulled shipping on which their prosperity had been based; the erosion of the British imperial trade system; and a general North American depression in the 1870s which vitiated the hopes that Maritimers had had that rail links with central Canada would guarantee continued prosperity – all of these were factors which contributed to the decline of the economy of the Maritime provinces in the closing decades of the 19th century, a decline from which (in relative terms) they have never fully recovered. Industry in the Atlantic region wilted when faced with the competition from a central Canada that could also base its economy on the expansion into the West.

Though coal had been discovered and was being exploited both for domestic use and for export, there was little initial development of industry from this energy base. Not until the emergence, in the early 1900s, of a steel industry in the region did the industrial revolution begin (in a limited and scattered fashion) to have an impact on the region. Many Maritimers tended to blame economic decline on Confederation and on central Canada.

Even in the 19th century, the revenue base of the Atlantic colonies was rather narrow. Revenues came mainly from import duties. Because of the low state of development of municipal government, even local revenues came from the revenue tariff imposed by Halifax, Fredericton, Charlottetown and St. John's. Thus the assimilation of powers to impose tariffs by the central government, under the British North America Act, removed the main prop on which the Maritime governments *and* municipalities had relied for financing government. This was recognized in the clauses in the original BNA Act that provided for subventions from the Federal government to make up for estimated losses in revenue. The path to Confederation was rocky in all of the Atlantic colonies. The initial effort (1864) to establish a Maritime Union had broken down partly because of Prince Edward Island's insistence on disproportionate legislative representation and that Charlottetown be the capital of the united province, and partly because Canadian representatives had interposed their own plan for a generalized British North American federation. It would seem that both the abortive Maritime Union proposal of the 1860s and the orientation toward a wider Confederation depended less on a positive impulse to form a wider arrangement than on reaction to external threats (the economic factors already mentioned, plus fear of post-Civil War militancy) and

reflected a casting about for any alternative arrangement that appeared to offer a glimmer of economic and political hope.

The main inducement the central Canadians could offer was a commercial one: the use of the credit of a Canadian government would enable completion of the Inter-colonial Railway between Halifax and Montreal and would encourage, it was expected, a boom in trade. Even this was not enough to ease the entry of the Atlantic colonies into the proposed new political entity. Newfoundland, suspicious of Canada and a competitor of Nova Scotia in fisheries and in other aspects of maritime commerce, early decided to stand aloof. When it did join Canada in 1949, even after the difficulties it had faced in the 1930s, it was only by a very narrow decision in a closely fought referendum with limited (some Newfoundlanders say "too limited") alternatives. Prince Edward Island stayed out till 1873: it entered Confederation at that time less because of positive infatuation with Canada than because of the failure to get British financing to buy off the absentee landlords where Canada promised to provide credit for this purpose, give subventions to the P.E.I. government, maintain a regular ferry service to the mainland, and aid in the construction of a local railway system. In New Brunswick, the first election held (1865) on the Confederation issue led to the return of an anti-Confederation government. Behind-the-scenes intervention by the Governor of the colony, and the provision of political funds by Macdonald and the Canadian Confederationists swung the second election (1866) in favour of Tilley and the pro-Confederation party. In Nova Scotia, the government did not dare bring the Confederation issue to an election. Partly because of the political beliefs of Premier Tupper's government, partly because of the high expectations of many Halifax merchants, Nova Scotia joined Confederation right at the beginning – against the opposition of the most influential Nova Scotian political figure, Joseph Howe. When Howe and his anti-Confederationists succeeded in winning 36 of the 38 Nova Scotia seats in the election to the first Dominion Parliament, the whole arrangement concluded by the British North American Act of 1867 was put in jeopardy. Howe then attempted to get the British government to repeal the BNA Act with respect to Nova Scotia. The resolute refusal of London to change the Act, coupled with the renegotiation of the terms of Nova Scotia's entry (a precedent for the successive process of "renegotiating federalism" insofar as "better terms" in the financial dimension are concerned), plus the offer – and acceptance – of a seat for Howe in the Dominion Cabinet brought about an end to this particular threat of secession.

Many believe that this centrifugal, and at times secessionist, tradition in Atlantic Canada should not be minimized; that in some respects this tradition, though recently somewhat submerged, is at least as persistent as Quebec's provincial nationalism.

The historical combination of economic difficulties and a political tradition which carries with it some degree of traditional scepticism vis-à-vis Confederation goes some way to explaining the background to present day Maritime and Newfoundland political attitudes and behaviour. At the same time, the *overt* manifestation of these attitudes from the past has been overlaid by the development of the last few decades, some discussion

of which follows below. Nevertheless, observers in the rest of Canada should realize that, both historically and in terms of contemporary realities, present economic programs concerning Atlantic Canada are not just a matter of “economic aid from the richer to the poorer regions” – they reflect a political realization that the spirit of scepticism concerning the benefits of Confederation has not been completely laid to rest in the region. For example, Newfoundland has taken a firm stand on the question of jurisdiction of the Continental Shelf off its coast.

### *Some Features of the Economy of the Atlantic Provinces*

Major structural changes are taking place in the traditional bases of the economy of the Atlantic provinces. Agriculture is continuing to decline in significance: within the agricultural sector, the smaller farm unit, family-owned for generations, is being displaced in favour of larger units, some of which are owned and managed by corporations. For the region as a whole, the share of agriculture in net value of commodity production declined from 6.0 per cent in 1961 to 4.9 per cent in 1967. Between 1961 and 1966, the total number of farms in the Maritime provinces declined from 31 693 to 24 684. The percentage decline in the number of farms for each of the four Atlantic provinces over the same period was as follows:

New Brunswick	26.1%	Prince Edward Island	13.3%
Nova Scotia	23.1%	Newfoundland	2.5%

There was also a substantial decline in the employed agricultural labour force, as indicated in the following figures:

1953	56 000	1968	27 000
1956	49 000	1969	26 000

In percentage terms, the farm labour force accounted for about 10 per cent of the total employed labour force in 1956 and had dropped to 4.3 per cent by 1969. Between 1961 and 1969, there occurred a decline of over 50 per cent in the farm labour force.

Fishing is traditionally a significant sector of the economy of the Atlantic provinces and will continue to be of importance provided that adjustments are made to changes in the nature of the industry. The general characteristics of the fishing industry in Atlantic Canada are summed up in the following passages from the Atlantic Development Council's study of *A Strategy for Economic Development of the Atlantic Region*:<sup>26</sup>

“An important feature of the fishing industry in the region is the predominance of casual and part-time fishermen. Full-time is defined as ten months and over each year; in Newfoundland, full-time fishermen are defined as those who spend more time fishing during the year than at any other type of paid employment. In 1968, full-time fishermen accounted for about 60 per cent of the number employed in the primary fisheries in Newfoundland, 29.7 per cent in Nova Scotia, and 7.3 per cent in New Brunswick. In Prince Edward Island, the employment in the primary fishery was almost entirely on a part-time or occasional basis....

“There has been a downward trend in employment, but no marked exodus from the industry. In Newfoundland, in particular, there would appear to be some tendency for people to move into or out of the primary

fishing industry in response to change in the demand for labour in other sectors of the economy.”

In recent years, there has been increased rationalization and investment and growing technological sophistication in the fishing industry, but this has been concentrated largely in the offshore as opposed to the inshore fisheries. Here, provided that Canadian fishermen can compete with the ocean-going European fishing fleets, (particularly those from the Soviet Union and the Eastern European countries), the possibility for viable activity remains strong. There is an increasing market, at rising prices, for fish in the United States, and Atlantic Canada is favourably situated to supply this market. However, there is a growing concern that those employed in offshore fishing, which is the most viable part of the fishing industry, will be attracted to employment on offshore drilling rigs. Men familiar with conditions in the offshore fisheries (long periods away from home, some degree of hazard, some experience on the more modern deepsea vessels with complicated equipment) are more suited for the transition to work on drilling rigs than are inshore fishermen.

The traditional inshore fisheries, where activity is often combined with small-scale farming, have been dying out as an area of activity in recent years. It is recognized that a fundamental change must take place in the inshore fishery, but the kind of change required is drastic: centralization and technological improvement of port facilities; licensing and restriction of the numbers of people engaged in the inshore fishery; environmental regulation aimed at husbanding a relatively fixed resource. The result is that more and more of the inshore fisheries tend to be regarded as a discrete and limited type of economic activity rather than as supplemental to subsistence farming.

Because of the combination of attrition of the small farm and limitation of the inshore fishery, subsistence and marginal activity combining farming and fishing will become increasingly non-viable; those who persist in these activities will depend increasingly on various types of government assistance. The significance of the fisheries may remain, particularly if Atlantic Canada can be competitive in serving the American market. However, within the fisheries increasing importance will devolve on offshore fisheries, where technological improvements can be effective, and where the labour force tends to be more stable and more highly skilled.

It is other types of activity in the primary sector, forestry and mining, that are on the rise in Atlantic Canada, as agriculture and fisheries decline in importance. The following points may be made regarding the forestry industry:

- 1) Forestry has been contributing a rising proportion to the economy of the Atlantic provinces. However, since new technologies for woods operations are being rapidly adopted, rising output is accompanied by declining employment in this sector. In the 1960s, there was a decline of about 25 per cent in employment in the forest industry from about 15 000 in 1961 to 11 000 in 1968.

- 2) The value of shipments in the Atlantic provinces' forest industries is particularly high when one takes into account processing by regional wood-

using industries, including the pulp and paper industry.

3) Labour costs are similar to those in Quebec, and the Maritime pulp and paper mills can benefit because of easy access to ocean shipping. The cost per ton of fibre is a key variable, and in Nova Scotia and New Brunswick, fibre costs are lower than in Quebec and Ontario, mainly because of better accessibility to the raw resource (in Newfoundland, wood fibre costs are slightly higher than in Central Canada). Largely because of the difference in fibre costs, the growth rate of the pulp and paper industry has been higher in the Maritimes than in Quebec and Ontario.

4) The Atlantic provinces' pulp and paper industry is heavily dependent on the export market: about 75 per cent of output goes to the United States, and about 10 per cent to Great Britain.

In recent years, there has been a sharp increase in the development of the minerals industry in the Atlantic provinces. The general significance of the mineral sector in the Atlantic provinces is indicated in the Atlantic Development Council Survey:<sup>27</sup>

“Substantial increases in mineral production in the Atlantic provinces have occurred during the last decade. In 1959 the total value of regional mineral production was about \$158 million. In 1968 it was over \$470 million. The region during the decade also increased its share of the value of Canadian mineral production from 6.6 per cent in 1959 to 9.9 per cent in 1968.

“These increases were due to vast new activity in Newfoundland and New Brunswick. In Newfoundland, the value of mineral output climbed dramatically from about \$72 million in 1959 to \$323 million in 1968. In New Brunswick the increase was from about \$18 million to almost \$90 million. Mineral output in Nova Scotia was more stable during the 1959–68 period, and in 1968 was valued at \$58 million. In Prince Edward Island the mining industry is relatively small and activity is confined to structural materials.”

The pattern of development within the *primary sector* is not conducive to increasing levels of employment. The kinds of activity that are remaining viable, or that are increasing in importance, will be those where capital, corporate organization and marketing, and technology can be most effectively combined. Consequently, the Atlantic Development Council predicts a decline of approximately one-third in employment in the primary sector in the Atlantic provinces in the course of the 1970s. Correspondingly high pressure for employment will be exerted upon other sectors. In addition to the question of whether such employment opportunities will, in fact, open up to the degree that is needed, there is also the question of whether the labour force that is displaced in the primary sector will prove to be mobile enough and flexible enough to benefit from changes in the rest of the Atlantic provinces' economy. Expectations are likely to be high and, probably, unreasonable – particularly in connection with the benefits in terms of employment to be derived from major offshore oil and gas developments and related economic phenomena. Whether such expectations are, in fact, met could significantly affect political and social behaviour in the area over the next decade.



Historically, the *manufacturing industry* of the Atlantic provinces has lagged behind that of the rest of the country. The supply of manufactured goods in the Maritime provinces tended, particularly from the 1890s on, to reflect the spillover from the development of the industrial economy in central Canada, where economies of scale could more readily absorb costs of industrial production on a larger scale than was possible on the Eastern seaboard. Even in World War II, when the productive capacities of Maritime industry were stretched to their utmost, industry in the region received relatively little in the way of government support for expansion. Transportation costs, limited regional markets, and the tariff barriers that limited access to nearby American markets tended to affect adversely the development of Maritime industry.

The lag of the Maritime provinces and Newfoundland in industrial development continues to be reflected in the proportion of the labour force absorbed in manufacturing. In 1967 Ontario accounted for about 50 per cent of the total Canadian labour force in manufacturing, Quebec for about 36 per cent, and the Atlantic provinces for about 4.5 per cent. In 1971 the breakdown of the labour force by sector indicated that less than one-seventh of the employed labour force of the Atlantic provinces was engaged in the manufacturing industry. Some leading industries are listed in Table VI. Because of the relatively small scale of these industries, it would not require the creation of too many new jobs in the offshore oil and gas industry to equal the employment levels in some of the existing industries.

**Table VI—Some Leading Industries in the Atlantic Provinces in 1966** (ranked by value of shipments)

	Value of shipments (\$ million)	Number of persons employed*
Food and beverage industry	478.9	26 500
Wood industries	77.1	6 299
Metal fabricating industries	58.8	3 798
Electrical products industries	30.2	1 997
Miscellaneous manufacturing industries	11.6	969
Industries for which data cannot be published†	323.9	11 474
<b>Total</b>	<b>1 400.5</b>	<b>72 930</b>

\*Employment includes supporting workers in aggregate for manufacturing total activity.

