UNIVERSITE DU QUEBEC

mémoire

présenté

à

l'Institut national de la recherche scientifique (Eau)

comme exigence partielle

de la

maîtrise ès sciences (eau)

par

Marcus Alexander Peterson

Bachelier ès Arts (biologie)

Université du Nouveau-Brunswick

Normative futures planning for environmental quality

Mai 1982

ACKNOWLEDGMENTS

I wish to express my deepest gratitude first and foremost to my directing professor, Dr. Jean-Louis Sasseville, of the INRS-Eau, for his invaluable advice, stimulating conversations and continuous encouragement throughout the period during which this dissertation was prepared. I also wish to extend thanks to Mr. Richard Marceau and Mr. François Frechette, former students of the INRS-Eau, and Mr. Yves Comtois, of S.A.P.P.A., Ltd., for many discussions concerning concepts on which this work has been based. I thank Dr. Henry Regier, of the University of Toronto, and Mr. Michel Gauvin, of the Quebec Ministry of the Environment, for conversations involving specific areas of this research. As well, I thank Dr. Gerald Jones, of the INRS-Eau, for accepting to be the internal corrector of this dissertation, and Dr. Leonard Ortolano, of Stanford University, for his willingness to be the external corrector.

Moreover, I wish to express thanks to Mr. Gaetan Godbout and Ms. Christiane Bourque, librarians of the INRS-Eau, for their time and consideration devoted to the retrieval of documentation indispensible to the research underlying this dissertation. I equally thank Ms. Lise Raymond for the care with which this manuscript has been typed, Mr. Andre Parent for the preparation of the necessary graphic materials, and Mr. Magella Cantin for the final edition of this text.

Finally, I wish to express my sincerest appreciation to my fiancee Johanne, her family, my family, my friends Casey and John, and all the students of my class for their moral support during the preparation of this dissertation, and to all my professors at the INRS-Eau for an enriching educational experience in the variety of disciplines related to water resource management and the environmental sciences.

This work is dedicated to the memory of my grandfather, Watson Alexander Peterson, whose example, and love of life and people, have provided me with a constant inspiration to devote my professional efforts to the betterment of the human condition.

ABSTRACT

The purpose of this dissertation is to introduce and describe a conceptual framework for undertaking normative futures planning toward the end of maintaining or improving the quality of life and the human condition. Given the increasing complexity of societal problems, the development of a global, synthetic, supradisciplinary planning methodology is seen to be a necessary step for future efforts to reverse degradation in the human and material environments of man. Normative futures planning permits the synthesis of contributions from a requisite variety of disciplinary and professional fields, an incorporation of human values associated with aspirations for a desirable future state, and an application of this knowledge to research for a control of the quality of human actions.

The introductory section of this paper provides a brief discussion of the nature and causes of complex problems concerning normative futures planning. Presented next is the theory underlying the methodology, systemology and the theory of human action, and its relevance as a foundation for the orientation of societal planning. The various phases comprising the planning framework are then elaborated and an exemplary application of the methodology to the problem of water quality deterioration is provided in general terms. Following this is a discussion of the nature of societal learning and institutional change which may be required to accomodate the implementation of normative, future-anticipative planning methodology.

Concluding remarks, treat the possibilities afforded by this type of planning activity for enhancing the quality of the human condition through a profound understanding of systems comprising reality and an articulated quality-control of the many human actions which together shape the collective destiny of mankind. The last section provides explanations of the principal terms and concepts providing access to a rapid comprehension of the text.

The Appendix A, an essay reporting the research employed in the development of normative futures planning, is an integral component of this thesis. In this text, all of the various aspects of this methodology introduced in the thesis are presented in much greater detail, and a higher degree of relevance to the particular environmental quality situation in Quebec is sought. An extensive survey of the literature is provided to validate the fundamental premises of the methodology and to stimulate further investigation into an elaboration of its component operations.

RESUME

Le développement de programmes publics à caractère socio-économique ou environnemental se réalise habituellement de façon sectorielle, limitant ainsi les champs d'intervention à des espaces du réel facilement intelligibles, mais engendrant en retour des interventions peu performantes qui favorisent l'apparition de situations conflictuelles. Les méthodes de planification utilisées pour le développement des programmes publics ont donc aussi une portée sectorielle et ne peuvent ainsi tenir compte de l'ensemble des liens importants entre les systèmes écologiques et socio-économiques. En effet, étant structurées pour aboutir à des solutions techniques, ces méthodes sont insuffisantes pour décrire le comportement des systèmes complexes auxquels elles s'adressent; de plus, elles ne favorisent pas chez les planificateurs et décideurs l'évaluation des situations futures qui seront engendrées par la réalisation des programmes d'actions qu'ils auront conçus dans leur secteur d'activités et de juridiction. Les coûts sociaux associés à une utilisation sous-optimale des ressources humaines et matérielles ainsi que l'intégration incomplète des contraintes et conditions à la réalisation des programmes d'actions entraînent à plus ou moins brève échéance la nécessité d'interventions correctrices (de soutien et d'encadrement), elles aussi coûteuses et mobilisatrices de ressources rares.

Certaines approches récentes en planification suggèrent d'introduire, dans le design des programmes d'actions nationaux et régionaux, des méthodes permettant de maximiser la cohérence entre les contenus des différents programmes, de tenir compte des répercussions de chacun d'eux et de les orien-

ter par rapport aux images d'un futur souhaité collectivement. Le présent mémoire a pour but de présenter les grandes lignes d'une telle méthode de planification, à la fois normative et prospective[1]. Le cadre conceptuel qui y est développé est suffisamment large et contraignant pour élargir les champs de la réalité sous observation et pour favoriser la cohérence entre les divers acteurs impliqués dans le processus de planification. Cette méthode de planification est sise sur la qualité du transfert de l'information entre les décideurs et sur l'intégration des connaissances issues des diverses disciplines qui contribuent au processus de planification. Cet outil est conçu de façon à faire intervenir dans les décisions des considérations objectives et subjectives plus amples que celles qui sont habituellement issues des analyses sectorielles; de plus, il facilite la participation de l'ensemble des acteurs impliqués dans le processus. Cette méthode de planification normative et prospective repose aussi, d'un côté, sur les mécanismes de conception des objectifs au niveau normatif, stratégique et tactique et, d'un autre côté, sur le fonctionnement de dispositifs administratifs de coordination entre les gouvernements régionaux et le gouvernement central.

Les assises théoriques de cette méthode de planification normative et prospective sont présentées au premier chapitre du présent mémoire. On y aborde brièvement la systémologie (la science des systèmes) en tant que

---

[1] La méthode de planification dont il est question dans le présent mémoire a fait l'objet d'une réflexion détaillée dont l'essentiel est rapporté dans l'essai placé en annexe (annexe A).

support approprié à l'analyse de concepts et de phénomènes interdépendants ainsi que la théorie de l'action comme postulat à l'édification de la méthode de planification, méthode qui se destine à la confection de programmes d'actions respectant les contraintes de cohérence entre les acteurs et de convergence des actions vers des futurs adoptés collectivement[1].

Supra-disciplinaire par définition, la systémologie offre un cadre théorique idéal pour structurer l'analyse et organiser l'information nécessaire à la planification normative et prospective et à l'adaptation des pratiques de planification aux limites organisationnelles et instrumentales qui apparaissent au cours de la réalisation des programmes d'actions. L'utilisation des concepts systémiques permet une compréhension poussée et utile de l'état des systèmes faisant partie du champ de la réalité sous observation, de leur comportement et de leur évolution; elles favorisent la constitution d'images de la réalité et du futur en fournissant un "cadre conceptuel dans lequel l'homme et son environnement social, biologique et physique peut être organisé en des structures cohérentes"[2]. Le langage systémique peut être ainsi utilisé pour la recherhe de nouveaux moyens permettant l'exploitation des potentiels offerts par les divers systèmes composant les champs de l'analyse (normative et prospective) et par les acteurs

---

1 Pour faciliter la compréhension des divers concepts abordés dans ce mémoire, un glossaire de termes a été élaboré et introduit à la page 46, après le chapitre des conclusions.

2 Caldwell (1974).

impliqués dans le processus de planification. Utilisés dans une perspective publique, les concepts systémiques élargissent la problématique de la qualité du milieu de vie, en y introduisant des dimensions sociales, économiques et politiques. Finalement, la systémologie permet le développement de modèles expliquant les mécanismes de genèse et de réalisation de l'action humaine intentionnelle et facilite la mise au point de méthodes de recherche de cohérence dans la détermination des programmes d'actions publics.

La théorie de l'action humaine présentée à la seconde partie du chapitre 1 deviendra le fondement du cadre conceptuel de la méthode de planification normative et prospective qui fait l'objet du présent mémoire. Cette théorie aspire à une première description de la dynamique interne d'un type particulier de système - le système téléologique - et des mécanismes de genèse de l'action humaine, mécanismes que l'on représente sous la forme d'un système téléologique spécifique - le téléon -. L'intérêt de cette théorie pour l'élaboration de méthode de planification est évident; en effet, la compréhension des mécanismes de genèse et de réalisation des actions humaines permettra de mettre en évidence des moyens de contrôle de la qualité et de la pertinence des programmes d'actions destinés à améliorer la condition de vie des citoyens. Cette théorie de l'action prédit que l'individu ou l'organisation, chacun avec ses propriétés constitutives, agira dans le sens de maximiser sa satisfaction: les actions qu'il entreprendra de réaliser seront conformes à ses aspirations fondamentales à la sécurité (maintien de l'intégrité fonctionnelle) et à la liberté (maintien de ses degrés de liberté dans le choix des actions). La nature et la structure des

actions que le téléon "choisira" seront influencées par ses valeurs et préférences, sa rationalité, son expérience, ses capacités et aptitudes cognitives vis-à-vis des situations qu'il observe et des images du futur qu'il dégage et enfin, par la situation dans laquelle il perçoit se trouver (objectifs, mandats et contraintes).

Les actions que le téléon choisit de réaliser et la structure qu'il leur donne sont aussi fonction de la façon dont il perçoit leur insertion dans la réalité; c'est à cette phase du processus de planification que les actions devraient idéalement s'ajuster sur les résistances à leur réalisation éventuelle et sur la pertinence réelle de les réaliser et ce, en fonction de l'activité des autres téléons agissant dans des champs d'intervention qui sont en intéraction avec ses propres champs d'activités.

La théorie de l'action prend un sens particulier lorsqu'on la traduit dans un cadre conceptuel pour la formulation de politiques publiques ou pour le développement de programmes d'actions. En effet, ce dernier amènera le téléon - l'acteur politique, l'administration publique - à prendre conscience de son rôle dans la configuration des événements socio-économiques et favorise l'intégration, au stade de la planification, des considérations multiples associées à la réalisation des actions publiques. Plus encore, il mettra l'accent sur le développement de démarches cognitives orientés vers la recherche des valeurs à privilégier dans le processus de planification qu'il reconnaît comme un déterminant important des programmes publics.