†Data drawn from the 1969 DBS Annual Census of Manufacturers were either considered confidential or were non-available for the following: textile industry; knitting industries; paper and allied industries; printing, publishing and allied industries; primary metal industries; machinery industries; transportation equipment industries; non-metallic mineral products industries; petroleum and coal products industries and chemical and chemical products industries.

Source: Atlantic Development Council, *A Strategy for Economic Development of the Atlantic Region*. 1971-1981, Fredericton, 1971.

As has been the case in the rest of Canada, it has been the *service industries*, rather than manufacturing, that have expanded proportionately in the Atlantic provinces as the agricultural sector has declined. The service sector was estimated, in 1971, to have accounted for 344 000 of the Atlantic provinces' employed labour force – three times the size of any of the other sectors and almost 54 per cent of the total. Growth of the main components of the service sector in the 1950s and the 1960s is indicated in Table VII.

In the Atlantic provinces, strong growth of the service sector, particularly in the 1950s and early 1960s, appears to have been associated with the rapid expansion of government services, both federal and provincial.

Table VII—Employment in the Service Sector in the Atlantic Provinces

	Percent of total labour force, 1951	Percent change 1951–61	Percent change 1961–68
Trade	13.3	27.2	23.5
Finance, Insurance and Real Estate	1.4	58.9	39.6
Community, Business and Personal Services	13.7	41.5	37.2
Public Administration and Defence	7.4	76.7	16.2*
<i>Total Services</i>	<i>35.8</i>	<i>44.2</i>	<i>29.4</i>
By province:			
Nova Scotia	39.4	42.9	26.2
New Brunswick	33.5	50.5	23.9
Prince Edward Island	29.7	29.4	26.3
Newfoundland	33.5	41.7	46.9

\*Does not include non-civilian defence personnel.

Source: Atlantic Development Council, *A Strategy for Economic Development of the Atlantic Region, 1971-1981*, Fredericton, 1971. p. 82.

Transfer payments and equalization grants, aimed at providing for this area a level of government service approximating that available to citizens in other parts of Canada, generated rapid increase in government employment in the area and in activities supported by government funding. The pattern for the 1950s and 1960s reflected the impact of three forms of federal financial support for government and social services: first, the support, via undifferentiated transfers, for general increases in provincial governmental activity, and hence for increases in employment in the public service; then, from the mid-1950s on, for expansion of educational services, particularly at the postsecondary level; finally, in the late 1960s, for health-care and related community services. Although this general pattern may be discerned in other regions of Canada, it was particularly significant in the Atlantic region, where provincial funding *per se* would not have allowed activity on the scale that was actually mounted, and where federally-channelled redistribution of tax revenues was crucial in each phase of development.

Historically, and in the last decade as well, the economy of the Atlantic provinces has been significantly oriented to exports. In 1969, 20 per cent of the Gross Regional Product, approximately \$802.1 million, was accounted for by exports from the Atlantic provinces to foreign countries. Approximately 66 per cent of exports during the 1965–1969 period were directed to the United States (\$351 million in 1965, \$520 million in 1969); 10 per cent to the United Kingdom (rising to 12.9 per cent in 1969); almost 10 per cent to the countries of the European Common Market; and 6 per cent to the Caribbean and South America (4 per cent and 2 per cent respectively). The overwhelming majority of exports – over 80 per cent – was accounted for, during 1965–1969, by primary products. Ranges for the 1965–1969 period were as follows:

Forest products	33–41 per cent
Minerals	24–36 per cent
Fish products	16–19 per cent

The export position of the Atlantic provinces is based primarily on a few commodities. Thus, from 1965–1968, about 25 per cent of the total value of all exports was accounted for by iron ore shipments from Labrador

(valued in 1968 at \$185.8 million; in 1969, this dropped to \$125.9 million, 16 per cent of total exports, due to a strike). Another 20 per cent of total exports was accounted for in 1969 by shipments of newsprint (valued at \$169.3 million) while some 14 per cent of the total was attributable to woodpulp exports (\$115.6 million). Thus, in a normal year, close to 60 per cent of the value of the Atlantic Provinces' exports (12 per cent of Gross Regional Product) would have been accounted for by the export of iron ore, newsprint and pulp. In this respect, the Atlantic provinces are in a position somewhat analogous to that of countries which are heavily dependent for export earnings on a few commodities subject to short term swings in international demand.

#### *Some Features of the Socio-Political Life of the Atlantic Provinces*

Social stratification and the patterns of influence in the Atlantic society have undergone important changes in recent years. With the decline of traditional sources of influence such as the local clergy and the shift from rural to more urban centres, secular values have become almost as significant in the region as in the rest of Canada. While urban values are not as dominant as in central Canada, they are appreciably more dominant than they were a generation, or even a decade, ago.

By and large, the absence of significant manufacturing centres conditioned the kind of middle class that developed. The middle and upper-middle classes in Atlantic society have usually consisted of people from two sectors: the professions, particularly law and medicine, and the more prosperous merchant group. The former is maintaining its influence, while the latter appears to be declining in influence as new groups emerge. The emerging groups reflect the injection of public funds into the building up of governmental and social services over the last two decades. Civil servants are becoming more numerous, more highly professionalized, and more influential. Also in recent years, rising salaries, improved job security and numerical expansion have contributed to the emergence of educators as part of an increasingly influential new class of articulate bearers and moulders of opinion and expertise. The influx of technical and managerial personnel associated with offshore oil and gas developments and other newer economic activities could prove very important in completing a transition from the more traditional structure of the Atlantic society and from the older patterns of influence.

The changing social stratification also reflects changes in political patterns. For the region as a whole, the prevalence of interpersonal aspects of politics and the dominance of relatively few prominent political personalities seem to be more significant than in most other parts of Canada. Political leaders have tended to build up their own personal political machines, and the party systems have tended, at least until recently, to be less professional and more interpersonal in character than in many other parts of North America.

Within the region, there is some variation in this characteristic. In Prince Edward Island and in Newfoundland interpersonal and prominent leadership has clearly been dominant. In Nova Scotia, the pattern is mixed; it might, perhaps, be characterized as one where regular political structures

have tended to form and reform around dominant interpersonal relationships. Only in New Brunswick is the political system highly structured, with personalities tending to be subordinated to the structure of political parties and governmental operations.

Until very recently, this system of personal (sometimes paternalistic) partisan politics tended to dominate the process of government, the civil service was relegated to a less significant position vis-à-vis the policy process. In the last few years, the numerical strength and quality of the civil service has made significant gains throughout the region. This is leading to increased routinization of everyday government via the civil service, rather than through the political machinery. The opportunity exists in some provinces for younger, technocratic civil servants to play a significant role in discrete areas of policy (e.g., the mineral resources field) by establishing closer relations with the responsible political figures than would be possible for individuals of their age and rank in many other jurisdictions.

In terms of political style, the system of locally-based, face-to-face political activity was dominant in the Atlantic Provinces until a relatively late date. Media influence (particularly television) and "professionally-styled" campaigning began to become evident in Canadian federal politics in the late 1950s and became dominant by the late 1960s (particularly in the 1968 election campaign). In Atlantic Canada, the decisive shift to media-intensive professionalized campaigning occurred with the elections of 1970 and subsequent years. In part, this may have been aided by the lowering of the voting age throughout the region and the emergence of voters and younger politicians less encapsulated by their immediate local environments and more in tune to the general media-oriented lifestyles of younger North Americans.

Because of lags in economic development, the Atlantic Provinces have tended to lack the kind of technological and social delivery systems that are a concomitant of much of industrialization and social modernization. In the absence of these economically-rooted systems, the political system *per se* has come to bear more of the burden of the primary delivery of goods and services to the population. That is, it acts as a mediator between public wants and available resources. It has had to face little competition (except, perhaps, from the local religious structures which, for the last decade or more, have been in decline). Across the whole range of activities, from various forms of patronage to regularized and institutionalized programs, government has played a more highly functional and significant role in the life of the Atlantic Provinces than almost anywhere else in Canada. At the same time, because of the highly personal style of politics, access to government has tended to be non-routinized, that is, it has meant relatively easy access to, and reciprocal relations with, politicians. The relationship between citizen and politician has tended to be an intimate one, at least until recently. As changes occur, two phenomena may be noteworthy: some degree of antipathy towards, or suspicion of, institutionalized programs operated by civil servants of a technocratic stripe may reflect awareness of just how much these arrangements constitute a move away from the traditional way of doing things; and insofar as offshore oil and other developments lead to the introduction into the Atlantic Provinces of new

capabilities, new non-political (or only partially political) delivery systems, and new and more technocratic leadership, they will tend to cause further displacement and conflict vis-à-vis the rooted political lifestyles.

While the political delivery systems remain important, there is at the same time another tradition throughout most of the Atlantic region whereby government is treated with a certain amount of reserve by the individual. Precisely because of traditional dependence on government decision making, and because of a folk heritage where government has been associated with major restrictive policies (e.g., resettlement and land tenure in the 18th and early 19th centuries) and with varying degrees of favouritism, there is some degree of suspicion of almost any type of government policy that is announced. In short, there is a persistent ambivalence with regard to government and its role, and it is against this ambivalence that the politicians and civil servants must struggle whenever – as will be the case with offshore oil and gas – major governmental programs for development and social reform have to be launched.

The economic position of the Atlantic region, their traditions of local “delivery system” and interpersonal politics and government, and the heritage of the past with regard to Confederation tend to be projected onto the field of federal-provincial relations. If economic conditions place great emphasis on the need for government policy to redress gaps in the intrinsic economic situation, and if the political system within each province functions for want of economically rooted delivery systems that are fully operational, then the Federal government is regarded as part of a major delivery system, a delivery system taken to a higher degree. Consequently, federal-provincial relations are viewed in a context which places priority on shrewd and tough bargaining on an ongoing basis, rather than on rationalization over the long run or on constitutional issues *per se*. Since the days of the “better terms” offered to Howe, Maritimers have tended to view Canadian Confederation, in its economic dimension, as highly malleable or (to change the metaphor) as a game where almost anything goes around the bargaining table and where there are few fixed rules. With considerable success and panache, their representatives have managed to play a rather good hand in the Confederation poker game – even in the absence of any really good cards. One can only wonder what the situation will be when and if they in fact have resources that can be deployed in the bargaining situation.

### *Synopsis*

Several points must be kept in mind regarding the economic and socio-political contexts of the Atlantic Provinces.

1) Some traditional sectors of the economy (e.g., agriculture, inshore fisheries) continue to decline in significance. It is predicted that employment in the primary sector will decline by approximately one-third throughout the 1970s. Would the most viable part of the fishing industry, offshore fishing, be adversely affected if these fishermen seek employment on offshore drilling rigs?

2) The manufacturing industry has lagged behind that of the rest of Canada and remains weak. Will an underdeveloped manufacturing sector

be able to benefit as much as it might from oil and gas development?

3) The Atlantic Provinces are heavily dependent for export earnings on a few commodities subject to short-term fluctuations in international demand. Will offshore petroleum alter this situation significantly?

4) As has been the case in the rest of Canada, it has been the service sector, rather than manufacturing, that has grown. Some growth of the service sector appears to have been associated with the rapid expansion of governmental services. What new governmental services will be required if there are significant commercial developments offshore?

5) Emerging groups (e.g., civil servants, educators, managers) are changing the traditional patterns of influence. Would the influx of technical and managerial personnel, associated with oil and gas and related developments, accelerate the transition from more traditional to more secular values in Atlantic society?

6) With the increasing number and quality of civil servants, the more traditional system of personal, sometimes paternalistic, partisan politics which tended to dominate the process of government is starting to evolve towards a "mixed system" where civil servants are playing more significant roles in policy making. How effective can personal, partisan politics which still dominate be in guiding offshore developments?

7) There has been a lack of technological and social delivery systems (e.g., health care, transportation, construction) geared to the scale of activity in the Atlantic Provinces. Such delivery systems which tend to be national in scope are often ill-adapted to meet regional needs. What kinds of delivery systems are needed in order to ensure successful exploitation of offshore resources?

8) Given the success over time with which the Atlantic Provinces have been able to negotiate better terms within Confederation, what new leverage in the bargaining situation would be brought about if significant reserves of oil and gas are discovered offshore?

The above are but a few of the elements of the complex economic and socio-political systems operating in the Atlantic Provinces. They are listed here for illustrative purposes only. Although it falls outside the scope of the present study, we believe that it is essential in any technology assessment to integrate as many elements as possible into some framework in order to obtain an understanding of the underlying processes at work in a society. It will then become possible to better appreciate what could be the consequences of introducing a new technological capability in that society. Without some appreciation of *context*, technology assessment studies will be of very limited value indeed.

### **The Future**

More than sixty wells have been drilled in the East Coast offshore since exploratory drilling began. While there have been encouraging finds to date, no commercial volumes of oil and gas have been encountered so far. This could be thought of as a disappointing result. However, in the North Sea, it has taken 400 exploratory wells to find six commercial gas fields and about ten exploitable oil fields, for an overall success ratio of 1 in 25. Even this is considered to be an extremely high success ratio compared

with most sedimentary basins in the world.<sup>28</sup>

Some members of the petroleum industry believe that the East Coast offshore has all the ingredients of a good petroleum region. This, combined with the changing international situation described earlier, should mean that exploratory drilling will continue – at least for the next few years. This activity will entail the minimum work obligation expenditures shown in Table VIII, assuming that none of the permit holders relinquish their acreage. Total exploration work obligations represented by offshore permits issued thus far off the East Coast, assuming all were to be held to the full term, approach \$1 billion.