La planification normative et prospective ne saurait être efficace pour améliorer la qualité des programmes d'actions que dans la mesure où elle permet de constituer un forum accessible aux divers acteurs touchés par leur réalisation. C'est la perspective que l'on donne au cadre méthodologique développé au chapitre 2; on y découpe le processus de planification selon trois (3) phases interactives permettant de structurer les mécanismes de contrôle de qualité des actions projetées: la phase normative où sont exprimés les déterminants des politiques publiques et ou sont identifiés les objectifs qui serviront d'assises aux décisionnaires, la phase stratégique où les choix opérationnels publics sont précisés et la phase tactique au cours de laquelle sera établi un système (cohérent) de buts et de moyens - le(s) programme(s) d'actions - chacun étant nécessaire et suffisant pour réaliser la(les) politique(s) publique(s).

La phase normative verra l'identification des objectifs et priorités à caractère public issus d'une analyse conjoncturelle des situations présentes et des images du futur souhaité. Les perceptions du réel et des images seront propres à chaque acteur; cependant, les programmes d'actions envisagés par les autres téléons feront partie intégrante des réalités de chacun d'eux et chacun des acteurs ajustera ses analyses et ses intentions en fonction de celles que privilégieront les autres. L'établissement de liens entre les différents acteurs ne sera possible, évidemment, que si l'ensemble des acteurs partage une vision grossièrement similaire du futur, c'est-à-dire que chacun d'entre eux puisse participer à la définition des images, que ces images ont un caractère de vraisemblance et qu'elles sont cohéren

tes les unes avec les autres. Les perceptions prospectives, bien que subjectives et maléables, deviennent ainsi l'élément central de la phase normative.

La phase stratégique se destine principalement à harmoniser les interactions politiques, qui ont été précisées en termes d'objectifs et de priorités au niveau normatif, aux capacités humaines et aux ressources accessibles. Elle transforme les normes politiques en stratégie décrivant la nature des programmes d'actions politiques et les mécanismes de réalisation eux-mêmes. Ainsi, au niveau stratégique, les modes de gestion des programmes d'actions ont une importance aussi grande que leur développement. Enfin, le choix de la nature des programmes d'actions nécessite une analyse des contraintes (ou résistances) qui pourront limiter leur efficacité. Ces contraintes, qu'il faut intégrer à la conception des programmes et des modes de gestion, seront de type endogène selon qu'elles proviennent de la structure interne des différents téléons, ou encore, de type exogène, selon qu'elles originent des lieux dans lesquels s'insèreront les éventuels programmes d'actions. La phase stratégique sera le lieu d'un ensemble de décisions, généralement de niveau politique, qui stipuleront si ces résistances seront respectées, ignorées ou éliminées à l'étape de la réalisation.

La phase tactique du processus se destine à l'identification des objectifs opérationnels (des buts) et des moyens nécessaires à la transformation des stratégies politiques en programmes d'actions réalisables. Alors qu'au niveau normatif et stratégique les mécanismes de participation sont

surtout du domaine politique, la phase tactique du processus de planification nécessitera une approche structurée des acteurs touchés par les programmes d'actions et une intégration méthodologique de leur participation à la détermination des buts et des moyens. Au niveau tactique, en effet, la variété des actions correspondant aux intentions et stratégies politiques est étendue et le nombre des options opérationnelles est généralement élevé. Ainsi, étape cruciale, le choix des buts et des moyens et leur hiérarchisation subséquente seront réalisés sur la base de leur pertinence aux objectifs et modes de gestion mis en évidence au niveau stratégique mais devront aussi intégrer les préférences et les intérêts des acteurs (citoyens, organisations diverses, communautés locale et régionale, gouvernements locaux et régionaux) touchés par le processus.

Le chapitre 3 expose un exemple d'application au secteur de l'eau. En première partie, on y présente le scénario de ce que pourrait être le comportement du ministère de l'Environnement du Québec, principal gestionnaire de la ressource, face au problème de la détérioration de la qualité des eaux superficielles, si ce dernier adoptait une pratique de gestion basée sur le cadre méthodologique de planification normative et prospective présenté au chapitre précédent. En seconde partie, on retrouve une synthèse des activités de planification imaginées dans le contexte du scénario élaboré en première partie et structurées de façon à respecter le cadre conceptuel de la méthode faisant l'objet du présent mémoire.

Le scénario présenté illustre l'attitude administrative que pourrait prendre le ministère de l'Environnement face au problème de la détérioration

de la qualité de l'eau, attitude qu'il segmente selon les niveaux normatif, stratégique et tactique du processus de planification. Cette analyse sommaire de la démarche administrative du gestionnaire de l'eau repose sur deux hypothèses: d'un côté, le ministère de l'Environnement adopte le cadre conceptuel de la planification normative et prospective; d'un autre côté, la perception de problématique respecte les préceptes de l'analyse systémique. Cette analyse du comportement hypothétique du ministère de l'Environnement a servi à formuler une méthode prescriptive capable d'encadrer les pratiques administratives en matière de conception de programme d'actions. Pour faciliter la compréhension, les opérations de planification y sont présentées comme étant sous la responsabilité des administrations régionales. Le contenu opérationnel de la méthode sera décrit sommairement dans les pages qui suivent.

LA PHASE NORMATIVE: le développement des bases normatives du maintien et de l'amélioration de la qualité de l'eau comporte les opérations suivantes:

1. La description et l'analyse de l'utilisation du territoire et des ressources, particulièrement de la ressource hydrique; ceci implique la formulation de critères permettant l'analyse des éléments suivants:

   a) le système de détérioration de la qualité de l'eau (pollueurs, polluants, impacts de projets de développement);

b) les institutions dominantes et leur influence sur la qualité de l'eau;

c) les aspirations (droits et besoins) des citoyens;

d) la structure du système de valeurs et ses manifestations sur la dynamique régionale;

e) la nature et l'accessibilité des ressources humaines, financières et matérielles;

f) le bilan énergétique régional;

g) les publics et intervenants dans le processus.

2. La description et l'analyse du rôle du Ministère en région ou sur le bassin: mandat régional, relations avec le pouvoir central, relations avec la population, position par rapport aux pollueurs, etc...; ceci implique la formulation de critères permettant d'identifier et d'étudier:

a) les moyens techniques et infrastructures existantes;

b) les capacités financières, les ressources humaines;

c) les structures administratives et gestionnelles.

3. La synthèse de l'analyse de bassin (ou régionale) comprenant la formulation de critères permettant de reconnaître et d'analyser:

   a) les objectifs locaux, régionaux et nationaux de développement en regard du bassin (ou de la région);

   b) les contraintes et opportunités économiques, légales et politiques;

   c) les contraintes et nécessités sociales et culturelles;

   d) l'état des processus écologiques et d'exploitation des ressources.

4. La conception, au stade préliminaire, avec la participation des publics, des objectifs réalisables à long terme dans les secteurs de la protection du milieu et du développement socio-économique.

5. L'établissement et l'analyse des images du futur concernant le système de détérioration et d'usage de la ressource eau, intégrant les dimensions sociales, économiques et politiques; ceci implique la construction de scénarios normatifs (futur désiré) et tendanciels (probable en fonction des tendances actuelles) et l'analyse des différences entre les deux types de scénarios.

6. La détermination des objectifs de qualité pour la ressource-eau en mesure d'engendrer des activités correctrices conformes aux images du futur.

7. L'évaluation des objectifs retenus.

8. La sélection d'un ensemble cohérent d'objectifs de qualité en termes d'usages et de constituants de la ressource; ces objectifs seront conformes aux normes nationales mais réflèteront les problématiques régionales et locales.

LA PHASE STRATEGIQUE: l'établissement des actions thématiques devant contribuer au maintien ou à l'amélioration de la qualité de l'eau regroupe les activités suivantes:

1. Conception, dans leur stade préliminaire, des actions thématiques formant un sous-ensemble cohérent des politiques générales dans les secteurs économique et environnemental; ces actions constituent les éléments de la stratégie d'amélioration de la qualité de l'eau.

2. Identification et analyse des modes de gestion et des dispositions administratives devant contribuer à la réalisation des actions thématiques.

3. Evaluation des moyens de réalisation en fonction de leurs répercussions socio-économiques et environnementales et analyse des contraintes à la réalisation des actions thématiques.

4. Ordonnancement préférentiel des modes de gestion et des dispositions administratives pour la protection de l'eau en fonction de leur performance d'ensemble.

5. Evaluation des actions thématiques en fonction de leur capacité d'atteindre les objectifs de qualité de l'eau, par simulation de leur implantation et par analyse de leur adéquation au contexte administratif et social.

6. Choix des actions thématiques et des moyens de réalisation devant constituer la stratégie la plus appropriée pour la poursuite des objectifs de qualité de l'eau.

NIVEAU TACTIQUE: la détermination du programme d'actions pour maintenir ou améliorer la qualité de l'eau comporte les étapes suivantes:

1. Détermination, au stade préliminaire, des objectifs spécifiques de qualité formant un sous-ensemble cohérent de la stratégie de développement régionale.

2. Evaluation de ces objectifs spécifiques en fonction:

   a) de leurs interactions dans la réalisation des actions thématiques;

   b) des contraintes qui seront issues de leur réalisation.

3. Choix des objectifs spécifiques dont l'atteinte est nécessaire et suffisante pour réaliser l'action thématique, transformant ainsi la politique en biens et services publics.

4. Identification et analyse des moyens opérationnels et des dispositions administratives particulières en fonction de leur capacité de réaliser les objectifs spécifiques de qualité de l'eau.

5. Evaluation de ces moyens opérationnels et dispositions diverses en fonction de leurs impacts socio-économiques et de leurs répercussions;

6. Confection des programmes d'actions ministériels destinés au maintien ou à l'amélioration de la qualité de l'eau, ces programmes comprenant les dispositions et modes gestionnels nécessaire à leur réalisation.

7. Développement de l'agenda ministériel et établissement des calendriers de réalisation.

8. Elaboration d'un projet de suivi des programmes ministériels.

Au chapitre subséquent (le chapitre 4), on discute du cadre conceptuel de la planification normative et prospective en termes de son apport potentiel à la configuration de programmes d'actions faisant intervenir plusieurs acteurs, tant comme agents de réalisation que comme individus ou institutions affectés par leur réalisation. La méthode présentée est d'application générale et peut être utilisée par tout centre de décision comme outil

supra-disciplinaire permettant d'appréhender la complexité des problèmes surgissant dans un milieu en continuelle transformation. Elle met en évidence l'utilité d'exploiter les tendances naturelles pour corriger les imperfections dans l'utilisation des ressources comme l'eau et minimiser l'effet du processus de complexification des problèmes, complexification accentuée par l'absence de cohérence entre les interventions et par la congestion dans l'utilisation des ressources rares.

La discussion traite aussi du besoin de développer la recherche dans le domaine du contrôle de qualité des interventions humaines touchant l'environnement et les ressources. En particulier, le développement de méthodes d'analyse systémique et de prospective pouvant s'incorporer aux processus décisionnels ainsi que, au niveau empirique, la construction de scénarios décrivant les cheminements souhaités vers le futur, le développement d'ensembles cohérents d'objectifs, la mise au point de méthodes administratives favorisant la participation populaire, l'amélioration des méthodes d'évaluation des répercussions et la conception de dispositions institutionnelles hospitalières pour les activités précitées sont des éléments essentiels à l'amélioration de la qualité du milieu de vie.

On conclut que, par l'utilisation d'une méthode appropriée de planification normative et prospective, il est possible de développer et d'exécuter un programme d'actions cohérent au plan conceptuel et opérationnel et harmonisé aux interventions diverses avec lesquelles il interagit.

TABLE OF CONTENTS

LIST OF FIGURES

INTRODUCTION

The experience of the past decade has brought with it an emerging popular awareness of the alarming extent to which environmental quality is compromised in the traditional pursuit of basic societal objectives. These objectives issue from fundamental human aspirations for security and liberty which express the need for access to adequate life means, a healthy life habitat and other important aspects of human fulfillment. The pursuit of human objectives has always been problematic, being carried out in a more or less turbulent environment, however these problems, or undesirable situations in reality, have been exacerbated in recent years by the accelerated rate of technological change and more frequent manifestations of environmental degradation. These problems have complexified because of the multitude of heretofore inapparent relationhips now emerging between ecological and social systems due to increased demographic and economic pressures. As a result of this complexification, the majority of planning methods conceived to realize societal objectives and defuse complex problem situations have been rendered inadequate for the formulation of actions which respect the integrity of social and ecological systems (Ackoff, 1974; Giles, 1977; Michael, 1973). Being for the most part merely technical solutions, their theoretical bases are insufficient to describe the behavioral complexity of the systems involved. As such, they are ill-equipped for a meaningful attack on problems related to diminishing environmental quality.

There are numerous reasons for which current attempts at societal planning are incapable of integrating the amounts and kinds of information necessary for the rapidly developing challenges of the future. For one, action programs are habitually planned and carried out in a sectorialized fashion, wherein the scope of concentration is reduced to a well-defined, intellectually malleable perception of reality. Situated within the limited perspective of their specific mandates, sectorial decisionmakers are not encouraged to fully consider the development potential of available resources and the environmental and social consequences that their actions could entrain. Full appreciation of future contexts which will effect sectorial plans, as well as the impacts such plans may have on desired future situations, is precluded by the lack of coordination between sectors. For the same reason, decisionmakers may not arrive at a sufficiently profound understanding of the constraints inherent to certain interventions nor their potential for compromising the quality of projected actions. In sum, planning and action cannot at present be sufficiently coordinated within sectorialized structures of intervention to permit the kind of transparent decision making necessary for a rational confrontation of complex societal problems.

It follows that the means chosen to pursue sectorial objectives are often incompatible with those employed in attaining other important objectives, thereby reducing the quality of these interventions. The extensive requirements of environmental planning are not adequately satisfied

when such efforts are undertaken independently of other planning activities affecting the use of land and other natural resources. Ecological and social systems become disequilibrated when the quality of interventions is reduced. This disequilibrated condition can often bring on situations of serious instability because natural constraints arising within the environment of interventions, which oppose their successful realization, are not sufficiently internalized within the planning process. Human and material resources are misappropriated in this manner; economic externalities and other diffuse social costs are the result. In effect, the complexity of the many qualities possessed by these systems imposes serious constraints to the overall efficiency of planned action. The now familiar situation is brought on where new interventions are planned and undertaken to correct the unforeseen and undesired consequences of past interventions.

Therefore, in general, the current state of societal planning precludes the coherence in collective action required to effectively respond to the global problem of diminishing environmental quality. Organizational capacity and strategic and tactical capabilities have not evolved apace with the societal problems to which they are now compelled to respond. Bella (1974) suggests that "the accepted paradigms, assumptions and techniques of technological societies are significant components of their social inertia". Michael (1973) maintains that society must accept to undertake "long-range social planning" in order to extract itself from the predicament of environmental degradation. He suggests that this process can only evolve through the massive employment of "future-responsive social learning". This opinion

is upheld by Ackoff (1974), who maintains that "there is an urgent need to change our society in ways that increase its ability to learn and adapt".

This thesis introduces a conceptual framework for performing normative futures planning, or planning oriented towards valued future outcomes, and will discuss its theoretical foundations, its methodological content and the conditions its development and use might require. It represents both a summary and an extension of the research essay appearing in Appendix A. This research was undertaken to develop a conceptual planning framework of sufficient scope to respond to highly complex societal problems, using the problem of water quality deterioration as a structuring example, and explains the concepts associated with normative futures planning in much greater detail.

The conceptual framework for normative futures planning described herein provides the coordination and scope of inquiry appropriate to an improved control of the quality of virtually any type of planned action. Generalized in nature, it aspires to facilitate the transfer of required information between decisionmakers through a supradisciplinary approach to policymaking and planning. By integrating a range of academic and professional disciplines, the framework is rendered more accessible to the parties involved in a planning situation and has the potential to widen channels of communication between them. The use of the conceptual framework assures that an extensive range of objective and subjective considerations are included in policy and planning decisions, and encourages the participation of all implicated parties.

Briefly, this methodology involves the conception of specific objectives, relative to a given planning context, which are adequated to broader societal objectives drawn from a common vision of an accessible and desirable future situation. Based on popular consensus, this vision incorporates the collective human values which influence the formation of objectives and a realistic appreciation of potential constraints, thereby contributing to the improvement of the quality of pursuant actions. Normative futures planning offers a conventionalized tool for perceiving situations in reality, often referred to as problems, which call for responsive policy implementation and planned action.

CHAPTER I

SYSTEMOLOGY AND THE THEORY OF HUMAN ACTION

Systemology and the systemic theory of human action together embody the necessary theoretical foundations for the development of normative futures planning. They offer the fundamental language appropriate to such an undertaking, as well as a model of human action capable of structuring a conceptual framework for its application. Systemology facilitates an interpretation of all objects comprising systems in reality, and the cybernetic controls which govern their behavior and evolution, while the systemic theory of human action explains the nature of purposeful human activity, a notion that is indispensible to an understanding of planned action.

1.1 Systemology: A Scientific Tool for an Adequate Perception of Reality

The emergence of systemology, the science of systems, provides a more relevant theoretical basis for organizing the information and analyses required for normative futures planning. It promotes a means for perceiving reality wherein everything real is regarded as a system, composed of smaller systems, and situated in an environment of larger systems. The use of systemology encourages the development of a profound and useful understanding of the state, behavior and evolution of the many diverse systems comprising situations in reality. Supradisciplinary by definition, the science of

systemology serves as "a conceptual framework into which knowledge of man and his environment, social, biological and physical, can be organized into a coherent pattern (Caldwell, 1974)."

Systemological inquiry concentrates on the internal workings of pertinent systems, their parts and their environment, as well as the complex web of interrelationships entertained between them. Systemology, as a mode of systems thinking and acting, recognizes the indissociability of all objects comprising reality:

> "Viewed structurally, a system is a divisible whole; but viewed functionally it is an indivisible whole in the sense that some of its essential properties are lost when it is taken apart."
> "...in systems thinking, an attempt is made to evaluate the performance of a system as a part of the larger system that contains it (Ackoff, 1974)."

Systemology is uniquely equipped for the perception of complex situations in reality because "it is attached to an intellectual framework that is built over and around the one it replaces (Ackoff, 1974)." Through its synthetic approach to the acquisition of relevant knowledge, systemological inquiry expands upon the observations of a multitude of academic and professional disciplines in order to arrive at a unified, comprehensive and apolitical characterization of a given reality situation. Toward this end, systemology incorporates a synthesis of general systems theory, for an understanding of system properties; cognitive systems analysis, for systems modeling and simulation; and normative systems analyses, for systems control and design (Sasseville and Julien, 1979).

Systemology can thus be employed to structure research aimed at finding alternative ways and means of manipulating various system potentialities in such a way as to redirect their functioning toward the attainment of a more desirable future situation. The multidisciplinary inputs required enforce a more lucid comprehension of environmental and social contexts related to proposed interventions. When used to structure observations involved in planning and policymaking, systemology lends an especially broad significance to the concept of environmental quality so as to encompass the majority of apparently unrelated problem situations facing modern society. As a theoretical basis for normative futures planning, systemology, through system-thinking, encourages the acquisition of an adequate perception of reality, and through system-acting, provides an opportunity for controlling the quality of collective human action.

1.2 The Theory of Human Action: Key to the Quest for a Control of the Quality of Human Actions

The structure of the proposed conceptual framework for normative futures planning is founded in the systemic theory of human action (Sasseville and Marceau, 1979). The theory aspires to describe the internal dynamics of a special type of system, the purposeful system, and a specific kind

of purposeful system: man (Ackoff 1974). The theory of human action explores the thought processes undertaken by human purposeful systems when planning and carrying out their actions. It depicts the genesis (conception) and gestation (maturation) of human action as a systemic process through which single actions naturally coalesce into coherent systems of actions. The relevance of this theory to the elaboration of a heuristic planning methodology is apparent: with a comprehension of the ways in which human actions are generated, means can be discovered for controlling the extent of quality sought from the process and the actions which result.

The essential postulates of the theory of human action are schematized in Figure 1. The focal point of this concept is the teleon, a human purposeful system, either individual or group, that is at once an observer of reality and an actor within it (Sasseville and Julien, 1979). The teleon observes his environment, the systems comprising it, the system he himself represents and their patterns of interrelationship. He then acts consciously to modify this reality based on the objectives he, as a purposeful system, has formulated from his observations and experience.

The genesis of human action commences when the teleon applies his values and fundamental aspirations to the conception of a desired state of satisfaction, a vision embodying the objectives that he wishes to see fulfilled. This vision initially defines the range and depth of subsequent observations undertaken by the teleon in planning his actions; it is determinant of the nature of the cognitive model employed and the choices of knowledge and assumptions that the teleon devotes to his observations.