**Table VIII—Estimated Permit Work Obligations from 1972 to 1975**

	Scotian Shelf		Gulf of St. Lawrence		Grand Banks		Coast of Labrador		Total
	\$ Million	%	\$ Million	%	\$ Million	%	\$ Million	%	\$ Million
1972	15.0	32.6	5.0	10.9	22.0	47.9	4.0	8.7	46.0
1973	16.0	28.1	7.0	12.3	26.0	45.6	8.0	14.0	57.0
1974	20.0	25.6	10.0	12.8	34.0	43.6	14.0	18.0	78.0
1975	20.0	23.0	12.0	13.8	39.0	44.8	16.0	18.4	87.0
<b>Total</b>									
<b>1972-1975</b>	<b>71.0</b>	<b>26.5</b>	<b>34.0</b>	<b>12.7</b>	<b>121.0</b>	<b>45.2</b>	<b>42.0</b>	<b>15.7</b>	<b>268.0</b>

*Source:* E.I.U. Canada Ltd., *The Impact on the Regional Economy of Eastern Canada Resulting from the Potential Development of Off-shore Oil and Gas*, Summary Report prepared for the Departments of Regional Economic Expansion and Energy, Mines and Resources, April 1972.

Of course, only a commercial discovery would ensure a long term development which could have a significant impact on the Atlantic Provinces – and Canada. Some appreciation of the extent of the impact can be obtained by looking at the activity which has developed following commercial finds in the North Sea, an area not unlike the Atlantic offshore with regard to climate, supply and service requirements and access to important markets. The discoveries to date in the North Sea (i.e. five billion barrels) compare with the fields at Prudhoe Bay, Alaska. It has been estimated that about £5 000 million (\$12.5 billion) will be required to finance the development of oil production in the North Sea over the next ten years, and at the height of the exploration program during the next two years, £300 million (\$750 million) will be spent annually by the industry on services and supplies.<sup>29</sup> The importance of this venture becomes clearer when these numbers are compared with a total capital investment of £2 157 million in the U.K. manufacturing industry in 1971. These large expenditures are needed to develop an offshore area where the proven reserves still amount to only one per cent of Middle East reserves.

Opportunities have been seized by Europeans. The Dutch have built over 95 per cent of the platforms installed to date in the North Sea, together with many supply boats, cranes and barges. The Norwegians have established their own drilling and seismic companies and have designed offshore platforms. The Norwegian Government has developed plans and has insisted throughout the granting of concessions and contracts that Norwegian companies and suppliers be involved.<sup>30</sup> By contrast, the British have been slower to respond but are now becoming increasingly involved in the offshore industry. Emphasis in the U.K. has apparently

been on getting the oil out rapidly without worrying about who does the work, and thereby saving foreign exchange and becoming less dependent on the Middle East.<sup>31</sup>

Regional impact is felt largely around supply and services centres. In Norway, for example, much of the regional impact has been felt around Stavanger, a city with a sheltered deep-water anchorage and a tradition of shipbuilding and located strategically close to the Ekofisk field. As the new activities have created new jobs and pushed up wages in certain sectors (e.g., welders), land prices have increased and there is a housing shortage. In the U.K., Aberdeen has become the centre of the supply industry. Over 100 exploration, production and servicing companies have set up bases in Aberdeen. Here also, housing prices have increased rapidly and Aberdonians are increasingly becoming aware of the threat to their environment when production begins. It has been estimated<sup>32</sup> that about 2 800 people in Northeast Scotland are employed directly or indirectly by the oil business; by 1975 the total should be nearer 10 000. Furthermore, Scotland could get as much as \$2.4 billion of oil company capital spending during the next decade, plus a further \$1.2 billion in operating expenditures, which could create as many as 110 000 new jobs.<sup>33</sup> Better government controls and planning in Norway than in Scotland seem to have led to a more orderly development in the Stavanger area than in the Aberdeen area.<sup>34</sup>

A sizeable commercial find off Canada's east coast could result in analogous developments in the Atlantic Provinces providing that steps are taken to ensure that benefits are made to accrue to Canadians. An estimate prepared by Shell Canada of the goods and services required for development of an oil field off Nova Scotia is given in Appendix C. The petroleum industry does not think that local manufacturing concerns can meet the total potential demand, particularly in the early stages of development, because of the specialized nature of the oil industry and the heavy investment which would be required. But they maintain that a viable local industry could be established over time. One petroleum company executive suggested to us that eventually 30 to 50 per cent of direct expenditures surrounding an offshore development could stay in the Atlantic Provinces providing they are competitive.

The regional impact of offshore oil and gas development, if it occurs, is likely to be sharply differentiated among the various sub-regions in the Atlantic Provinces. Oil and gas development is less likely to operate alone in this direction than as an *additional factor* strengthening trends that are already discernible – particularly the emergence of growth centres. The areas most likely to be affected by current and future developments are the following:

- Halifax, N.S.: accelerating growth and consolidation of its position as the dominant financial and administrative centre, not only for the Maritime core, but also for the region as a whole. Halifax's dominance is facilitated by a number of considerations: the existence of a relatively strong and growing legal and managerial cadre, major research and development facilities, better transportation and communications links, better amenities to attract and hold corporate and professional personnel.



- Strait of Canso Area: potential major industrial development (e.g., pulp and paper, petroleum refineries, deep-water port facilities). Offshore petroleum development could lead to petrochemical and industrial complexes.
- Moncton, N.B. Area: spill-over effect from Halifax, Canso and offshore activities. Moncton is the transportation hub of the region. This is dictated by the spatial configuration of the Maritimes and by earlier historical patterns in the development of railways and highways.
- St. John's, Nfld. Area: intensification of the tendency for population growth in the area and likely mushrooming of industrial and onshore support activities for the offshore petroleum industry.

Growth in a few centres will also bring into these centres qualified labour, technicians and managerial personnel from other parts of Canada and from abroad. This can be considered a gain. On the other hand, areas such as northwestern New Brunswick, parts of Prince Edward Island or Cape Breton, and much of Newfoundland could be left in much the same position as they were before the onset of growth in the favoured centres. Would this form of differentiation lead, in the long run, to greater fragmentation in the Atlantic Provinces and frustrate attempts at rationalization?

### **Summary**

Changes in the world energy situation, the rise of associated political and economic uncertainties (e.g., the Middle East), and advances in technology make it commercially worthwhile to consider exploitation of offshore oil and gas in the Atlantic Canada regions.

While exploration permits have been issued since 1960, it is only since the late 1960s that the exploration activity has been attracting the attention of an increasing number of parties. Accelerating offshore exploration activity is bringing to a head a number of issues such as the offshore jurisdictional dispute between the federal government and the governments of the Atlantic Provinces, the adequacy of existing regulations governing energy resources development, and the possibilities for associated industrial development in the Atlantic Provinces in particular and Canada in general – that is, issues which surround the development of an indigenous technological capability.

In the next Chapter we will analyze these developments in terms of the concept of Technology Assessment System described in Chapter I.

### III. Analysis of the Technology Assessment System

## Introduction

In this chapter we propose to further clarify the ideas set out in Chapter I by applying them to a concrete example, the information base which is detailed in Chapter II. From the outset, a distinction has been drawn between the informational and the decision-making aspects of technology assessment. It is our intention to keep these aspects analytically separate in what follows although it is recognized that in practice the two exist in a kind of symbiotic relationship: information influences decision making, but the perspectives of decision makers dictate what information shall be collected or considered as relevant. Further, we recall that technology assessment has been described in terms of the ability of a given set of actors to guide the application of a technology with respect to its internal and external consequences. (See Chapter I, p. 34.) On the other hand, the set of actors comprises the technology assessment system – those social groups which are (or should be) concerned with developing a given technological program. Technology assessment, as we have defined it, refers to an ideal form of activity; it is a statement of what some may like rather than of what is. The technology assessment system refers to those groups which are drawn by mutual interests into controlling the development of technology and, because each group reflects specific interests, the ideal of total, rational control is unlikely to be reached. Therefore, the question to be met and dealt with in this chapter and the next concerns the degree to which the technology assessment system approaches, or can be made to approach, the ideal form of activity described in the definition of technology assessment. We will begin by distinguishing the various classes of actors that comprise the technology assessment system and conclude with a discussion of the information that they find available or demand.

Within the technology assessment system it is possible to identify three different classes of actor. It can be argued that we as investigators were also part of this particular technology assessment system, since we could have had some influence on the perception of the various actors. We do not consider ourselves major actors and therefore we will not, for the sake of clarity, include ourselves in the system. The actors are distinguished by their degree of involvement with the development of a given technological capability. The core actors are those intimately and continuously involved in the process of development; they are, if you like, the main actors and there are only a few of these. Less intimately involved are the rather more numerous collection of supporting actors. They may have an interest in one or more aspects of the development of a given technology but, by and large, they affect it only tangentially. This is not to say that at some time during the evolution of a technology one of the supporting actors cannot so intrude into the process as to alter the outcome desired or narrow the range of possibilities available to the core actors. The emphasis, here, is on the *continuity* of concern rather than on the *likelihood* of concern. A further group of actors – ones important to the ideal of technology assessment – are those that *should be* but are not involved in the technology assessment process. It is one of the expressed aims of technology assessment to canvass as wide a range of interests as

possible and at least some of these may be expected to be sufficiently large to affect the path of technological development but not politically organized. The problem is how to involve these groups more closely.

These three main types – the core actors, the supporting actors and those that should be but are not involved – comprise the technology assessment system. The system itself is supposed to have no specific goal other than that derivable from the decisions of the actors themselves. (This conforms to Lindblom's definition of good decisions as those with which the decision makers agree.) As a first approximation, we assume that the goals of the technology assessment system are describable as a combination of the individual goals of the core actors. The goals of the technology assessment system need not be static but may alter as new information and new actors enter the technology assessment system.

Individually, the actors are presumed to behave according to the mixed-scanning model of decision making. (See Chapter I, p. 32.) Accordingly, each actor is concerned with the degree to which he is being successful in attaining his primary goal, such as producing petroleum at a profit large enough to satisfy his Board of Directors, and he evaluates his success in attaining his secondary goals in terms of, or with respect to, his primary goal. In the event that things are proceeding satisfactorily one might expect that no new initiatives would be likely to result. On the contrary, according to Etzioni, the decision maker scans his horizon looking for both problems and opportunities which, if identified, are monitored continuously. It is possible that one or more of these developments will come to be of sufficient importance to constitute a major change in policy relative to the primary goals. Such a policy initiative has been referred to previously as a "fundamental decision" and it may provide the context for a whole range of subsequent incremental decisions. It is, at least partly, through this scanning function that individual actors become aware of the need for information. New studies may be commissioned as a result of the identification of a new problem or opportunity. The information thus collected, if it is circulated, may have the effect of attracting the attention or changing the perspectives of other actors involved and so lead to fundamental decisions at points quite far removed from the original inquiry.

In what follows, we propose:

- to introduce the actors comprising the technology assessment system concerned with offshore petroleum exploration;
- to describe the nature and degree of their involvement in the technology assessment system;
- to relate their activities to the concept of technology assessment; and
- to illustrate the role that information plays in the technology assessment system.

## **The Actors**

The technology assessment system – defined as those social groups which are (or should be) concerned with the development of a given technological program – was identified and structured, gradually, through a series of

interviews carried out in the federal and provincial governments and in the petroleum industry. Since the issues surrounding exploration for, and the possible exploitation of, the petroleum resources off the coastlines of the Atlantic Provinces have received a good deal of attention in the press, we were able to obtain information about and eventually meet with other actors not included in the three sectors mentioned above. By asking each actor to describe the individuals and groups with whom he was normally involved we were able to piece together a mosaic consisting of a number of actors more or less concerned with exploration and the eventual exploitation of potential oil reserves. As not all the actors were involved to the same degree, they were classified according to intensity of involvement as core actors, supporting actors, and actors who were not as yet but should be involved (in our opinion as well as those of some of the interviewees).

The core actors in the technology assessment system effecting petroleum exploration off the Atlantic coast are

- 1) the petroleum industry
- 2) the Federal Government Department of Energy, Mines and Resources (EMR)
- 3) the Provincial Governments of the Atlantic Provinces.

It is perhaps worth noting that, although each of the Provincial Governments has a department concerned with the exploration and exploitation of natural resources, the focus of debate and discussion has seemed to us to originate at the level of the Premier's office; this accounts for the rather broad designation in 3) above.

We have also identified a large supporting cast. These are actors, such as those discussed in Chapter II, whose activities, although related to developments of Canada's east coast, are not central to the evolution of the petroleum exploration program. This does not mean that these actors do not, or could not, have a profound influence on the direction and level of offshore activity; it is only that they do not appear to be as continuously concerned about offshore exploration as the core actors. These supporting actors include:

in the Federal Government:

- the Department of Regional Economic Expansion (DREE)
- the Department of Industry, Trade and Commerce (IT&C)
- Environment Canada
- the Ministry of Transport (MOT)
- the Ministry of State for Science and Technology (MOSST)

in the industry:

- Halifax Shipyards
- the Independent Petroleum Association of Canada (IPAC)
- the Canadian Petroleum Association (CPA)
- the National Advisory Committee on Petroleum (NACOP)
- the Crosbie Group (the Crosbie Group is composed of Newfoundland businessmen who have carried out some comparative studies of offshore oil exploration).<sup>1</sup>

In addition, one can identify within this group yet other actors who interact from time to time with the above supporting actors. For example,

the universities in the Atlantic Provinces have played an advisory role with respect to both the petroleum industry and the provincial governments; oil companies have consulted with and entered into joint research programs with such groups as the Bedford Institute and the Nova Scotia Research Foundation; the Supreme Court of Canada gave an advisory opinion in 1967 concerning the ownership of offshore resources (Chapter II) and the Federal and Provincial Governments have met from time to time at ministerial and official levels to discuss the jurisdictional situation and set guidelines for the administration of the exploration and exploitation of natural resources.

There is also a number of groups which should be concerned with the development of offshore petroleum exploration and exploitation. The fishing, agriculture, forestry, and recreation industries, for example, could well be disrupted by acceleration of developments offshore. The fact that these groups were rarely mentioned during the interviews does not mean that the impact of the development of petroleum resources off the East Coast Continental Shelf could not, one day, have a profound effect on these sectors. It seems, rather, to suggest to us that at this point in time and at this level of exploration activity these groups are not perceived as being of primary importance by the actors interviewed. From the point of view of technology assessment, of course, this could be an important oversight – what we refer to as a “blind spot” in the technology assessment system. We will return to discuss this aspect of technology assessment in Chapter IV.

In summary, we have identified three types of actors, classified according to whether they interact strongly or weakly in the technology assessment system concerning the exploration for and exploitation of petroleum off the Atlantic coast. At the core we find a few actors whose objectives are closely tied to the development of a technological capability in petroleum exploration and exploitation. Among these actors there is a strong interaction. Moving out from the core of the technology assessment system we have identified a much larger group of supporting actors whose individual objectives are related to some aspects of the development of the technological capability. These actors interact more or less strongly with the core actors depending on the developing situation but are usually only loosely coupled to one another. These actors may from time to time involve still other actors in an advisory capacity. Finally, there is the third group of actors, those who should be involved in shaping the development of the technological capability but who for some reason, varying from lack of awareness to lack of effective organization, are unable to take part in the technology assessment system.

All of these actors constitute the technology assessment system – a system whose operation, as we have explained may be investigated using a “mixed-scanning” model of decision making. To the illustration of this operation we now turn.

## Decision Making in the Technology Assessment System

### The Core Actors

An analysis of the material gathered through interviewing suggests that the operation of the technology assessment system can be described in terms of a few fundamental decisions made among the core actors. These decisions have set the stage and the subsequent evolution of policy has proceeded incrementally. Of the three core actors previously identified, the petroleum industry itself has been the most active in stimulating the development of a technological capability with respect to the petroleum reserves on the continental shelf off Canada's Atlantic Provinces.

Each company in the petroleum industry is concerned to maximize or, at least, optimize the return on its investments in petroleum exploration and exploitation. As business enterprises then, oil companies must be judged on their ability to achieve their stated objectives and any action they may take will be intelligible only from this perspective.

Nonetheless, the job of discovery is difficult and all oil companies are continually scanning for geological opportunities. This scanning is carried out nowadays on a global scale with a considerable degree of secrecy. Yet all geological opportunities are related to geography which, in turn, involves technologies, economies and politics. The geological opportunities that the oil companies seek are, ideally, those (1) that are easily available technologically (i.e., within the technological capability of the industry; (2) that are relatively cheap to handle and deliver; and (3) that lie within the bounds of stable political regimes which, again ideally, allow the firm to get on with its task of extracting the resource. Needless to say it is a rare event for a firm to find resources exhibiting all of these conditions simultaneously. The situation is further complicated by the fact that, despite attempts at secrecy with regard to geological information, an increase in exploration activity in one area of the world is apt to have the effect of inducing other major oil companies to behave likewise. This phenomenon is referred to by some members of the petroleum industry as the "herding instinct".

Thus, in the late 1950s, this procedure of scanning Canadian geological prospects took Mobil Oil of Canada to the Sable Island area. The technical surveys looked favourable and Mobil, consequently, took out exploration permits in 1960. We consider this decision by Mobil Oil to be a *fundamental* one because not only did it represent a major investment initiative on the part of the company but it also made the Atlantic offshore a new focus for petroleum exploration activity. The other major oil companies reacted quickly to the Mobil Oil initiative and by the late 1960s most of the Scotian shelf, the Grand Banks and Georges Bank were under permit. It is difficult to know whether to class these subsequent investment decisions by other petroleum companies as fundamental ones. From the point of view of the firm it certainly has involved a major commitment of resources and it is explainable, at least partly, as the result of the scanning procedures of the individual firms. But from the point of view of the technology assessment system, the chain of investment decisions appears to have been initiated by Mobil Oil. Thus it appears reasonable to inter-

pret the process of placing large sections of the Atlantic continental shelf under permit as being a series of incremental decisions occasioned by the prior fundamental decision by Mobil Oil.

As mentioned in Chapter II, there are work obligations tied to the holding of permits. These obligations increase annually and the cumulative cost approaches \$2.70 per acre over the full twelve-year life of a permit. Thus, from about 1968 onwards, it became possible to predict with a fair degree of accuracy the level of activity which is now observable off the coastlines of the Atlantic Provinces. The oil companies, once committed, have had to make a large number of incremental decisions regarding the structure of their respective exploration programs (e.g., undertaking and analysing seismic work, leasing exploration rigs) in order to keep in good standing with respect to their obligations.

Of course these incremental decisions regarding exploration programs will eventually lead to other fundamental decisions. The petroleum companies will have to decide at some time in the near future whether to go into the development and commercial production phases with regard to this geological area. This decision will not be an easy one to make. Mobil Oil, for example, has discovered sizable, though as yet apparently not commercial, quantities of gas around Sable Island and has recently applied to have its permits converted to leases. Since they were the first to take out permits the questions of whether to remain in the area and at what level of activity must be a matter of critical decision for them. But not for them alone. A decision by Mobil Oil in the next few years will surely result in a major change in the east coast activity because, as we have pointed out above, the petroleum companies continually monitor each other and it is not too pessimistic to suggest that with withdrawal of one or two of the major companies the remainder could easily follow. On the other hand, a decision to proceed with commercial development will entail the further commitment of large scale resources and raise in a serious manner the prospect of significant socio-economic repercussions on the Atlantic Provinces in particular and Canada in general. Either way there will be a basic re-orientation of activity in the not-too-distant future.

This brief description of the involvement of the petroleum companies in the east coast offshore exploration activity is sufficient, we hope, to justify our assertion that among the core actors of the technology assessment system the pace of development has been dictated largely by the petroleum companies.

Nonetheless, as we have explained, the petroleum companies have been, from the outset, operating within a set of regulations administered by the Federal Department of Energy, Mines and Resources (Appendix A). Indeed, from the point of view of the technology assessment system the direction of the development of Canada's offshore resources is, in large part, explainable in terms of a dialogue between EMR and the petroleum industry.

The regulations under which the oil companies undertook to explore the east coast continental shelf are comparatively free of restrictions in terms of how much acreage a given firm can put under permit and in terms of how much of the activity can be carried out using foreign technology



and supplies and so on. Historically, the reason for this derives from the fact that the regulations for offshore exploration were drawn up to *encourage* companies to explore the Arctic regions of Canada which were considered to be a harsh environment.<sup>2</sup> Since the early 1960s there has been concern that the regulations are too “easy” for the east coast (southern) offshore environment and that they should be changed to ensure that maximum benefits accrue to Canadians. More recently EMR has been involved in drafting a new set of regulations. A comparison of regulations in selected countries is given in Appendix D. The new draft regulations have been circulated among the oil companies. They have made their views known through the Canadian Petroleum Association (CPA), the Independent Petroleum Association of Canada (IPAC) and through the National Advisory Committee on Petroleum (NACOP), a group of ten senior executives from the petroleum (and related) industries who meet, from time to time, under the chairmanship of the Minister of EMR. It remains to be seen if these new regulations, when and if they come into effect, will constitute a fundamental policy decision. Will the regulations lead to a profound restructuring of the “rules of the game” or will they reflect incremental changes from the existing regulations? There are indications that the changes could very well be incremental.<sup>3</sup>

From the point of view of its objectives, EMR is attempting to administer a policy of rational development of Canada’s natural resources. As such it is in a position to strongly influence the *rate* of development of these resources by making it more or less difficult for the exploiting agencies – in this case private industry – to operate in Canada. Historically, Canada has represented a paradigm of the politically stable society, the kind the oil companies prefer to deal with. To drastically alter the terms of reference of the regulations, now that the petroleum industry has committed its resources, would be for Canada a significant departure from previous practice. It was clear from the interviews that the petroleum industry, while recognizing that in many countries their traditional freedoms are being curtailed, would be somewhat dismayed at the prospect of changed regulations in Canada. On the other hand, the Federal Government is not entirely free to *impose* any regulations. Since there have, as yet, been no major shows of oil or gas a unilateral act on the part of the Government of Canada could result in the departure of the oil companies from the continental shelf.

This in itself might not be a bad thing. After all, there is a considerable body of opinion in Canada which would prefer to slow down the pace of exploration and exploitation and wait for world oil prices to rise, thereby conferring greater economic benefits on the nation. Such a policy would be more viable were it not for the interests of the third group of core actors: the governments of the Atlantic Provinces. The objectives of these governments are clearly multiple but, from the point of view of their role in the technology assessment system, they perceive the exploitation of the oil potential to be one way of converting the Atlantic Provinces from “have-nots” to “haves” economically and they would like to influence events in this general direction as quickly as possible. Consequently, even though the ownership issue remains unsettled, the provincial governments

have insisted that the oil companies take out a duplicate set of exploration permits with the appropriate provincial government departments. In addition, the provinces have been maintaining a closer liaison with the Federal Government over the administration of the Canadian Offshore Regulations. For example, the present government of Newfoundland is claiming full ownership and jurisdictional rights over the resources of the adjacent continental shelf and has informed the oil companies that it will not be bound by agreements made with the previous government. Therefore the oil companies, too, have to become directly involved with the provinces. Postures like these – for at the present time they are only postures – could lead to fundamental policy decisions which, in turn, could lead to profound changes in the relationship between the Atlantic Provinces, the Federal Government and the petroleum industry.

We have now completed the introduction of the core actors of the technology assessment system. From the outset in the early 1960s, the system was describable in terms of the goals and objectives of industry and EMR, the latter exercising a regulatory function with respect to the former. More recently, however, the governments of the Atlantic Provinces have become coupled strongly to the technology assessment system, but only time will reveal the degree of their success in controlling the development of an offshore capability in oil exploration, exploitation and production.

It might be useful, at this point, to try to estimate how well the technology assessment system composed only of the core actors could be said to be performing an adequate technology assessment. The petroleum industry will no doubt have carried out its own cost-benefit and investment analysis. The Federal Government has produced a package of regulations which pertain to granting permits and certain safety and environmental regulations with regard to rigs and oil spills respectively. The Atlantic Provinces, although flexing their constitutional muscles, seem preoccupied with the economic consequences in terms of royalties and industrial development which might accrue to them from well developed oil and gas plays. One can say with confidence that not one of the major actors has carried out an overview of the likely long-term economic, social and political consequences of a major oil find, despite the fact that, because of the work obligations attached to the permits, reasonably accurate estimates of the level of activity on the part of the petroleum industry have been available certainly from about 1968 onwards. The technology assessment system seems quiescent and waiting for the necessary impulse to activate it – a major discovery.

### **The Supporting Cast**

While the core actors are striving to influence the course of technological developments, the increasing level of activity in the petroleum industry with respect to the east coast offshore has attracted the interest and concern of a much larger group of actors, those that we have called supporting actors. These groups are characterized by the fact that, while they have an interest in the development of a petroleum handling capability on the continental shelf of the Atlantic Provinces, the development of this

capability does not constitute, directly, one of their objectives. We proceed now, to introduce some of these actors and to indicate the roles they are playing in the operation of the technology assessment system.

The interaction of the petroleum industry with the Federal Department of Energy, Mines and Resources creates the *possibility* of developing a technological capability in the exploration, exploitation and production of petroleum on the continental shelf off the Atlantic Provinces. The granting of permits giving the right to exploration is by itself no guarantee that any technological capability will be developed or that it will be in any way describable as an indigenous or Canadian capability. Since the principal items of hardware contributing to this capability are supply vessels and drilling rigs, it would be possible for the petroleum companies to carry out a full exploration program simply by drawing on the technological capability they already possess by bringing it from other exploration sites to the Atlantic continental shelf.

Prior to the fundamental decision by Mobil Oil to take out exploration permits, Canadian industry possessed considerable technological capability in the design and construction of ships, but no capability in the design and construction of exploration or production rigs. The expertise in this latter area resides largely in the United States. A Canadian capability in rig technology began to emerge in the early 1960s soon after the rush to take out permits on the east coast began. It was triggered by a decision taken within a Canadian petroleum company to buy a rig in which there was some Canadian content. It was this situation that led the U.S.-based SEDCO Ltd. to place a contract with Halifax Shipyards, a company possessing considerable experience in shipbuilding but, at this time, no expertise in rig construction. Because of the circumstances surrounding the decision of the Halifax Shipyards to enter into this new technology, it is difficult to describe it as a fundamental decision. While it has significantly altered the technological expertise of Halifax Shipyards, the decision appears to have been heavily influenced by the presence of another supporting actor, the Department of Industry, Trade and Commerce. The fact remains that Halifax Shipyards have made the transition to a new technology, and from the point of view of the Atlantic Provinces, this decision and the events that have followed it mark the most tangible economic benefits to accrue to them from the as yet undiscovered petroleum reserves.