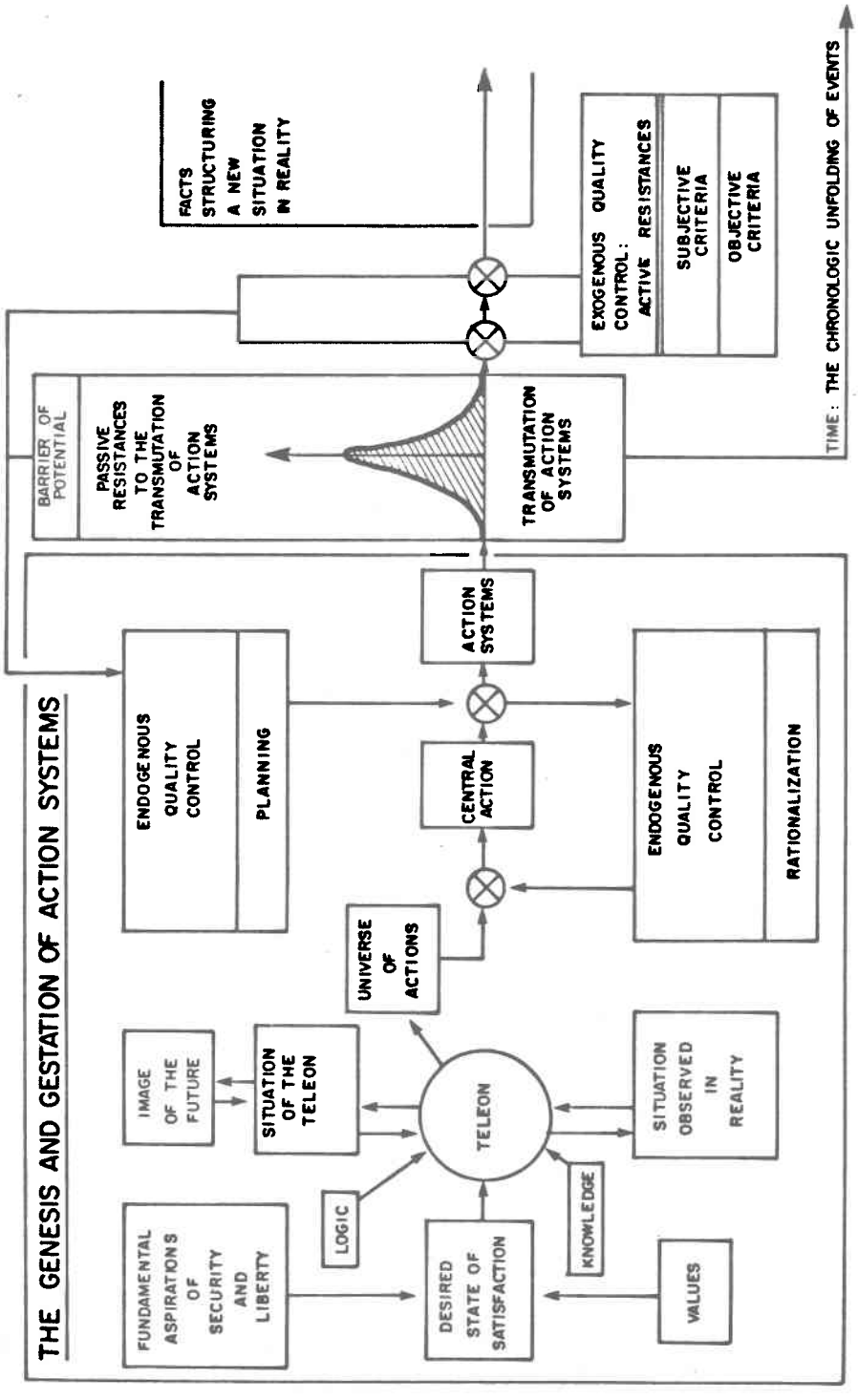

Figure 1. The theory of human action (Adapted from Sasseville and Julien , 1979).

La théorie systémique de l'action humaine (D'après Sasseville et Julien , 1979).

At the time action is being considered, the teleon develops a cognitive appreciation of the circumscribed portion of reality in which his actions are destined to be implanted. The teleon also develops an observation of his own situation within this reality, an effort extensively influenced by value judgments inherent in his image of an accessible and desirable future. This articulation of the cognitive and normative foundations of his projected actions constitutes an effort of rationalization equivalent to the first phase of an endogenous quality control. The teleon applies this control when choosing, from a universe of actions, a central action susceptible of modifying reality in a sense favoring the attainment of his desired state of satisfaction. Thus, it is his perception of present reality and that seen as desirable for the future which together represent factors determining the quality of the central actions proposed (Sasseville et al., 1977).

Before specific action systems are formalized, the remaining quality controls are exercized. The second phase of an endogenous quality control entails a planning effort aimed at a realistic assessment of the capabilities and limitations of the organizational capacity at the disposal of the teleon, or his ability to generate effective action. The two exogenous quality controls require an evaluation of constraints arising within the environment of the teleon. These active resistances are analyzed on the basis of objective and subjective criteria related to facts structuring current and historical situations in reality.

Once assured of their quality, the teleon chooses action systems in full recognition of their potential consequences. The gestation of human action is completed when the actions perturb the reality into which they are implanted and transmute into facts structuring a new situation in reality. This perturbation involves a confrontation between the actions and the passive and active resistances arising within the teleon and his environment which constitute the barrier of potential that all actions must overcome in order to successfully maintain their integrity during and after their transmutation. The potential barrier also incorporates internal resistances inevitably brought about by a certain loss of coherence in the formulation and execution of any actions.

When linearized into a conceptual framework for collective policy formation and planning, the theory of human action offers a rational progression of deliberations on which to base decisions. It coerces the teleon into a self-concious realization of his particular role in shaping situations in reality, his obligations with respect to perceived problem situations, and the variety of considerations he must make in selecting appropriate action systems. More importantly, it insists upon the development of value-related inquiries parallel to those regularly employed by individuals in the conception and execution of actions determining the course of their lives. In the pluralistic society of today, defined normative and cognitive contexts have become imperative for the integration of environmental quality considerations in decisions accompanying policymaking and planning.

CHAPTER II

NORMATIVE FUTURES PLANNING

Normative futures planning can only be effective in improving the quality of human actions if its methodological undertakings provide a coherent forum accessible to the multitude of human purposeful systems shaping reality. Systemology and the theory of human action provide a common means for teleons to perceive situations in reality and to structure their perceptions into a control of the quality of the actions they generate. The ability to understand the behavior of purposeful systems provides the teleons with a logical process for avoiding incorrect action as well as for recognizing future opportunities to improve the quality of actions. It also provides a basis for redesigning the overall system in some fundamental way encouraging either the dissolution of problem situations or improvement in system functioning (Ackoff, 1970). Systemological inquiry encourages inputs from a diversified range of human knowledge, digesting, systhesizing and orienting the facts structuring situations in reality in such a way as to draw forth their deepest significance and render it accessible to each and every teleon.

A generalized conceptual framework best accomodates these richly textured patterns of analysis and provides the flexibility necessary for normative futures planning to be relevant to problem situations of widely varying degrees of complexity. The conceptual framework presented herein is

developed in three interactive phases in order to structure the quality controls applied to projected actions and the multiple feedback loops of information flow on which they are based. It is designed to evolve into a continuous process, offering the coordination between policymakers and planners they would require for controlling the quality of actions through the anticipation and evaluation of their consequences.

The three interactive phases comprising this conceptual framework are summarized in Figure 2. The normative phase may be considered as the basic research undertaken for the formulation of policy. Objectives are conceived and made explicit in order to provide a credible foundation for the selection of policy. In the strategic phase of planning, an array of policies, in the form of central actions, are evaluated and chosen for their aptitude to interact complementarily between each other in the pursuit of objectives. The tactical phase provides for the conception of cohesive systems of goals, each one being necessary and sufficient for the achievement of the central action to which it pertains. The framework terminates with the evaluation and choice of the action systems needed to operationalize efforts leading to goal satisfaction. Normative futures planning, however, can only assume full significance if an effective surveillance potential is incorporated into tactical action. As action systems transmute into reality situations, they provide a valuable source of information for subsequent inquiries undertaken for the three interactive phases. By challenging or reinforcing the assumptions employed in the planning effort, this feedback can provide an explicit motivation for increasing the quality of actions through the improvement of the various perceptions, evaluations and choices at the heart of normative futures planning.

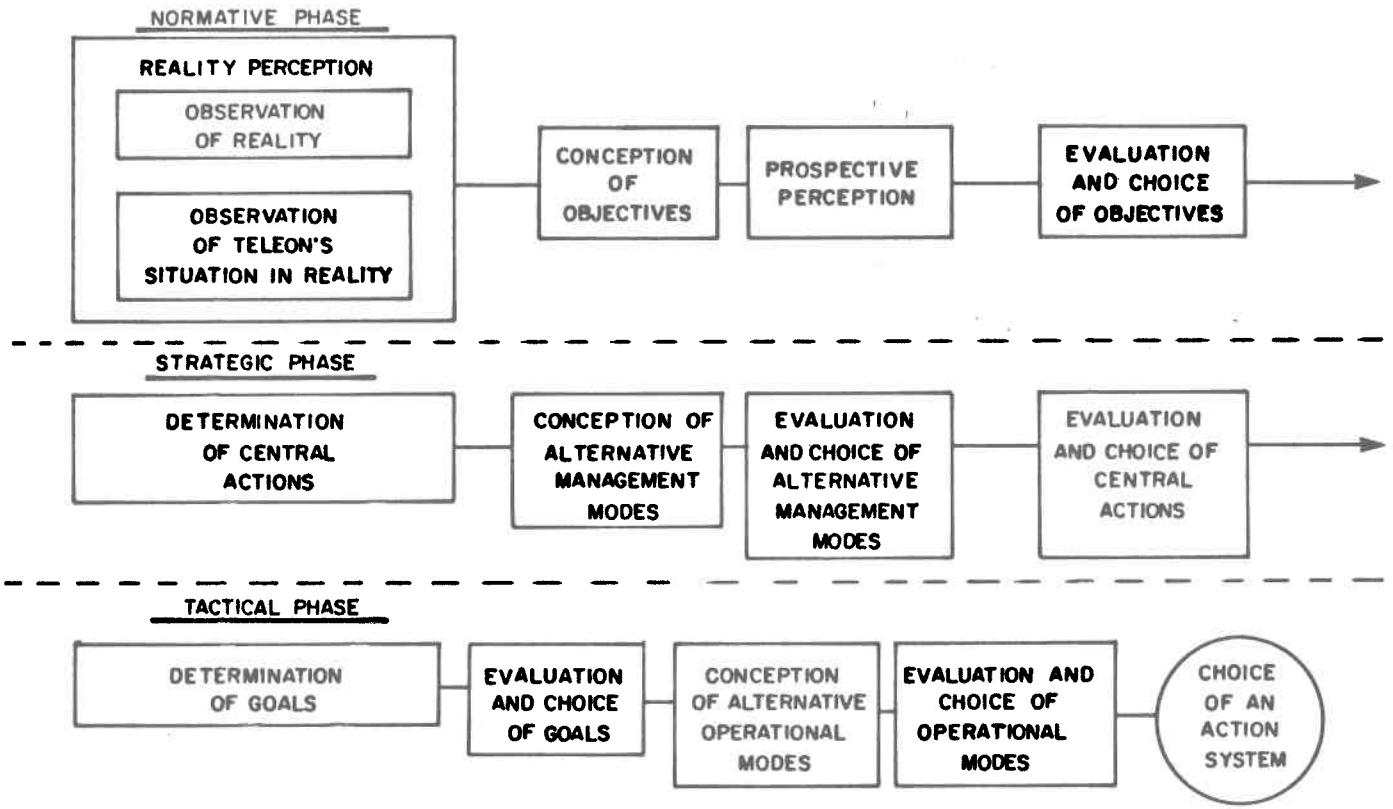

Figure 2 . A conceptual framework for normative futures planning (Adapted from Sasseville and Marceau, 1979).

Un cadre conceptuel pour la planification prospective normative (D'après Sasseville et Marceau, 1979).