The involvement of the Halifax Shipyards in rig construction technology would most likely not have occurred without the subsidies from the Department of Industry, Trade and Commerce. To date three rigs have been built and two are under construction. The Department of Industry, Trade and Commerce has had a role to play in the financing of each. Under the Federal Government's current shipbuilding subsidy plan, the structure of the drilling rigs and some of the drilling equipment can qualify for subsidy aid.

The encouragement of a developing capability in rig construction can also be related to Industry, Trade and Commerce's role in developing a Canadian-based ocean industry. The basis of this policy is considerably broader than that of stimulating petroleum exploration, exploitation and

construction and can be seen as the result of a fundamental decision, based on a scan of likely technological opportunities for Canada, taken by the Department of Industry as it then was in 1965. Since the decision was taken to develop an ocean industry, Industry, Trade and Commerce has been trying to increase public awareness of its potential by establishing a trade journal, a trade association and by holding a number of conferences.

However, if the task of stimulating new industries falls within the ambit of Industry, Trade and Commerce, that of overseeing the general economic expansion of the Atlantic Provinces belongs to the Department of Regional Economic Expansion. Since its creation in 1968 it has provided funds to the Atlantic Provinces under a number of programs "to facilitate economic and expansion and social adjustments ... [and] to improve opportunities for productive employment and the access of people to opportunities ...." Clearly, these programs have been more concerned with the problems of economic development in general than with specifically trying to stimulate the establishment of either a technological capability in petroleum recovery offshore or an ocean industry. Nevertheless, the experience of the Department of Regional Economic Expansion over the first few years of its existence served to indicate that of the two principal functions of the Department, a deeper understanding of the economic and social development problems of the underdeveloped regions of Canada was at least as important as the administration of incentive programs. Consequently, in a review of policies released in 1970 more emphasis was given to gathering data about social processes such as migration, education trends and divorce rates. The object of the exercise was to try to find out, using these data, why the various systems and sub-systems operating in the underdeveloped regions of Canada were not functioning as expected. From the point of view of the technology assessment system, this approach represents a significant departure, in terms of investigating external consequences, from single-minded analysis. It appears that with respect to the Maritime side of the review, the investigation began from a study of social processes and then moved to the narrower economic evaluation of a proposed development program.

It is perhaps also worth pointing out that by early 1970 the level of awareness of offshore activity was such that a study of the impact on the regional economy of eastern Canada resulting from the potential development of offshore oil and gas was commissioned by DREE, in part financed by EMR, and carried out by a private consultant. Some of its conclusions have been discussed in Chapter II.<sup>4</sup>

In addition to the interest in Canada's oceans expressed by Industry, Trade and Commerce, one must also consider that of Environment Canada and the Ministry of State for Science and Technology.

From the point of view of the technology assessment system, Environment Canada is concerned with regulating the development of offshore petroleum exploration, exploitation and production so that neither the rigs nor pollution coming from them (i.e., uncontrolled spillage, dumping of wastes, etc.) destroy the environment of the marine life below and the wild life above the water superjacent to the continental shelf. In particular, Environment Canada has prepared analyses of sensitive areas of the east

coast of the Atlantic Provinces. The analyses outline the extent of the larger fishing grounds and the routes along which wild life migrate in relation to the continental shelf and existing drilling operations.

Finally, many of the actors discussed so far, EMR, IT&C, Environment Canada, together with the Ministry of State for Science and Technology, are participants in preparing a Cabinet submission on Ocean Policy. The terms of reference of the task force are primarily addressed to the technological and economic aspects of ocean policy. The task force is future oriented, intending to speculate on the notion of Canadian adequacy in ocean technology in about ten years time. Adequacy in this context is broader than hardware and may include, as well as technological and industrial capability, some social and cultural consequences for Canada of a fully developed ocean policy.

Although it is much too early to even speculate on the possible outcome of the task force submission it does provide a useful point about which to pivot and observe the development of the technology assessment system so far. Looking backwards from 1973, we have seen that the initial system of two core actors which emerged in the early 1960s was extended to three with the later inclusion of the Atlantic Provinces as an important interest in the exploration of the east coast continental shelf. In parallel with this development we have described how various other groups, mainly government, have become more or less closely involved in the technology assessment system so that in 1973 a much wider range of interests is represented. There are other actors – for example, the Bedford Institute who have throughout the period provided both industry and government with specialist analysis pertaining to the ocean and the ocean floor; the Supreme Court which in the middle of our time span contributed an advisory opinion about ownership of offshore resources; the ‘Crosbie Group’, a collection of Newfoundland businessmen who journeyed to the United Kingdom and Norway to compare developments there with those in Newfoundland – who have also become attached, as it were, to the technology assessment system and who are (or will be) trying to influence its further development. It was not felt necessary to enumerate all of these because at the time of writing they were such recent arrivals as to make a judgment about their eventual influence too uncertain.

The point we want to make is that over the twelve-year period from 1960 to 1972, an increasing number of actors with interests in the development of a petroleum recovery capability on the east coast continental shelf has led to the emergence of a broadening perspective about this development. The question about whether this perspective is not only broad enough but detailed enough to constitute an adequate technology assessment is still before us, but we can move closer to the answer if we consider briefly the sorts of groups which fall into the category of actors who *should be but are not* involved in the technology assessment system.

### **The “Should-be” Actors**

At the centre of the activity of technology assessment is the desire to identify medium to long term, unintended, social consequences of the introduction of a new technology. The technology assessment system

which we have been describing is characterized by the fact that, at least at its present stage of evolution, it is preoccupied with the short to medium term, anticipated, economic consequences of technology. The gap between the ideal and the reality might be bridged by a systematic attempt to identify those groups which might be affected, adversely or otherwise, by the application of technology – in this case petroleum technology. Still, the identification is only part of the wider problem of involving these groups in the technology assessment system. As we have suggested above, there are a variety of reasons why these groups haven't become articulate members of the technology assessment system. Such factors as size, political organization, financial resources are, of course, obvious candidates. But more important is the fact that some of these groups do not perceive the need to be more closely involved – perhaps because they suspect that the development of a given technology will affect them only tangentially and at some remote time in the future. The problem at hand then is two-fold: *identification*, an active seeking out of these groups, and their *involvement* in the assessment of the application of technology.

We have identified some large sectors of economic activity in the Atlantic Provinces which we think fall into this category. They include the fishing, mining, forestry, and agriculture industries, and various labour organizations. The offshore fishing industry in particular could be adversely affected if alternate employment of either ships or manpower arising from the establishment of petroleum survey technology were to become established. Yet, in so far as we have seen able to determine, this sector of industry has not become involved to any significant degree in the technology assessment. Why? The answer to this question lies, partly at least, in the inability of this sector to organize itself for its own defence and partly, perhaps the major part, in that no one seems to have the responsibility of seeing that the possible consequences for the Atlantic Provinces' fishing industry are sought out and brought into the technology assessment system. Sensing that there will inevitably be conflicts between offshore petroleum developments and other areas of economic activity, and that there is a need to exert more control over offshore petroleum developments, the Government of Newfoundland has appointed an Off-shore Petroleum Industrial Advisory Council. This Council will consist of representatives from the various Newfoundland industries, from the fisheries, from all levels of government in the province, and from educational institutions and trade unions. In addition, we have identified other groups which should be drawn into the technology assessment system in an advisory capacity. These groups, which include the Institute of Social and Economic Research at Memorial University, the Atlantic Provinces Economic Council, and the newly formed Nova Scotia Resources Council, are all engaged in trying to understand the social and economic processes which constitute life in the Atlantic Provinces.

## **Information for Decision Making**

In the previous sections we have attempted to describe the interplay among the actors who are effecting the petroleum exploration programs off

Canada's east coast and to illustrate some aspects of the decision-making processes involved. Of course, the decisions are based on the information available and this can certainly affect a decision maker's perception of a situation. In this section we propose to outline the types of information concerning the consequences of offshore petroleum development which have been available to the actors in the technology assessment system.

As mentioned previously, the stage was set in the early 1960s for the level of activity seen at present off Canada's east coast. With such a lead time one would think that in-depth anticipatory studies investigating the potential consequences of such a development on the socio-economic life of the Atlantic provinces – that is true technology assessments – would have been undertaken. Yet this was not the case and the few studies which have appeared in the last few years deal only with certain very specific aspects of the situation (e.g., potential reserves, employment, economic potential). Developments off Canada's east coast only became highly visible in the late 1960s when the exploration activity gained momentum. In terms of the mixed-scanning model this would mean that before that time the east coast offshore opportunities were not considered part of the main alternatives being evaluated. However since then, the offshore petroleum potential has become very much part of the scan, and studies have been commissioned or undertaken by various interests in order to better evaluate this potential. Of course, different studies will reflect different perceptions of the situation. For example, the petroleum industry has made studies of the potential offshore petroleum reserves (see Chapter II, Table II). The Federal Government has its own estimates which are somewhat more conservative than those of industry.<sup>5</sup>

In the early part of 1970, representatives from the Federal Government's Department of Regional Economic Expansion (DREE) were scanning their environment to determine what studies they might be involved in. At that time they commissioned fifteen studies in various areas; one of which had to do with the impact on the regional economy of Eastern Canada resulting from the potential development of offshore oil and gas.<sup>6</sup> This study was undertaken in collaboration with EMR. The report states that the direct impact on employment from commercial oil or gas production will not be great. It does concede, however, that commercial production could provide some indirect benefits through the supply of goods and services. This report has been disputed by some provincial officials and industrial representatives.

Recently a group of Newfoundland businessmen visited Aberdeen, Scotland and Stavanger, Norway to look at the impact of North Sea petroleum developments on these two cities<sup>7</sup> and to learn of their experience in order to be better prepared if and when a petroleum strike comes off Newfoundland. The group has issued a report urging that the Federal Government study the Aberdeen-Stavanger situations and that the local community start preparing for the eventuality of a petroleum find offshore.

The collection and analysis of information, such as that done by the actors mentioned above and by others (see Chapters II and III) is undertaken from very definite perspectives. The petroleum industry is interested

in making the case for exploration and exploitation, DREE is interested in regional development, EMR is concerned with the husbanding of resources, the provinces are interested in direct revenue and technological spin-off, and so on. This is normal: each actor sees the situation through his own eyes. The totality of the information gathered and its analysis forms the information base; a base which is continuously changing as new information is collected and analyzed. This is the base on which decision makers in the Technology Assessment System depend. Yet this information base falls far short of comprising a "Technology Assessment" as we have defined the concept (p. 26); this for a number of reasons.

- Most studies are solely concerned with the internal consequences of development; that is, with those effects which offshore petroleum exploration and potential exploitation might have within the sector or area of those responsible for carrying out a given study.

- Little attention is paid to the external consequences; that is, those consequences which offshore petroleum developments could have outside the sector or area of those who are carrying out a given study. For example, offshore petroleum developments, along with other large natural resources development projects such as the James Bay Hydro-electric development project and the Northern Gas Pipeline, will require huge amounts of capital – much of it *must* come from outside the country. Large capital inflows could put some upward pressure on the Canadian dollar thus adversely affecting the manufacturing sector.

- Most studies deal mainly with short or medium term concerns (e.g., employment, revenue). Little is said of the longer term consequences on the Atlantic society, once this activity is firmly embedded in the fabric of that society. For example, who is thinking about what could happen in the long run if two subsocieties emerge in Atlantic Canada: one being in those areas that have benefited from oil and gas developments and the other in those areas that have been left more or less as they were before – or worse off. Could this lead to greater fragmentation?

- The interests of certain groups do not seem to be taken into account. As mentioned in Chapters II and III, offshore developments could have an effect on other sectors of the economy of the Atlantic Provinces. Yet the interests of the fishing, mining, agricultural, forestry, and recreation sectors do not seem to be considered by the actors in any detail.

- The studies do not show the interactions among actors. Hence, they do not illustrate the complexity of social processes in the Atlantic provinces in particular and Canada in general and the conflicts that could arise (e.g., need for foreign labour force vs. national immigration policy, need for foreign investment vs. federal government policy to screen and perhaps to control foreign investment). There is a growing awareness<sup>8</sup> that in order to give adequate advice to decision makers it is essential to have a reasonable understanding of the social and political processes at work in society. Technology assessments not based on such an understanding will be of very limited value indeed.



## Summary

In this Chapter we have attempted to show that the concept of a “Technology Assessment System” is a useful one to illustrate the on-going activity concerning the assessment of the east coast offshore petroleum potential, and that the mixed-scanning model described in Chapter I is a useful decision-making model to describe at least some of the decision-making activity which is taking place.

Since scanning and the evaluation of alternatives are based on available information, and since decisions taken on this basis bring about new information needs, it is difficult to separate the decision-making activity from the information gathering activity; the two activities are inextricably intertwined – each affecting the other. While it can be advantageous and at times necessary to step back from an activity to better assess it, to separate the analysis from the decision making, it must be recognized that decision making is a continuous activity and decision makers will act whether or not they have “all” the information. Since the quality of decision making is tied to the quality of the information, the former will depend on such factors as availability, having the correct information for a decision maker at the right time, and presentation, having the information in a form understandable to the decision maker. We will return to these concerns and discuss them in more depth in the next chapter. They are only included here to illustrate the point that the information gathering activity must be looked at within the decision-making context – not in a vacuum.