2.1 The Normative Phase: Adequation to the Fundamental Values and Aspirations of Man

The normative adequation of policy objectives sought within this first phase is realized through a conjunctural analysis of present situations in reality and desired future outcomes. The reality perception is developed through observations of the situations and systems composing the environment of the teleon and the situation in which he, as a purposeful system, finds himself in relation to this environment. The use of systemology facilitates the characterization of relevant systems by the interactions they entertain with their environment. It encourages the teleon to "deduce" certain facts apt to "induce" an understanding of the global behavior of the systems, an effort rendered impossible through the analysis of systems in isolation from their environment (Sasseville, 1978). The reality perception should permit the teleon to conceive various ways in which appropriate systems can best be manipulated in order to take advantage of favorable systemic tendencies. "The idea is to let the system do it, while our interventions are aimed at juggling internal system parameters without simplifying the interactions of parameters and components (Holling and Goldberg, 1971)." A space of intentions is created from these perceptions as the teleon seeks to articulate his reasons for wishing to act upon systems to exert a better control of their evolution.

The objectives initially conceived by the teleon will relate to the perceptions he has acquired of the behavior exhibited by specific systems and the modifications which could potentially result in improvements.

The objectives will generally aim for the achievement of harmony between the components of target systems and between these systems and their environment. These objectives are "governed by 'ends', that is, values; they are also governed by a long-term spectrum of options which the consequences of action create (Ozbekhan, 1971)." These determinations are accomplished through the application of the first endogenous quality control to planned action: the normative adequation of objectives, or a conjunctural analysis of the reality perceptions with a normative vision of an accessible and desirable future state.

The prospective perception required is a highly subjective yet imperative undertaking. Due to the fact that it "deals fundamentally with the future of the human community, it is useful only to the extent that it is normative, to the extent that it focuses on those aspects that matter to human beings (Harmon, 1975)." According to Ackoff (1970), a prospective perception involves the construction and investigation of two fundamentally different types of scenarios. The first attempts to articulate a prospective future state from an exploration of the continuation of trends presently observed in systems and situations structuring reality. The second scenario involves the establishement of a normative vision of an accessible and desirable future state and aspires to conceptualize means of reinforcing trends oriented toward the attainment of this state. In the conception of both these types of scenarios, "the needed holistic approaches must accomodate the 'soft' cultural phenomena (values, attitudes, beliefs, expectancies) as well as the 'hard' and quantifiable economic, demographic and technological

data (Harmon, 1975)." The difference between the outcomes of these two scenarios accentuates the problem areas to which attention should be devoted and thereby provides a validation for the initial space of intentions to act. Through a systemic perception of past, present and future situations, an analysis of the conjuncture giving rise to the necessity for action ensures explicit cognitive and normative contexts for the justification of selected objectives.

The final evaluation and choice of objectives defines the intention to act and in this way provides a normative template to be respected when strategies are devised in subsequent policy determinations. When tactical action is being planned, this normative template is imperative in the judgment of the ends chosen as a function of the values society holds in relation to the probable future consequences of these ends (Ozbekhan, 1971).

2.2 The Strategic Phase: Adequation to the Realm of Human Possibility

In the strategic phase of normative futures planning, central actions are developed to serve as policy initiatives undertaken in the pursuit of objectives. Ideally, central actions, representing policy strategy, are selected from a universe of actions of sufficient scope to deal with all of the situations and systems circumscribed by the nature of perceived problems. Unfortunately, however, the importance of adequately planning strategic action has not been fully appreciated in practice:

> "Environmental engineering and management literature has been nearly exclusively dominated by subjects of a tactical nature. The relatively few exceptions that have described environmental strategies have not been further analysed and developed in the literature with the same degree of technical aggressiveness as subjects of a more tactical nature. As a result, tactical decisions have often been made in a strategic vacuum (Bella and Overton, 1972)."

Even when strategy is formulated, no meaningful form of organized coherence has been attempted between the strategic actions of the various teleons carrying out related activities within the same environment. Rather, central actions devised for the implementation of policy should reflect two basically different kinds of strategies, "adaptation to the environment, whereby we include ourselves in its natural processes, and transformation of the environment in accordance with our own goals and problems (Shchedrovitsky, 1977)." Furthermore, these strategies must incorporate an acute awareness of the extent of ignorance surrounding man's knowledge of the dynamic properties of social and ecological systems. "The indeterminancy of environmental outcomes and the knowledge gap expressed in the environmental predicament must be, therefore, increasingly accomodated at the strategic levels of planning (Bella, 1974)."

As strategic deliberations coalesce, various means of managing and administering the central actions are then conceived and adequated with an overview of the organizational capacity at the disposal of the teleon. These management modes usually involve some mixture of disturbance-reducing activites, which "constrain variety so that 'pathological' situations are avoided," as well as adaptation-increasing activities which "promote variety by the creation of greater opportunities for improving future situations (Chadwick, 1971)." As well, they will often indicate a need for increasing

or adapting the organizational capacity of the teleon. This requires "organizational planning," the task of "determining organizational requirements and designing organizational arrangements and the management system that will make it possible to follow the prescribed means effectively (Ackoff, 1974)." The management modes thus conceived are evaluated for their pertinence to the strategy inherent in the central actions through a comparison of the relative value of potential action consequences and the desired outcomes made explicit in the normative phase. The criteria used for this evaluation should represent those systemic characteristics which are necessary to a harmonious functioning of the man-habitat system and capable of monitoring its future evolution. This evaluation must be exceptionally profound for actions involving high degrees of committment and irreversibility of effects.

The evaluation of alternative management modes also requires an estimation of constraints or resistances which could potentially limit the efficiency of projected programs. Endogenous constraints are those passive and active resistances which arise within the organization of the teleon. Exogenous constraints arise within the environment of the teleon and are usually beyond his immediate control. Decisions must be made as to whether or not these resistances should be respected, ignored or eliminated through the planning process. As a general rule, those constraints having systemic solutions are minimized or eliminated through planning while those representing established systemic properties are respected and accounted for during planning. Consideration of these resistances permits an appraisal of the

social, cultural, political, economic and ecological viability of the potential management modes. Methods of evaluating the repercussions of these various schemes on the human condition are particularly relevant to such efforts as they provide a feedback loop linking present and anticipated future situations with strategic intentions to act (Sasseville et al., 1977). They do this by facilitating a judgment of the intrinsic value of management modes as a function of the type of perturbations they can induce within the environment. With the termination of these evaluation efforts, alternative programs for realizing the central actions are chosen and ranked preferentially to serve as a resource inventory for future planning applications.

Based on the practicality of accepted management modes, a specific set of central actions is decided upon to serve as a strategic template for the elaboration of tactical action systems. This is accomplished through the application of the second endogenous quality control to planned action: the strategic adequation of central actions, or an assessment of the extent to which they represent the objectives retained as well as their liklihood to integrate harmoniously within their target environment and achieve the results desired. A comparison is made of the avantages and disadvantages inherent to each and an evaluation is made of the consequences of their potential repercussions on situations in the environment. The intrinsic value of the central actions is judged primarily by their ability to improve collective well-being without compromising individual liberties, to stimulate trends aimed at the obtention of the desired future state, to respect

limitations imposed by the availability of resources and the natural capacities of environmental systems, and to respect inherent delays to policy implementation. The result of the strategic phase is a normatively adequate policy framework for guiding the elaboration of action programs in the final phase.

2.3 The Tactical Phase: Adequation to the Range of Operational practicability

The tactical phase of normative futures planning begins with the conception of a set of operational goals intended to translate policy strategy into a series of attainable future outcomes. In the process of determining goals which are necessary and sufficient for the realization of the central actions, "time-specific outcomes are related to their more distant consequences (Ozbekhan, 1971)." These goals basically retain the normative stance used in choosing the central actions. Modifications in the hierarchical organization of preferred goals will occur from one locality or region to another, however, dependent upon the particular contexts shaping reality in different geographical areas.

Tactical goals usually seek a high variety of action responses to policy intentions so as to increase the range of options, choices and opportunities made available to individuals, communities and society in general. The goals are evaluated and chosen on the basis of their pertinence to both the central actions and the unique reality situations of the different environments for which they are conceived. It must be recognized, however, that goal achievement does not always imply simple straight-forward courses of

action and conflicts are inevitable. Under these circumstances, goals are not optimized but rather maximized subject to achievement of other goals (Giles, 1977). A coherence between the goals is then assured through the specification of relations that the goals must entertain between themselves and with the components of the environment they will effect.

Various operational modes are conceived to accomplish the chosen goal set and they are oriented into coherent systems of action whose overall strategy is compatible with the preferred management schemes established in the previous planning phase. The extent of planning required to adequately structure a relevant action system will be proportional to the amount of exogenous resistance posing a potential barrier to the successful realization of actions. Like the management modes, operational practices, procedures and programs are evaluated with respect to the endogenous and exogenous constraints inherent to each, their implantation in the environment is simulated and they are compared on the basis of the desirability of projected impacts and repercussions. "While comprehensive prediction in detail is impossible, general trends and responses to the activities of man can be identified by directing attention toward the ecosystem level of organization rather than confining environmental study to the components of particular ecosystems (Bella, 1974)." Adequate methods for evaluating environmental repercussions and their causal impacts are an essential prerequisite to normative futures planning as they help to clarify and render transparent decision processes related to planned action. Nevertheless, it must be remembered that the development of these techniques remains in an embryonic

form, and while "man has the technological tools that enable him to produce ever greater environmental changes... these same tools are of limited value in predicting the ecological significance of such changes (Bella and Overton, 1972)."

At this stage, the teleon is empowered to use the experience acquired during the performance of the entire conceptual framework for a judgment of the quality of actions through his analysis of the conjuncture responsible for their genesis. Once action systems have been chosen that appear to have the highest potential for bringing about the desired future outcomes, their implementation is scheduled and a genetic code has been prepared for action systems to follow when they transmute into an intervention in reality. From the time that the action systems become facts structuring new situations in reality, their ensuing quality is continuously monitored and new information is generated for feedback to the quality controls of the three interactive planning phases. Supradisciplinary surveillance functions thus provide the flexibility necessary to render the conceptual framework adaptable to a requisite variety of particular problem situations and guarantee that the cognitive and normative excercises undertaken in normative futures planning will evolve apace with changes in environmental and social systems.

CHAPTER III

NORMATIVE FUTURES PLANNING IN APPLICATION

An exemplary application of normative futures planning to a circumscribed problem situation can clarify its potential role in the assurance of environmental quality. Two fundamental conditions are required however for any application of this conceptual framework, conditions which currently exist, at best, in embryonic form. First, the use of the method by a teleon with a specific mandate presupposes that the perceptions articulated in the normative phase have been developed as well by other teleons in national, regional and local contexts through the stimulation of public participation. Second, because the content of the conceptual framework cannot be formulated in isolation from the activity of other teleons, a cybernetic organization such as that proposed by Ackoff (1974) is required wherein all teleons can compare and verify their perceptions. It is only through the achievement of a normative adequation between perceptions and evaluations undertaken by the many teleons in their policymaking and planning activities that the overall quality of human actions can be controlled in a transparent and coherent fashion.