As illustrated in the previous section the information base on which decisions are formulated is inadequate. The activity which is taking place within the “Technology Assessment System” cannot truly be called “Technology Assessment” as we, and others, have defined this concept. In the next chapter we will discuss ways of improving on this situation.

## IV. The Effectiveness of the Technology Assessment System

## Introduction

When, at the outset, we raised the question, What is technology assessment? we indicated that it was more a complex notion than is generally supposed. Some of the complexity at which we then hinted, is now manifest. And, hopefully, too, the analytical device of separating the informational and decision-making aspects of technology assessment has suggested that successful assessment depends critically upon their effective integration in practice. However, as we have seen in Chapters II and III, in the case of the development of a petroleum recovery capability on the east coast continental shelf, the technology assessment system does not spring grown into existence but rather seems to be the result of an evolving awareness of the ramifications of the technology. Thus, all the actors in the technology assessment system were not engaged immediately after Mobil Oil took out its initial permits in 1960 but rather they made their appearance gradually as offshore exploration activity increased throughout the decade. It is the evolutionary character of the technology assessment system that prompts the further question about its efficacy. If, after all, it is the objective of technology assessment to guide the rate of development of technology so as to maximize social benefits and minimize social costs, can one rely on the perspectives and interests of individual constituents to raise the relevant questions soon enough to ensure optimization?

As we indicated in Chapter I, the answer to this question depends partly on the choice of a decision-making philosophy which in turn implies a certain orientation toward data collection. In Chapter I, three decision-making models were identified: the rational model, the disjointed incrementalism model and the mixed-scanning model. In the light of our concern with the effectiveness of the technology assessment system, it seems worthwhile to explore further its relationship to each model.

## Comparison of Decision-Making Models

From the viewpoint of the adherents of the rational model, the effectiveness of the technology assessment system will be considered inadequate. Why? Because the rational ideal aspires to a greater degree of comprehensiveness with regard to both data collection and decision making than we have implied in our definition of the technology assessment system. The rational ideal *requires* that agreed-upon goals and objectives be identified in advance and that the actors in the technology assessment system be recognized beforehand and be given the opportunity to prepare and present their cases according to their respective viewpoints. It further presupposes that these presentations would be fully intelligible to each of the actors in the system – that there would be near perfect communication between them. From this position, it would then be possible to analyse the various presentations and investigate the consequences of the various alternatives suggested. Eventually, the various alternatives would be matched against existing constraints and the most viable alternatives acceptable to all actors would be selected. These alternatives would *then* be presented to the decision makers – and given that they are rational men

– the best decision for the common good would emerge: a decision which all the actors in the technology assessment system would accept and help to implement.

While we are in sympathy with the rational ideal, we feel that to separate, from the outset and so starkly, the informational and decision-making aspects of the assessment process would create a situation in which one was continually “getting ready to get ready” and consequently actually hamper the effectiveness of the technology assessment system. Further, it seems to us that the probability of identifying all those constituents who both are and should be involved in a given technological development is slight because many of them, due to the evolutionary nature of technological change as exemplified in the case of offshore exploration, do not perceive that they should be involved until the activity has reached certain levels.

Disjointed incrementalism stands in sharp contrast to the rational ideal: because of the limitations of time, money and the intellectual capacities of individual decision makers, it recognises that decisions have to and will be made in the absence of complete information. Disjointed incrementalism further accepts the fact that in a pluralistic society a certain measure of co-ordination can be achieved even if each decision maker pursues his policies from his own, perhaps narrow, perspective. Thus, the dialogue which exists between the petroleum industry and the Federal Government Department of Energy, Mines and Resources has grown out of the contact that resulted from each pursuing their individual interests. To our knowledge, there has never been an attempt, along the lines suggested by the rational model, on the part of either government or industry to establish, much less implement, any set of ideal regulations with respect to the development of oil on the east coast continental shelf. Still, if disjointed incrementalism is able to create a degree of co-ordination among diverse interests, its principal weakness is that it neglects the fact that fundamental decisions are taken by government and industry as well as by many other organizations; with this model there is no way to account for them. As an example, disjointed incrementalism as a decision-making model seems to us inadequate to explain the positions taken by the Newfoundland Government with respect to the petroleum industry and the Federal Government on the question of the ownership of offshore resources (see Chapter II). Further, from the point of view of the technology assessment system, the model does not lay sufficient stress on the importance of seeking out those actors who are not but should be involved in the decision-making process. As an example of this, the mutual give and take of the core actors in the technology assessment system has, so far at least, failed to involve to any extent either the fishing industry or the municipal governments of the Atlantic Provinces in a decision-making process the outcome of which could affect them directly. The recently formed Newfoundland Petroleum Advisory Council will, supposedly, try to incorporate as many views as possible when it advises the government of that province.

As we have mentioned earlier (Chapter I, p. 32) it was primarily the fact that some of the actors in the technology assessment system make fundamental decisions that introduced the mixed-scanning model of decision

making. We have indicated that such decisions, though not numerous, do provide the context for a larger number of incremental decisions. Secondly, it seems to us that the individual actors, as they scan the horizon with respect to their objectives for opportunities as well as problems, become aware of developments which they feel in their interests to watch more closely and so become active members of the technology assessment system. It is still difficult to show, however, that the scanning mode of operation is effective in drawing in those actors who should be but are not involved in the technology assessment system.

To return to the question posed at the beginning of this section, the operation of a technology assessment system would seem to be at least partially effective in monitoring the development of a given technology. In more formal language, it appears that the technology assessment system, operating in the mixed-scanning mode, has brought together into a loose aggregation the majority of the actors who have some interest in the development of an offshore petroleum recovery capability. Furthermore, their aggregation has caused certain studies to be undertaken and so is, partially at least, striving to collect the data or information it needs for decision making. However, from the points of view of the scope of the information being gathered and of the degree of co-ordination between actors being achieved, the operation of the technology assessment system could be improved in two ways. Firstly, the scope of the information so far generated by the technology assessment system seems to us unnecessarily narrow, limited as it is to immediate internal consequences for the actor concerned (see Chapter III). As a consequence no *overview* relating internal consequences to external consequences is being developed. Secondly, and as a corollary, the lack of the development of an overview has diminished the probability that all the relevant constituencies will be canvassed. This, in turn, has inhibited the establishment of a consensus among the actors as to the most appropriate future course of technological development pertaining to petroleum exploration on the east coast continental shelf. Some improvement of this situation seems possible and will now be discussed.

## Overview and Consensus

The notion of overview requires some clarification because it is too easily associated with generalizations based upon superficial investigations. We have tried to indicate above that the technology assessment system operating in the scanning mode has, at least in the case study described herein, failed to initiate research into the *social* implications of the development of the technology. This lack is crucial because, *from the point of view of technology assessment, it is precisely the extension of analysis to include the social consequences of technology that characterizes its novel element.* Indeed, from the evidence presented above, it would appear that Lindblom is correct when he observes that much of decision making takes place in the absence of complete information and proceeds by making adjustments at the margins of existing policies: the elaboration of an overview being the direct responsibility of no one in particular, none emerges. As long as one is dealing with short term evaluations there is perhaps little danger in adop-

ting this perspective, but if the activity of technology assessment is to have more meaning as an anticipatory policy-making tool an overview cannot be ignored when dealing with longer term problems associated with the development of a technological capability. And since the longer-term implications of technological developments are precisely those which alter the social structure of society, *one of the principal elements in an overview should be to elucidate the existing social processes which might be altered as the technology in question enters more and more deeply into the social structure.* The task is not an easy one, but to avoid it places the decision makers in a position analogous to the town planner who attempts to plan bus routes with no notion of where and how people live.

An overview can be obtained through a variety of mechanisms. However, from the discussion so far, it should be evident that the mechanism chosen to obtain the overview should meet the following criteria :

- It should be credible to the public. Credibility is essential if *all* actors affected by a technological development are to participate.

- It should be independent of party politics. This follows from the previous criterion.

- It should report to the political executive. As mentioned earlier, we should try to improve the effectiveness of the political executive; this accessibility ties information gathering and analysis to decision making.

- It should have adequate funding in order to be able to assess a given technological development in sufficient depth.

- It should undertake the inquiry publicly—it should get *all* the actors involved and should make its findings public.

These points are clarified further in the ensuing discussion.

In Canada, when an issue or state of affairs attracts a certain amount of public concern, the political executive in either the federal or provincial governments may resort to the establishment of a commission or task force<sup>1</sup> to look into the situation. Since this procedure is firmly established in the Canadian political system and since it meets the criteria outlined above, it might provide one relatively easy and effective vehicle for generating the social awareness and much of the information that is a prerequisite for the development of an overview. In fact, the expressed intent of certain commissions and task forces seems to approach our concept of technology assessment. For example, the terms of reference of the Commission of Inquiry into the Non-Medical Use of Drugs (which are presented in Appendix E) seem very close to the definition of technology assessment which we have set out in Chapter I.

While commissions and task forces have often been criticized for having only a limited impact on the policy-making process, their function in stimulating awareness and educating both the public and those who are required to prepare and present information to such bodies is rarely taken into account. For example, V. S. Wilson in studying the role in policy making of commissions and task forces has observed that :

“The analyses to date of the policy role of commissions and task forces has concentrated too much on the assumption that these devices are primarily involved in the input side of the policy structure related to the formulation

of new policy. While this emphasis is important, it is equally imperative to view such devices as incremental policy outputs. Hence they are necessary components of the on-going policy structure.”<sup>2</sup>

It is the policy output side of the commission or task force which we feel would go some way toward creating a consensus about the long term developments of a given technology. The technology assessment system, as we have described it, comprises a more or less loose coupling of individuals or groups who are concerned with the development of a particular technology. As we have seen in the case of the development of a petroleum recovery capability on the east coast continental shelf, the imperative of preserving or enhancing the interests of the individual actors is of sufficient strength to forestall any one or group of them from embarking on the development of anything which could be called an overview. Consequently, not only does no consensus or higher viewpoint emerge, but to a significant extent the actors appear to be operating in a milieu of mutual ignorance of each others perspectives. In our view, a commission or task force, in order to assess a given technological development, could create the initial conditions from which a genuine consensus might emerge by inviting the participation of the various actors of the technology assessment system and co-ordinating an exchange of views between them and by publishing its findings.

Still the task is not a trivial one for there is more involved than simply requesting inputs from the various actors in the technology assessment system. Each commission or task force would be served by a staff of one or more “Technology Assessment Analysts” whose function would be not only to collect data but also to interpret them in a manner comprehensible to all the actors. Further, it would be the job of the analyst or analysts, to seek out those constituencies which should be but are not yet involved in the decision-making process and see that they become fully involved. The dual problem of seeking out all the interested actors and rendering their submissions into a common language could lead to a demand for a new breed of science-based generalists such as are being turned out by some universities in Europe and North America. This is perhaps not the place to expatiate on the particular educational background of what we propose to refer to as Technology Assessment Analysts, but we should like to point out that some study of science policy and related issues—what is sometimes referred to as the external effects of science and technology—would appear desirable.

## **A Methodology for the Technology Assessment Analyst**

It may be appropriate at this stage to outline the nature of the tasks the Technology Assessment Analyst might be required to perform. If a commission or task force is established to assess a given technology, then ideally a Technology Assessment Analyst would be assigned to its staff to help the commission or task force to structure its inquiry. Such an analyst might well proceed in the following way:

- 1) Attempt to formulate with the Commissioners or heads of the task force a series of questions relating to short, medium and long term conse-

quences of the technology for the physical, economic, political, and social systems of the region in question, or indeed of the country as a whole;

2) Outline the technology assessment system for the particular technology under consideration (see Chapter III);

3) Seek out the “core actors”. By relating the perceptions of these major actors and the information they can provide with the questions to be answered in 1), it would be possible to outline the types of studies which should be undertaken and, further, to delineate some of the types of expertise needed on the research staff of the commission or task force;

4) Seek out and involve supporting actors and those individuals and groups which *should be* concerned with the application of the technology in question but which, for one reason or another are not yet visible in the technology assessment system. Analysis of their views could lead to further supplementary studies;

5) Prepare with the aid of the research staff a draft technology assessment for the commissioners or those heading up the task force;

6) With the commissioners or those heading up the task force prepare a final technology assessment for the political executive. An example of the contents of such a report is given in the following section. The report should be made available to all of the actors in the technology assessment system and to the public.

Throughout the exercise there is a need for close contact between the Commissioners or heads of the task force and the Technology Assessment Analyst and between the commission or task force and all the actors in the technology assessment system. As we have already indicated, the crucial task of expressing all research findings in a “common language” is the responsibility of the Technology Assessment Analyst. His objective may be considered to be achieved if, as a result both of the commission or task force and the research results, the various actors are able of their own accord to achieve a higher degree of co-ordination and consensus than previously. Ideally, decision making can be considered as having been improved if a consensus is reached and all actors are satisfied with the course of action decided upon. While this may be difficult to achieve in practice it should still be the ideal.

This methodology is, from the informational point of view, much less ambitious than the rational idea outlined in Chapter I. On the other hand, from the decision-making point of view, it seems to us a more effective and practical way of informing decision makers of the consequences of technological application.

## **Report Content**

In order to comply with the definition of Technology Assessment given in Chapter I, the report of the Commission or Task Force, which should be made public, would have to include the following:

1) a clear statement of the problem to be solved or the objective to be reached – either in terms of questions to be answered or hypotheses to be tested.

2) a description of the physical, social, political, and economic con-



texts in which the technological capability being assessed is to be embedded (such as the considerations mentioned in Chapter II). An attempt should be made to obtain some understanding of the underlying processes at work by studying the interrelationships between and within the physical, social, political, and economic contexts.

3) the identification of the actors in the Technology Assessment System

4) a clear statement of the position taken by each actor in the Technology Assessment System.

5) forecasts of the possible consequences of embedding a given technological capability within the social, political and economic contexts of a society, under different working hypotheses. For example, in our particular case study, two working hypotheses would be (a) a major, and (b) a minor discovery of gas and/or oil on the east coast continental shelf.

6) the identification of areas where there is, or could be, consensus and conflict among the actors (through a comparison of (4) and (5) above).

7) recommendations on the most appropriate path to follow to minimize conflict. If there is no obvious single path to be followed in order to solve a problem or reach an objective, then alternative routes should be laid down, stating the consequences which could result in each case, including the possible effects on the various actors.

## **A Role for the Science Council**

While pressure on the political executive to undertake a technology assessment can come from a number of quarters, the Science Council, because of its function as a public advisory body on science and technology-related matters, is in a position to play a crucial role in the initiation of technology assessment studies. The Science Council of Canada Act states in Clause 11 that:

“it shall be the duty of the Council to give consideration to, and to make reports and recommendations to the Minister on ...

(b) the priorities that should be assigned in Canada to specific areas of scientific and technological research ...

(d) long-term planning for scientific and technological research and development in Canada ....”

To accomplish these future-oriented tasks, the Science Council should continually “scan” the environment for technological opportunities and dangers which, although they may appear insignificant at present, would if they achieved any large scale or pervasiveness have significant consequences for Canada. Through this scanning operation the Council could identify those areas which, in its view, merit a technology assessment. It would be the job of the Council to prepare a case for the initiation of a technology assessment and present its judgments on the matter to Cabinet through the Minister of State for Science and Technology as well as to any other groups public or private which it deemed necessary to inform. Because its resources are limited and because technology assessment should remain but one element of its work program, the Science Council should not, itself, undertake the technology assessment but should do enough preliminary work to be able to justify the establishment of a

commission or task force in a given technological area. An example of the extent of the preliminary work needed is the background work undertaken for the present case study concerning the potential consequences of offshore petroleum development. By acting in this manner and focussing some of its resources on future-oriented studies, the Science Council would be fulfilling its function of providing advice on the long term implications of Canada's science and technology policies and would contribute to make Canada's political system less reactive and more anticipatory than it is at present.

# Appendices

## **Appendix A – Canadian Offshore Regulations**

The regulations under which offshore oil and gas rights are made available for development are the Canada Oil and Gas Land Regulations that are administered by the Department of Energy, Mines and Resources. They were promulgated under the Public Lands Grants Act and the Territorial Lands Act; it is the former Act that gives statutory authority as concerns the Offshore.

Before undertaking exploration work of any kind in the Offshore, a party must first acquire an exploration licence. A licence is non-exclusive and is renewable on an annual basis. A licence is necessary whether or not the party is already a permittee or lessee. It is in effect a “hunting licence” since with it a party may apply to carry out exploration work in any region of the Offshore not restricted in some fashion, short of drilling a well, including areas held under permit by other parties. The concept here is to encourage work throughout the Canadian Offshore and at the same time maintain control over all activities through operational and reporting requirements.

The second entity in the Canadian system is the exploration permit. A permit, in contrast to a licence, does involve certain exclusive rights. An authorization to drill a well within a permit area can be obtained only by the permittee, and only the permittee has the option of selecting oil and gas leases from a permit area. A permit normally covers a grid or half-grid area. A grid area south of latitude 70° North is delimited by lines of latitude 10 minutes apart and lines of longitude 15 minutes apart. North of latitude 70° North, a grid area is delimited by lines of latitude 10 minutes apart and lines of longitude 30 minutes apart. Grid areas vary in size due to the convergence of the meridians: for example, they comprise less than 64 000 acres off the northern tip of Labrador and more than 95 000 acres south of Nova Scotia. Permits may be issued directly to an applicant if an area has not already been held and surrendered back to the Crown. A party makes application for permits to the Department either in person or through an authorized agent. Where circumstances make it not desirable to do so, the original permits issued in an area may be disposed of by public tender.

The emphasis at the permit stage is on exploration work, the discovery of oil and gas deposits. Offshore permits are valid for six years, with six renewals each of one year. The permittee must make a guaranty deposit at the time of issuance of each permit to the full amount of the work requirements for the first period, as a surety that the work will be carried out. Similarly, guaranty deposits must be made prior to each succeeding work period. Guaranty deposits are returned upon receipt of satisfactory evidence that appropriate work has been performed – they are subject to forfeiture otherwise. Applications for refund of guaranty deposits must be supported by appropriate reports and certified statements of expenditures. Permit work requirements increase progressively so as to reflect the progressive increase in expenditures necessary to effectively evaluate an area, from relatively inexpensive reconnaissance work, through detailed geophysical surveys, to high-cost exploratory drilling operations.

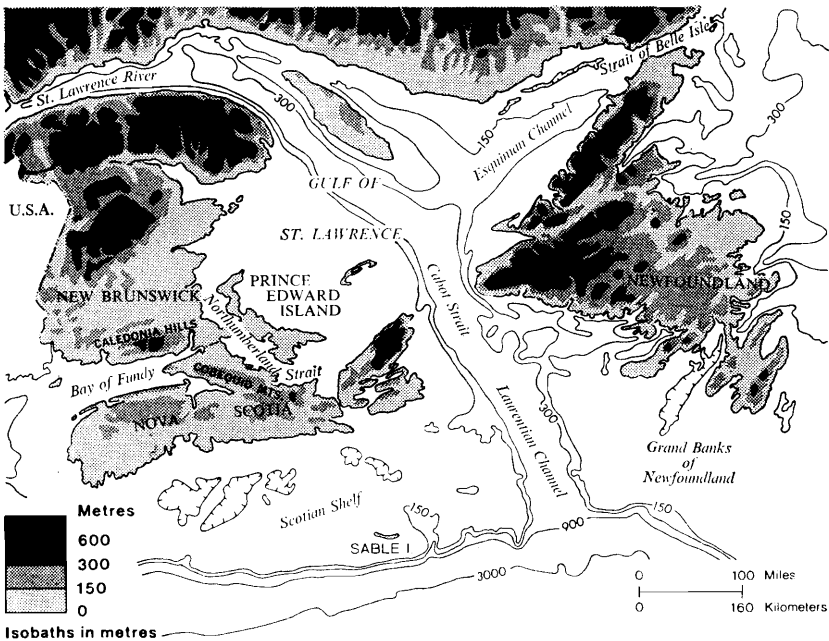
The third entity in the Canadian system is the exploitation lease. Commercial production cannot be undertaken while acreage is still in permit form, it must first be converted to lease. It is at this stage that the emphasis is placed on direct revenues, primarily through royalties on production and annual rentals. A permittee may acquire leases covering up to half the area of a permit, with that portion not converted to lease reverting to the Crown. Leases last for 21 years, and can be reissued for a further period of 21 years.

There are certain “Canadian participation provisions” that apply to the lease stage. In accordance with these provisions, for example, any individual wishing to obtain a lease must be a Canadian citizen, and any company wishing to obtain a lease must be incorporated in Canada. The Regulations stipulate further that the Minister must be satisfied with the opportunity Canadians have for participating in the financing and ownership of corporations involved in applications for leases.

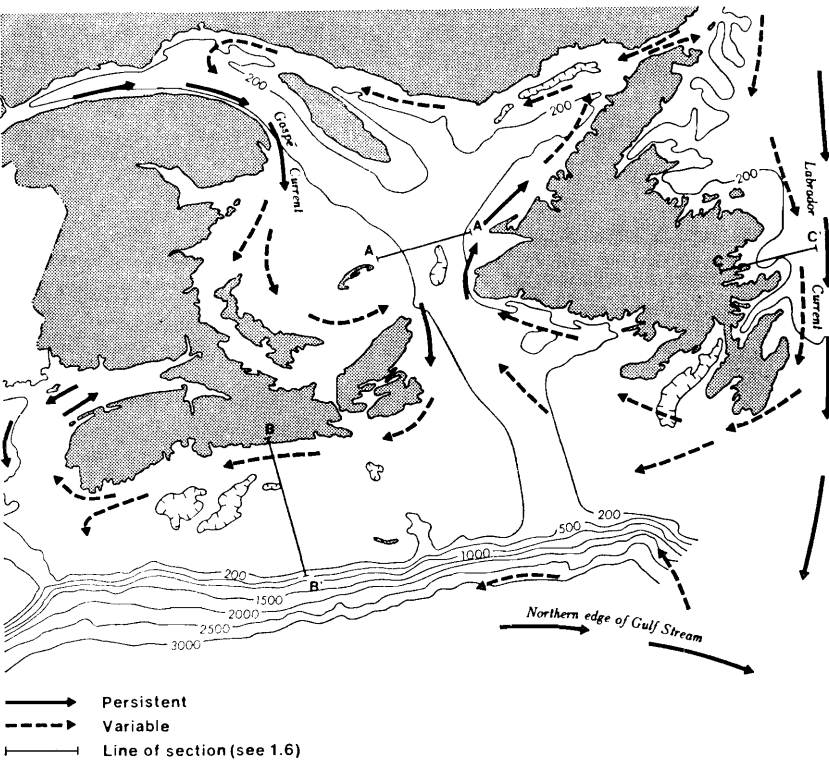
Permit or lease acreage reverting to the Crown through expiry, cancellation or surrender, thereby becoming what is commonly termed Crown Reserves, may be re-issued as single permits or in blocks of permits by way of public tender, on either a cash bonus or a work bonus basis. Reverted acreage may also be re-issued in lease form through public tender – utilizing such methods as work bonus, cash bonus, cash bonus with an undertaking to drill a well – and the terms and conditions of such leases are as the Minister himself may determine.

These regulations are to be amended.

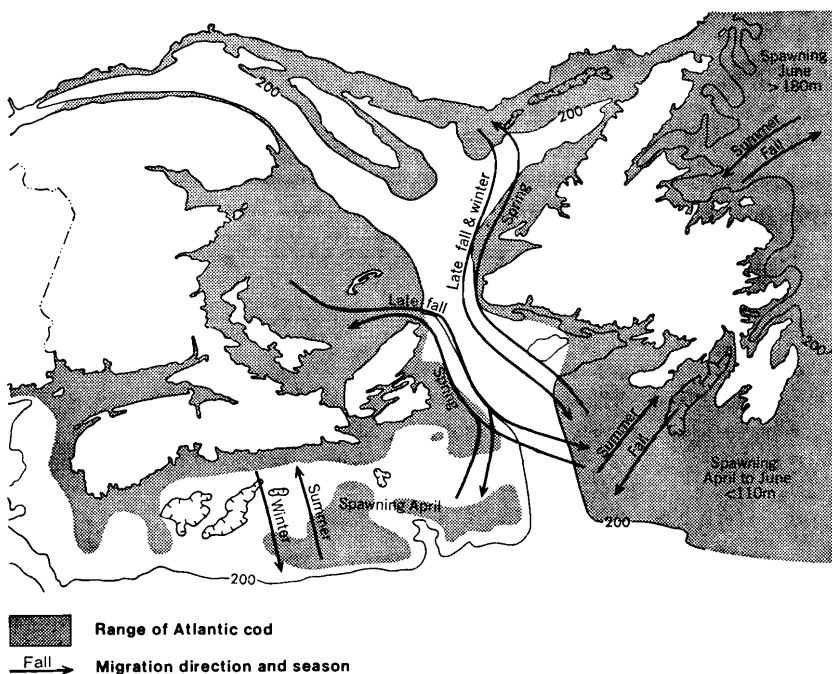
Appendix B – Some Features of the Physical Geography of the Atlantic Provinces



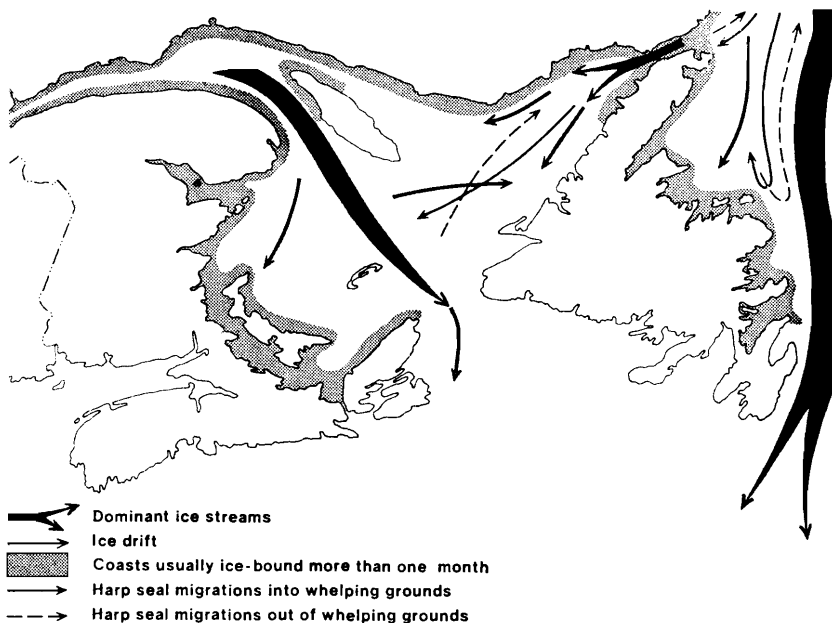
Bathy-Orography of the Atlantic Provinces



Surface Circulation of Atlantic Region Offshore Waters in Spring and Summer



### Range and Migrations of Atlantic Cod in the Atlantic Ocean



### Sea-Ice Movements & Harp Seal Migrations in the Atlantic Region

Source: I. Brooks, "The Physical Geography of the Atlantic Provinces", *Studies in Canadian Geography, The Atlantic Provinces*, A.G. Macpherson, ed., University of Toronto Press, Toronto, 1972.