The teleon chosen for this example is a hypothetical Ministry of the Environment, charged with devising interventions to improve or maintian environmental quality. The specific problem with which the Ministry is concerned in this application of the conceptual framework is the diminishing

quality of aquatic ecosystems. Through the use of normative futures planning, an appropriate response to the water quality dilemma, as for other problems of environmental deterioration, is seen to lie in the quest for a control of the quality of human actions. This endeavor involves an adequate articulation of values underlying policy as well as a solid appreciation of the many types of constraints limiting the institutional performance and environmental acceptance of action systems.

3.1 Normative Adequation

In fulfilling its appointed mandate, this Ministry perceives, among others, a problem of water quality deterioration and structures its reality perception hierarchically in order to encompass the local, regional and national contexts associated with various manifestations of the problem. Employing systems-thinking, Ministry planners might wish to regard water resources first and foremost as a physical system, entertaining relations with other systems composing its environment, and choose the concept of the watershed as the focus for an observation of systems and situations in reality. The Ministry would then wish to develop an understanding of natural, man-made and purposeful systems, situations associated with them and their interrelationships within the environment of this watershed, perhaps in the manner elaborated by Giles (1977).

One way the Ministry could organize its systemic perceptions would be through the conception of a water quality deterioration system. The

Ministry would refine its observations of the components of this system, that is to say, the agents of pollution (pollutants), the sources of pollution (polluters), the effects on receptive ecosystems (ecological, economic and social impacts) and the effects on human health, economy or land use (environmental repercussions on the human condition), and explore their interactions. Ministry personnel would develop a variety of objective and subjective observations for an understanding of the internal dynamics of these systems and their relationships to each other and to their environment. The use of a systemological orientation in its perception of the problem allows the Ministry to delve into the minute details of natural, man-made and purposeful systems while guarding a perspective on the overall problem situation.

To better understand its role in fulfilling its mandate, the Ministry would structure an observation of its own particular situation in this reality. Ministry staff would examine and question the mandate confided to them, the different values this mandate represents, the interests it projects, the efforts it may require and the relations it will necessitate with the systems observed in reality. The Ministry especially needs to develop a profound perception of the organizational environment within which it will operate. By doing so, it is placed in a position to compare its cognitive and normative perceptions of the water quality deterioration system with those of other teleons in the environment. The fusion of an observation of its own situation in reality with an observation of reality itself creates a sufficiently broad-based perception of the conjuncture in which the actions of the Ministry will take place (figure 2).

It is at this point that the Ministry begins conceiving objectives to pursue in the fulfillment of its mandate. Planners would then undertake a prospective perception aimed at the articulation of a vision of an accessible and desirable future environmental situation. The Ministry continually attempts to normatively adequate its vision to others developed at hierarchically superior levels through a review of popular goal expressions and the values they place on future outcomes. When satisfied with the pertinence of its prospective vision, the Ministry would then construct an anticipatory scenario by assembling a coherent progression of emergent societal trends likely to bring about the desired future state. It would also build an exploratory forecast on the extrapolation of current trends in order to see how this course of events would lead to a deviation from the desired future state. A comparative analysis of these scenarios permits the Ministry to judge the overall range of intervention it must envision for satisfying the terms of its mandate and provides additional criteria, comprising an endogenous quality control, for the evaluation and choice of the objectives it will subsequently pursue (figure 1).

3.2 Strategic Action

Supposing that the Ministry has retained for one of its objectives the maintenance of an equilibrated aquatic ecosystem, it might immediately conceive two central actions: the correction of water quality deterioration where it exists and the prevention of this condition where it has yet to occur (SPEQ, 1978). The Ministry would then begin compiling an inventory of

management means to accomplish these central actions by organizing them under several headings such as judiciary, judicial, economic, administrative, technological and political means (Descoteaux and Delisle, 1978). It would attempt to rank these means preferentially by considering the limitations of its organizational capacity to efficiently employ the means (endogenous constraints) and the systemic behavior of systems in the environment which could compromise its use of the means (exogenous constraints). Considerations related to the quality of life means, the life habitat and the human condition are used in such a ranking, as well as efficiency, equity and allocation criteria. Other central actions required for the pursuit of objectives might suggest themselves from Ministry evaluation efforts and further means would be scrutinized. For example, Ackoff (1974) suggests using legislative processes as "an instrument of social education...that will facilitate learning by the public about those aspects of ecology involved" in the degradation of the life habitat.

The Ministry would evaluate the retained central actions for their pertinence to the conjuncture it has observed and for their aptitude to provide a sufficiently interesting strategy, incorporating alternative means, to guide the design of tactical action systems (figure 2). It would then evaluate the synergic effect of the central actions, and the means they require, on present situations and desired futures states. This constitutes the second application of an endogenous quality control to its system of action generation (figure 1).

3.3 Tactical Action

The Ministry initiates the tactical phase of planning with the determination of goals, the achievement of which would guarantee the realization of the policy intent of the central actions (figure 2). It would develop water quality goals related to its mandate in such a way that they form a coherent subset of an environmental quality goal set, itself a subset of an overall goal structure related to the human condition and articulated through popular participation at hierarchial levels ranging from the local to the national. In this context, Giles (1977) describes methodology for devising and weighting citizen goal statements and provides an example of a general system representing the highly valued goals of citizens in a given territorial unit. The Ministry would also develop goals related to the performance it expects of its organization. For example, it might suggest that interventions be undertaken where the greatest public benefit can be exacted or that interventions concentrate on the restoration of ecological equilibrium where it has become disrupted (SPEQ, 1978). Such criteria can be employed to ensure that the action systems eventually conceived will reflect goal priorities based on the reality contexts particular to different localities. In effect, means employed will only be valuable to the extent that they incorporate the more important issues inherent to the social dynamics of different regions and localities.

In conceiving operational means for the accomplishment of goals, the Ministry would expand upon the inventory of management modes determined in the strategic phase of planning. These are developed in operational detail and a preliminary selection of the most promising alternative arrangements of means, or action systems, is performed. These are evaluated by the Ministry once again in relation to the endogenous and exogenous constraints inherent to their use. The Ministry would simulate their implantation within the environment in order to develop an assessment of their potential present and future repercussions, including, among others, their ecological, economic, political, social and cultural impacts. Ministry planners evaluate the outcomes associated with these repercussions so they can compare the advantages and inconveniences posed by the action systems, both individually and in concert with each other. The Ministry also wishes to determine the extent to which action systems could increase the aptitude of localized populations to create a better equipped and informed collectivity, thereby lending a self-entraining dynamism to action systems through their familiarity and valorization by the constituencies they are designed to serve. Thus, its evaluation process leads the Ministry to a specification of the relations the action systems must entertain with their environment and condiderations, such as distributive equity, that they must respect. The tactical phase of planning culminates in the choice of action systems and a schedule for their implementation, the quality of each intervention having been controlled through the normative and cognitive adequation achieved by the Ministry in its use of the conceptual framework.

3.4 A Synthesis of Normative Futures Planning

This synthesis of the three interactive phases of normative futures planning is provided in outline form in order to indicate with greater precision the operations involved in an application of the conceptual framework. For increased clarity, these operations are described in a context specific to the hierarchial level of the watershed and are assumed to be the responsibility of a regionalized or decentralized Ministry of the Environment. Nevertheless, it must be emphasized that normative futures planning is undertaken at many hierarchial levels ranging from local contexts to the international, that operations analogous to those described herein are performed by a variety of actors at each of these levels, and that all of these planning levels and their operations interact in a cybernetic fashion. At a given planning level, the successful completion of each of these operations requires extensive feedback acquired during the performance of the other operations, and presupposes fully transparent decisional processes as well as vital participation from the requisite variety of implicated publics. The steps described below correspond directly to the normative futures planning functions outlined in figure 2. For further clarification, phrases in parentheses situate the planning operations within the context of the theory of human action, as presented in figure 1. Portions of the following synthesis have been adapted from Chadwick (1971), Giles (1977) and Sasseville and Marceau (1979).

NORMATIVE ADEQUATION -- Policy Research: development of the normative basis for maintaining or improving water quality

1. Description and analysis of land- and resource-use patterns in the watershed; this involves the formulation of criteria for recognizing and examining:

   a) the water quality deterioration system i.e. pollutants, polluters, impacts and repercussions (situation observed in reality);
   b) the dominating economic, legal and political institutions and their influence on water quality problems (exogenous quality controls);
   c) the social, cultural and socio-psychological necessities of the citizenry (aspirations and desired state of satisfaction);
   d) the general value structures of the citizenry, the extent of public awareness, ways and means of public education and participation; (values, logic, knowledge);
   e) the nature and availability of human, economic and environmental resources (situation observed in reality);
   f) watershed energetics and the extent of overall economic and resource self-sufficiency (situation observed in reality);
   g) the various publics, or intervenants, directly or indirectly involved in the water quality deterioration system, and the particular values held by these intervenants in relation to this system. (situation observed in reality).

2. Description and analysis of the role of the Ministry within the watershed (situation of the teleon); this involves an examination of the mandate conferred to the Ministry by government and the population, a specification of relations between the ministry and the various intervenants involved in the water quality deterioration system, and the formulation of criteria for recognizing and examining (endogenous quality controls):
   a) technical means and fixed capital;
   b) financial capacity and human resources;
   c) administrative and management structures.

3. Synthesis of the watershed analysis with the analysis of the role of the Ministry; this requires the formulation of criteria for recognizing and examining (situation observed in reality):

   a) local, regional and national objectives associated with socio-economic development, in general, within the watershed;
   b) economic, legal and political constraints and opportunities;
   c) social and cultural constraints and necessities;
   d) the current state of ecological processes and resource exploitation.

4. Preliminary conception, incorporating public participation, of water quality objectives whose attainment is seen to be possible in the long-term; these form a tentative subset of the general set of watershed objectives which relate to environmental protection, socio-economic prosperity and human fulfillment.

5. Articulation and analysis of possible future states of the watershed and its water quality deterioration system; this involves a description of current economic, social and political tendencies in the watershed and the actual values, needs and aspirations of the citizenry, a prediction of potential economic, social and political transformations in the watershed and the emerging values, needs and aspirations of the citizenry, a delineation of principles guiding policy research in relation to future states of the human and material environments of the watershed, and an incorporation of this knowledge in (image of the future):

   a) the construction of a normative (anticipatory) scenario depicting the normative future state toward which watershed planning is being undertaken, i.e., an image of an accessible and desirable future based on valued outcomes;
   b) the construction of a tendential (exploratory) scenario depicting the probable future state of the watershed and its problems, given present trends;
   c) an examination of the difference between the projected normative future state (anticipating problem dissolution) and the tendencial future state (anticipating problems) of the watershed and its water quality deteriotation system.

6. Determination of water quality objectives for the watershed, i.e., a coalescence of the normative context within which subsequent planning and action could be performed as a function of the deviation perceived between the tendencial and normative future states.

7. Evaluation of the retained objective set; this involves an application of the first phase of an endogenous quality control: a normative validation of intentions to create policy and plan action for improved water quality in the watershed.

8. Selection of water quality objectives which form a coherent subset of general objective sets articulated within the watershed, the region and the nation; these objectives reflect a normative vision of the most favorable future state and together provide for the achievement of a specified portion of this future state through a control of the behavior of the water quality deterioration system.

STRATEGIC ACTION -- Policy Decision: establishment of thematic actions for maintaining or improving water quality

1. Preliminary conception of central actions which form a coherent subset of general policy in socio-economic planning and environmental protection; together these thematic actions embody that strategy which is necessary and sufficient for a successful pursuit of water quality objectives.

2. Identification, analysis and inventory of alternative management means, and arrangements of means, for accomplishing the central actions within the particular context of the watershed (universe of actions).

3. Evaluation of the various management means, and the most interesting arrangements of means, for the potential social, economic and ecological impacts, and environmental repercussions, associated with their use in the watershed, region and nation; this involves the application, in strategic terms, of the second phase of an endogenous quality control: a planning effort aimed at the recognition and accomodation of those passive resistances (endogenous constraints) and active resistances (exogenous constraints) which could potentially compromise the use of these means for accomplishing the central actions.

4. Selection of management means, and arrangements of means, for water quality protection; this represents a preferential ranking of potential ways for accomplishing, within the context of the watershed, the strategic intentions of the central actions.

5. Evaluation of the central actions for their liklihood to offer a sufficiently interesting strategy in pursuit of water quality objectives; this requires:

   a) a simulation of their implantation, using the selected management means;
   b) an analysis and evaluation of their respective strong and weak aspects, in social, economic and ecological contexts within the watershed, as a function of the various difficulties involved with the use of selected management means.

6. Selection of those central actions, with viable management means, which together provide the most adequate strategy for a successful pursuit of water quality objectives.

TACTICAL ACTION - Program Specification: elaboration of action systems for maintaining or improving water quality

1. Preliminary determination of specific water quality goals which form a coherent subset of general goals for the realization of policy intentions in the watershed.

2. Evaluation of the goals; this requires a projection of the results of goal satisfaction on the future state of water quality in the watershed, incorporating:

   a) an understanding of how goals can interact in order to work in a complementary fashion to accomplish central actions;
   b) an examination of constraints to goal achievement which might compromise the accomplishment of a central action, hence policy strategy for environmental protection in general (active and passive resistances to the transmutation of action systems).

3. Selection of specific water quality goals whose attainment are necessary and sufficient for the accomplishment of central actions translating policy intentions in the watershed.

4. Identification, analysis and inventory of alternative operational means, and arrangements of means, for fulfilling water quality goals within the particular context of the watershed; this operation includes:

   a) a formulation of criteria which the means must satisfy in order to respond effectively to the water quality problem in the watershed; (subjective and objective criteria);
   b) a projection of the direct and indirect effects of the implementation of these means within the watershed.

5. Evaluation of operational means, and potential arrangements of these means, for the projected social, economic and ecological impacts, and environmental repercussions, following from their implementation in the watershed; this involves the application, in tactical terms, of the second phase of an endogenous quality control: a planning effort aimed at the recognition and accomodation of those constraints, arising within the watershed and elsewhere, which could potentially diminish the effectiveness of means used for fulfilling water quality goals.

6. Selection of specific Ministry programs, or systems of action, which are necessary and sufficient for the fulfillment of water quality goals; these action systems incorporate arrangements of operational means aimed at attaining specific goals.

7. Scheduling of the implementation of Ministry programs; a timetable is set so that specific action systems retain their coherence with others taking place in the watershed and can therefore achieve optimum performance in goal satisfaction (transmutation of action systems).

8. Monitoring and surveillance of Ministry programs as they unfold within the watershed; this involves the development of criteria for judging the degree to which action systems are integrating harmoniously within the watershed and contributing to goal satisfaction (subjective and objective criteria).

CHAPTER IV

DISCUSSION

This exemplary application demonstrates how a purposeful system can use the normative futures planning framework to achieve a level of quality in action impossible to obtain when relevant issues are evaded and fundamental planning considerations are not rendered explicit. It shows how the methodology can be used by any decisional locus as a supradisciplinary tool with which to penetrate the overwhelming complexity of problems in a changing environment. It indicates the extent to which this perception can be employed to devise strategy which exploits favorable systemic tendencies while simultaneously reducing systemic deficiencies, so as to arrive at a more equilibrated and harmonious system functioning, and an improved human condition, as a result. Finally it reinforces the idea that "a conceptual revolution in the nature of the questions we ask, the answers we accept and the actions we deem appropriate must occur if we expect to enhance or even preserve our environment in a way that is humanly relevant (Bella, 1974)."

In a more general sense, normative futures planning is a flexible concept with the potential to evolve in such a way as to prevent problem situations from complexifying at a rate surpassing human abilites to comprehend them. The organized systemic perception achieved through the use of the conceptual framework stimulates purposeful systems to evaluate the quality of their daily experience, to relate it to a normative vision of a desirable future situation and to embrace this vision in the genesis of

their actions. As such, this method represents the view that planning is "beneficial cybernetics," an endeavor for which "a concept of an ultimately good environment-man interaction must be conceived" to provide the bases for a vision of an accessible and desirable future (Giles, 1977). In this way, normative futures planning advocates a preliminary strategy of wide-scale social experimentation, encouraging teleons to devise and attempt ever newer and more imaginative ways of recognizing opportunities and using them for bringing about improvements to the human condition. Its ultimate aim "is to help the society better judge what is good for itself (Harmon, 1975)."

The pressing need for planning methodology of a more explicitly normative nature has become increasingly apparent through recent efforts to expand the scope of contemporary planning efforts. Research devoted to the development of new synthetic fields such as prospective planning, technology assessment and environmental impact assessment bears witness of a rising collective desire to impose some degree of quality control on an ever greater range of human interventions. The conceptual framework described herein introduces some of the fundamental concepts which must be addressed in the quest for such a quality control. Nevertheless, many important aspects of this method will require extensive research and experimental application before its potentialities can be realized. Chief among these tasks are the development of systemology, the elaboration of futures research and the construction of alternative paths to the futures, the articulation of comprehensive goal and objective sets, the integration of wide-spread public and organizational participation to the planning process, the amelioration of methodologies for evaluating impacts and environmental repercussions, and

the conception of organizational arrangements capable of fully utilizing these contributions. Only through the type of "future-responsive societal learning" envisioned by Michael (1973) can normative future planning methodology assume the qualifications requisite for adaptive "long-range social planning" in a turbulent environment.

CONCLUSION

Normative futures planning aspires to provide a conceptual framework for controlling the quality of human actions with the express intent of improving environmental quality and the state of the human condition. It encourages those responsible for decisions to learn, and to discover how to learn, ways that quality can be achieved in their perceptions of reality and applied to their choice of actions. They and any other number of teleons are provided with a common means of assuring that their planned actions are compatible, that they will integrate harmoniously in the environment they will effect and that they define a coherent trajectory toward the attainment of a desired future situation. Thus, through the use of normative futures planning, specific decisions relating to the design and execution of action programs can possess an inherent quality control assuring their conceptual and operational coherence with other decisions and actions taking place in the same environment.

Furthermore, normative futures planning can imbue the many teleons acting in reality with a common recognition of the necessity for adequately planning societal change. It stresses that technological or economic solutions alone are insufficient for dealing with the complexity of environmental quality problems. Rather, a profound learning process is called for so that adaptive solutions can be found. This view of planning enforces a realization that partial solutions only contribute further to serious system perturbations, amplifying external diseconomies, diffuse social costs and foregone opportunities. When problem situations are allowed to escalate

through inadequate planning and disjointed action, they inevitably entail greater expenditures and provoke planning responses "conceived out of desperation rather than deliberation (Ozbekhan, 1971)."

To the contrary, the methodological requirements of normative futures planning challenge planners and policymakers to respond appropriately to problem situations by developing the subjective and objective observations requisite to an understanding of these problems and by providing for change in areas of current institutional and organizational inadequacy. Planning of this scope stimulates the explicit definition of a collective normative context whose inherent demands ensure that environmental quality considerations, and other fundamental aspirations related to the human condition, are incorporated in all of the important decision processes undertaken by teleons throughout their evolution.

GLOSSARY

An explanation of the principal terms and concepts structuring normative futures planning, and the theory on which it is predicated, is provided in order to facilitate access to a rapid and profound comprehension of the methodology and its potential for controlling the quality of human actions. Some of these terms and concepts are straightforward, their definition having been established with precision and consensus in the planning literature, whereas others have yet to achieve the level of sophistication required to render their definition explicit and unquestionable. Therefore, the majority of the following explanations are offered as proposed definitions and are presented in the way they are to be understood in the context of this thesis.

ACCESSIBLE AND DESIRABLE FUTURE: incorporating that which is humanly feasible and that which is universally seen to be of interest to continuing human progress and development, it is a prospective vision of collective human destiny and the state of the human condition which is predicated on collective human values and approached through the pursuit of societal objectives.

ACTION PROGRAMS or INTERVENTIONS: systems of human action conceived and undertaken by teleons in order to achieve valued outcomes, ie., satisfaction of their needs.

CENTRAL ACTIONS: these are thematic, hierarchically superior actions conceived for the pursuit of objectives; their accomplishment necessitates the conception and transmutation of specific systems of action (Sasseville and Marceau, 1979).

COLLECTIVE HUMAN VALUES: inherent to the conception of an accessible and desirable future, they reflect the normative stance shared by a collectivity and provide normative criteria guiding preferences and choices of systems of human action (Adapted from Ozbekhan, 1971).

CONJUNCTURAL ANALYSIS: a holistic observation, description and interpretation of the multitude of systems comprising a situation in reality toward the end of discerning their behavior and evolution as one interactive entity.

CYBERNETIC ORGANIZATION: one characterized by communication feedback processes which are sufficient to enable individual members to share an adequate perception of their particular roles in the observation of reality situations, and in the conception and execution of planned action within this reality.

ENDOGENOUS CONSTRAINTS: resistances arising within a human purposeful system which compromise the reality observations and action programs required for the fulfillment of objectives and goals (Adapted from Sasseville and Marceau, 1979).

ENDOGENOUS QUALITY CONTROL: an effort of rationalization and planning undertaken to minimize the compromising effects of endogenous constraints to the achievement of objectives and goals; it is used to ensure the highest possible degree of equilibrium between an action program and the environment within which it is to be implanted, thereby reducing the passive resistances and accomodating the active resistances which pose a barrier of potential to the transmutation of action systems (Adapted from Sasseville and Marceau, 1979).

ENVIRONMENT: the entire experiential milieu of man, encompassing all things, both abstract and concrete - nature in its multiple aspects, society, institutions, the plethora of artifacts created by man through his technologies, the forms of collective experience we call cultures, ways of life, history, and the accumulated dreams and memories of people (Ozbekhan, 1971).

ENVIRONMENTAL QUALITY: human value judgments and perceptions related to the actual state or condition of the totality of all that surrounds man, including other men, in all its physical, ecological, social, economic, cultural and psychological aspects.