## Appendix C – Goods and Services Required for Development of a Single Oil Field Offshore Nova Scotia

### Introduction\*

Once an offshore oil field is discovered and its reserves and areal extent established by delineation wells, a development program is initiated. The following outlines the major steps taken and the goods and services required for the development of an offshore oil or gas field after the delineation wells have confirmed a commercial-sized reservoir.

For purposes of illustration we have assumed an oil field located 100 miles offshore in 350 feet of water. The reservoir contains 100 million barrels of recoverable reserves. The costs outlined in Table C.1 represent development only and do not include exploration costs, nor do they include onshore product transportation.

**Table C.1–Development Costs of Offshore Oil Field**

Item	Total Cost (\$ millions)	Total Labour (man years)
Platform	16.0	400
Development Drilling	10.0	90
Lease Facilities	7.3	250
Pipeline	20.8	320
Total	54.1	1 060

### Platforms

In an offshore environment, the most important single item, the platform, is the most critical to the timing of the project. The only purpose of the platform is to provide an area on which to support the entire drilling and producing operation. A tower extending from the ocean floor to an elevation high enough to clear the highest ocean waves supports a deck. The entire platform is then sustained on a pile foundation penetrating as much as 400 feet into the sea bed. Due to the high capital cost of providing offshore platforms, as many wells as are practical are drilled directionally from a single location. Since drilling angle is limited the number of wells per platform, hence the number of platforms per field, is dependent upon reservoir depth and areal reservoir extent.

Platforms for eastern Canada offshore will need a long design and fabrication schedule. Essentially, they require six months to design, two months to bid and award, twelve to fourteen months to fabricate (depending on water depth) and three months to install, totalling twenty-three to twenty-five months from start to finish. Additionally, meteorological and oceanographic conditions on the Nova Scotia Shelf are such that installation is only possible during June, July and August in any one year. The timing must be rigid in order to avoid waiting a full year for another installation period.

The cost of a single platform installed on the Nova Scotia Shelf is approximately \$16 million. This can be broken down as follows:

1. Tower \$3.7 million
2. Piles \$3.2 million

\*Information for Appendix C was supplied by Shell Canada Ltd.



- |                 |               |
|-----------------|---------------|
| 3. Deck         | \$3.6 million |
| 4. Installation | \$5.6 million |

The tower portion, consisting mainly of large-diameter tubular members, requires skilled fabrication techniques and high standard specifications. Standards of this quality are seldom found in shipyards and are usually more prevalent in the bridge building and high-rise steel construction industry. Ordinarily, however, shipyards have the advantage of ready access to the ocean which is essential to tower fabrication. In the early stages of offshore development, Canadian yards would be hard pressed to bid competitively with U.S. Gulf Coast fabricators or meet early delivery periods for the structures. However, as the economic incentive becomes apparent, Canadian heavy steel construction companies should be able to supply capital and build fabrication yards on the coast of Nova Scotia for the fabrication of offshore structures and packages. In this event, their advantageous geographical location would place these yards in a much better bidding position than the Gulf Coast fabricators.

The piles for the platform are constructed of long lengths of large diameter pipe. Large quantities and tight specifications are required. Normally the fabrication of the piles takes approximately one-half as long as the tower itself; therefore timing is not as critical. The piles could probably be fabricated in Canada. Access to the Atlantic by means of barge traffic on the St. Lawrence could make fabricators all the way to the Lakehead competitive, but fabricators located in Nova Scotia would have a geographic advantage.

The deck portion of the platform consists mainly of standard building construction from steel plate and structural shapes, fabricated to a high standard specification out of low temperature, high strength steels. Although the structural portion of the decks is within the capability of heavy steel construction companies, the packaging of equipment, wiring and piping is a specialized business and experienced people on the North American continent are now found only on the Gulf Coast. However, we assume that, in the event of discoveries, local offshore packaging plants will be constructed on the Nova Scotia coast for the purpose of supplying the oil industry.

The installation of offshore platforms requires some rather special pieces of heavy equipment. Offshore derrick barges measuring 400' x 100' x 26' supporting revolving cranes with capacities up to 600 tons are used to place the tower on the ocean floor, install the piling and lift the finished deck sections into place. A typical installation spread of equipment may be as follows:

1. One 500 – 600 ton derrick barge
2. Three 4 000 h.p. tug boats
3. Three 2 400 h.p. tug boats
4. One crew boat
5. Three 250' x 75' materials barges

The total value of the above equipment is approximately \$19 000 000. The total daily rate for the above spread of equipment would be approximately \$40 000 per day. The seasonal working period of this equipment is restricted to 3 months per year. American equipment could be used in Canada

for the summer and returned to the Gulf for the rest of the year. Conversely, of course, aggressive Canadian companies might wish to develop a base in Canada and compete in the world market.

The number of people involved in the above spread of equipment would number about 150 including all tug boat crews.

### **Development Drilling**

Development drilling is necessary to provide the required number of wells to economically exploit the reserves. In the case under discussion 16 wells are required to an estimated cost of \$10 million. This includes the cost to drill producing wells, dry holes, injection wells and source wells. The development drilling can be broken down into the following basic categories:

1. Rental rate for the equipment
2. Labour
3. Consumable supplies

A breakdown of drilling costs is given in Table C.2.

We would anticipate that most drilling contractors will attempt to train and utilize local people as soon as possible to reduce travelling and accommodation expenses. Consumable supplies will take the form of tubular steel products, drilling fluids, etc. The pipe is available from steel mills located in Ontario. Drilling mud is normally supplied by branch offices of large drilling mud companies. Assurance of a steady market could result in local sources of supply being established.

### **Lease Facilities**

Platform facilities are designed to provide for separation of gas and free water from the well effluent, production testing of individual wells, treatment of produced water to acceptable standards of disposal, water injection and water treatment for pressure maintenance, gas compression for artificial lift, disposal of excess produced gas, quarters for personnel and many other minor items in support of the above. These facilities will consist of such things as a quarters building for 120 people; turbine driven electric generators; compressors approaching 20 000 horsepower; 12-foot diameter, 40-foot long, low pressure process vessels; and miles of intricate, low and high pressure piping, including manifolds, valves, instrumentation and safety devices. For facilities to handle sixteen 2 750 barrels-per-day productivity wells, an expenditure of approximately \$7.3 million is required.

Many of the major pieces of equipment required are not now being manufactured in Canada. Initially, much of the packaging and assembling of the facilities would probably take place on the Gulf Coast. However, as with the platform fabrication, it is anticipated that when investment opportunities become more certain on the east coast, offshore facility packaging could be done in Nova Scotia or other appropriate provinces.

### **Pipeline**

Although the pipeline appears to be the most costly single item provided, it is hoped that it may be shared with other fields in the immediate area and its total cost per field reduced accordingly. Basically, there are two

**Table C.2—Breakdown of Drilling Costs for a 16 Well Platform in the East Coast Offshore**

	Cost \$ thousands
Equipment rental	
Rig	2 500
Miscellaneous tools	450
Transportation, supplies and communications	1 650
<i>Subtotal</i>	<i>4 600</i>
Labour	
Rig crew	900
Logging	150
Perforating	50
Stimulating	50
Deviation control	250
<i>Subtotal</i>	<i>1 400</i>
Consumables	
Fuel	550
Mud and chemicals	250
Water	50
Bits	450
Cement	350
Wellhead equipment	150
Tubular Goods	2 200
<i>Subtotal</i>	<i>4 000</i>
<b>Total</b>	<b>10 000</b>

major costs in the building of an offshore pipeline – materials and labour. Approximately one half of the total cost of \$20.8 million is required for supplying pipe, coating, cathodic protection, valves and other miscellaneous items. Pipe is currently available from mills in Ontario, however European mills provide stiff competition. Pipe mills could be expected to locate in the Maritimes if the volume of business appeared to justify such a course of action. However, an accompanying coating yard must be set up near the pipe construction site to apply corrosion protection and concrete weight coating to the pipe. Coating for the pipeline costs in the order of \$1.5 million for the one hundred mile pipeline in question.

Labour for the pipeline is similar to platform installation. Heavy, rather specialized offshore construction barges are required. A typical spread may include:

1. One 400' x 100' lay barge
2. One 300' x 90' burial barge
3. Three tugs varying from 2 000 to 6 000 h.p.
4. Ten 165-foot supply boats

The total value of the above equipment is approximately \$32 million. The total daily rent for the above spread, including labour, would be approximately \$75 000 per day. As with platform equipment, climate conditions restrict the working time of this equipment to 5 months per year. American equipment could be used for the summer and returned to the Gulf Coast for the remainder of the year, although here again Canadian companies may wish to compete on a world wide basis.

There are approximately 320 people employed in the above spread.

### **Operating Personnel**

Approximately 40 operating personnel, located in the Nova Scotia area, would be required to operate the above facilities following completion of construction.

## Appendix D – A Comparative Table of Offshore Oil and Gas Rights

	U.S.A.	U.K.	AUSTRALIA	CANADA
Allocation Method	1. Dept. of Interior advertises available areas and invites bids  2. Companies submit bids on competitive basis	1. Dept. of Trade & Industry advertises available areas and invites applications  2. Areas awarded by administrative discretion (but one case of competitive bidding in 1971)	1. Designated Authority advertises available areas and invites applications  2. Areas awarded by administrative discretion	1. Companies file applications without invitation  2. Areas awarded to first qualified applicant to file
Basic Rights Structure	One stage: lease (exploration and productive rights)	One stage: production licence (exploration and production rights)	Two stages: (a) permit (exploration rights) (b) licence (production rights)	Two stages: (a) permit (exploration rights) (b) lease (exploration and production rights)
Right to Convert	Not applicable	Not applicable	Upon discovery only – in respect of 5/9 of location declared re-discovery	Automatic
Maximum Area	5 760 acres	250 sq. kilometers (100 sq. miles approx.)	(a) permit: 10 000 sq. miles (b) licence: 125 sq. miles	(a) permit: 150 sq. miles (b) lease: 75 sq. miles
Area Limitation	None	None	None	None
Area Reduction	None	At least 50% after 6 years	(a) permit: at least 50% after 6 years, and then at least 50% of remainder at the end of each 5 year period (b) licence: none	None
Term of Rights	5 years and so long thereafter as commercial production continues	6 years, with extension as of right for a further 40 years	(a) permit: 6 years plus unlimited number of 5 years each (b) licence: 21 years, with extension as of right for a further 21 years, and further extensions as granted by the D.A.	(a) permit: 6 years, with 6 extensions of one year each as of right (b) lease: 21 years, with a right of reissuance for 21 years from the date of commercial production, and extensions of 21 years each while the area is capable of commercial production

Work Obligations	None	Negotiated between D.T.I. and applicant before production licence granted (except where licences granted by competitive bidding)	(a) permit: negotiated between D.A. and applicant before permit (b) licence: \$100 000 per block per year (but value of production deductible after first year)	(a) permit: total of \$2.70 per acre during initial term and extensions (b) lease: any time after 3 years the Minister may order the drilling of a well. If the well does not locate commercial production he may order a further well after one year from abandonment
Royalty	16 2/3%	12 1/2%	10%	5% for first 5 years or first 36 months of commercial production, then 10%
Rental	Usually \$3 per acre (but has been \$10 per acre)	45 pounds per sq. kilometre for first 6 years, then increasing annually to 350 pounds per sq. kilometre per year	(a) permit: none (b) licence: \$3 000 per block per year (approx. 20c per acre)	(a) permit: none (b) lease: 50c per acre for first year, \$1.00 per acre per year thereafter (but reductions until commercial productions, and then by previous year's royalty)
Crown Reserve	Not applicable	Not applicable	(a) unselected area within location (b) additional royalty on <i>all</i> production from location between 1 and 2 1/2%	(a) unselected permit area (b) additional royalty on production from Crown Reserves between 5 and 10%

## **Appendix E – The Terms of Reference of the Commission of Inquiry into the Non-Medical Use of Drugs**

The Commission was required to:

- a) marshal from available sources, both in Canada and abroad, data and information comprising the present fund of knowledge concerning the non-medical use of sedative, stimulant, tranquilizing, hallucinogenic and other psychotropic drugs or substances;
- b) report on the current state of medical knowledge respecting the effect of the drugs and substances referred to in (a);
- c) inquire into and report on the motivation underlying the non-medical use referred to in (a);
- d) inquire into and report on the social, economic, educational and philosophical factors relating to the use for non-medical purposes of the drugs and substances referred to in (a) and, in particular, on the extent of the phenomenon, the social factors that have lead to it, the age groups involved, and problems of communication; and
- e) inquire into and recommend with respect to the ways or means by which the Federal Government can act, alone or in its relations with Government at other levels, in the reduction of the dimensions of the problems involved in such use.

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### IV. The Effectiveness of the Technology Assessment System

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On the other hand, Task Forces are informal administrative aids to

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