ENVIRONMENTAL REPERCUSSION: the result of a future consequence of human action on the human condition which sufficiently changes the human condition to create a new situation in reality (Sasseville et al., 1977).

EXOGENOUS CONSTRAINTS: resistances arising within the environment of a human purposeful system which compromise the reality observations and action programs required for the fulfillment of objectives and goals (Adapted from Sasseville and Marceau, 1979).

EXOGENOUS QUALITY CONTROL: a natural integration of active resistances to the transmutation of action systems, it exists as a negative feedback rendering actions more harmonious with human necessities related to the quality of life means and the life habitat; it is based on objective criteria arising from organized decision processes, each having direct impact on the existence of planned action, and from diffuse sets of rationalized decisional loci, each aiming at particular aspects of the nature or structure of planned action, as well as on subjective criteria arising from diffuse non-rationalized decisions, founded in the value system, which obstruct the success of planned action (Adapted from Sasseville and Marceau, 1979).

FACT STRUCTURING A SITUATION: a body of events or actions, having already occurred and therefore well-defined in space and time, which crystallizes in a quantifiable or qualifiable whole (Sasseville and Marceau, 1979).

GOAL: a preferred outcome that can be obtained within a specified time period (Ackoff, 1971).

HUMAN ACTIONS: the body of essential and non-essential acts undertaken by individuals (personalized action) or collectivities (depersonalized action), they reflect that which is willed to occur in reality; they create history, maintain the present, and structure the future; they are the means used to achieve those goals deemed necessary for the pursuit of objectives (Sasseville and Marceau, 1979).

HUMAN CONDITION: the state of the man - environment system, encompassing the human and material environments of man, its quality increases through the strategic exploitation of new types of interactions between these human and material environments which maintain the equilibrium between social demand and the capacity of the environment to satisfy it (Sasseville, 1978).

IMPACT: the result of a future consequence of human action on the life habitat or life means which sufficiently changes the life habitat or life means to create a new situation in reality (Sasseville et al., 1977).

LIFE HABITAT: the material environment of man, it includes all the inert and living matter comprising natural or modified ecological systems, as well as the exchanges and interactions which occur there (Sasseville, 1978).

LIFE MEANS: the human environment of man, this concept includes all human systems: scientific and technological tools, ideals and values, institutions, politics, lifestyles, occupations, etc. comprising human social, economic, political and cultural systems, as well as the exchanges and interactions which occur there (Sasseville, 1978).

MANAGEMENT MODES: nature and configuration of means for potentially accomplishing central actions which together embody the strategic intent of the objectives retained.

NORM: a general principle that defines and dictates the procedures of any action whose ends and goals are given (Adapted from Ozbekhan, 1971).

NORMATIVE FUTURES PLANNING: a conceptual framework for societal planning, predicated on a supradisciplinary approach accomodating human values attributed to the present and to a desired future state of the human condition, it is used to achieve the coherence in reality perception necessary to attain a control of the quality of human actions.

OBJECTIVE: a preferred outcome that cannot be obtained within a specified period but which can be obtained over a longer time period (Ackoff, 1971).

OPERATIONAL MODES: nature and configuration of means for potentially accomplishing human actions which together embody the tactical intent of the goals retained.

PLAN: a complex, dynamic system -- an event-controlling structure whose function is to effect, in its environment (which is another complex, dynamic system), the kind of organized change that general values define as desirable (Ozbekhan, 1971).

PLANNING: a rationally organized, consciously future-directed system of human actions; NORMATIVE PLANNING refers to what "ought" to be done, STRATEGIC PLANNING to what "can" be done, and OPERATIONAL PLANNING to what "will" be done (Ozbekhan, 1971).

POLICY: decision rules that can incorporate all the relevant information available at the time of decision, and, hence, can provide maximum flexibility and adaptability (Ackoff, 1970).

PURPOSEFUL SYSTEM: one which functions or employs means toward the achievement of an end, it can produce the same outcome in different ways in the same (internal or external) state, and can produce different outcomes in the same or different states, through the application of will (Adapted from Ackoff, 1971).

QUALITY CONTROL: a negative feedback process regulating socio-economic growth and development in such a way as to assure the intrinsic value of human actions (Sasseville and Marceau, 1979).

QUALITY OF THE LIFE HABITAT: a value judgment of the state or condition of the material environment of man, it involves the synthesis of an objective evaluation of the aptitude of this environment to maintain its integrity through its own functional and organizational infrastructure and a subjective evaluation of what the state of this environment should be (Sasseville, 1978).

QUALITY OF LIFE MEANS or QUALITY OF LIFE: a value judgment of the state or condition of the human environment of man, it involves a subjective evaluation of the extent to which collective ideals of liberty, security, bounty, justice, etc. are being attained, and the way other aspects of this environment are evolving, based on indicators of social, cultural, economic and political progress (Sasseville, 1978).

SITUATION IN REALITY: a continuum of facts and ideas, created by the interactivity of man and environment, it represents the real state of the ecosystem which is dynamic, hence in continual change, and whose structure is a conjuncture of interlinked events (Ozbekhan, 1971).

STRATEGIC ACTION: a body of means, conceived for the pursuit of objectives, which concerns the comprehensive employment of power and resources (Bella and Overton, 1972).

SUPRADISCIPLINARY APPROACH: a perspective for observtion and action which encompasses the body of all disciplines of human endeavor in such a way as

to integrate their contributions to a profound knowledge of reality situations; when employed to acquire an understanding of complex situations in reality, it facilitates access to unified concepts and language from the variety of disciplines that must be involved for an adequate comprehension.

SYSTEM: a set of interrelated elements, the behavior of which bears witness to a certain cohesion with its environment (Ackoff, 1971; Sasseville et al., 1977).

SYSTEM OF HUMAN ACTION: a coherent set of hierarchically organized actions, conceived through a rational process of action generation, which have not yet occurred but are necessary and sufficient for the accomplishment of a central action (Sasseville and Marceau, 1979).

SYSTEMOLOGY: the science of systems, it is developed and employed to adequately manipulate the knowledge necessary and sufficient for an understanding of the structural, organizational, functional and interrelational aspects of all systems comprising reality (Sasseville, 1978).

TACTICAL ACTION: a body of means, conceived for the accomplishment of goals, which concerns the immediate or local employment of power and resources (Bella and Overton, 1972).

TELEON: a human purposeful system, be it an individual, informal group or formal group, which possesses a cognitive capacity, a passive and active

memory, and a capacity to choose and undertake specific courses of action based on his observation of reality and dependent upon the interactions he entertains with his environment; his primary motivation is to maintain, restore or increase the physical or conceptual territory that he requires to protect his integrity as a functioning purposeful system, according to his teleological conception of his continuing development (Sasseville and Julien, 1979).

TRANSMUTATION: a chronological transition process during which a system of human action becomes a series of new facts structuring situations in reality, it is a transformation from the abstract state of action generation to the concrete state of action realization (Sasseville and Marceau, 1979).

BIBLIOGRAPHY

ACKOFF, R.L. (1970). "A Concept of Corporate Planning." Wiley-Interscience, Toronto.

ACKOFF, R.L. (1971). "Towards a System of Systems Concepts." Management Science, 17(11): 661-671.

ACKOFF, R.L. (1974). "Redesigning the Future. A Systems Approach to Societal Problems". Wiley-Interscience, Toronto.

BELLA, D.A. (1974). "Fundamentals of Comprehensive Environmental Planning". ASCE, Engineering Issues -- Journal of Professional Activities, 100(E11): 17-36.

BELLA, D.A. and OVERTON, W.S. (1972). "Environmental Planning and Ecological Possibilities." ASCE, Journal of the Sanitary Engineering Division, June, p. 579-592.

CALDWELL, L.K. (1974). "Environmental Policy." in "Human Ecology." F. Sargent (editor), North-Holland Publishing Co.: Amsterdam.

CHADWICK, G. (1971). "A Systems View of Planning--Towards a Theory of the Urban and Regional Planning Process." Pergamon Press, Toronto.

DESCOTEAUX, Y. and DELISLE, A. (1978). "Les Citoyens et l'Evaluation de la Qualité des Actions Humaines". AGIR, Ste-Anne-de-Beaupré, Québec.

GILES, R.H. (1977). "A Watershed Planning and Management System: Design and Synthesis." Virginia Water Resources Research Center, VPISU, Blacksburg, Virginia, Bulletin 102.

HARMON, W.W. (1975). "On Normative Futures Research." Policy Sciences, 6: 121-135.

HOLLING, C.S. and GOLDBERG, M.A. (1971). "Ecology and Planning". Journal of the American Institute of Planners, 37(4): 221-230.

MICHAEL, D.N. (1973). "On Learning to Plan and Planning to Learn - The Social Psychology of Changing Towards Future - Responsive Societal Learning." Jossey-Bass, San Francisco.

OZBEKHAN, H. (1971). "Planning and Human Action" in "Hierarchically Organized Systems in Theory and Practice." P.A. Weiss (editor), Hafner Publishing Co.: New York.

SASSEVILLE et al. (1977). "Vers une Nouvelle Génération de Méthodologies d'Évaluation des Répercussions Environnementales." INRS-Eau, Québec, Scientific Report No. 74.

SASSEVILLE, J.L. (1978). "Stratégie pour une Contrôle de la Qualité des Actions Humaines." INRS-Eau, Québec, Scientific Report No. 106.

SASSEVILLE, J.L. and JULIEN, P.A. (1979). "Théorie de l'Action et Developpement Intégré." International Colloque on the Environment, Methods and Strategy for Integrated Development, Arlon. Belgium, September 23-29.

SASSEVILLE, J.L. and MARCEAU, R. (1979). "Le Contrôle de la Qualité des Actions Humaines: Théorie et Méthode." INRS-Eau, Québec, Scientific Report No. 108.

S.P.E.Q. (1978). L'assainissement des eaux au Québc - Politique et programme. Comité des politiques d'assainissement, S.P.E.Q.: Québec, Summary Report.

SHCHEDROVITSKY, G.P. (1977). "Problems in the Development of Planning Activity". General Systems, 22: 3-16.

APPENDIX A

A PLANNING METHODOLOGY FOR ELABORATING ACTION PROGRAMS IN RESPONSE TO COMPLEX PROBLEMS WITH SPECIFIC APPLICATION TO WATER QUALITY DETERIORATION

by

M.A. Peterson, B.A.

MAY 1982

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

"The environmental crisis, if it is to be resolved by other than biological disaster, requires more than 'mere' technical improvements. We must confront the implications it has for our economic structures, our political process and institutions, our living habits, and the moral basis of our philosophy and culture. We must pose and confront the necessary questions, and offer imaginative and serious alternatives"*.

* Robert Paehlke, editor, Alternatives.

INTRODUCTION

In a pluralistic democracy, such as that which has been established in North America for over two hundred years, a variety of public, private and individual actors undertake their respective activities with little regard for the interrelations and cumulative effects that these actions necessarily entrain. That these actions lack a certain desirable coherence is made evident by the variety of externalities which concern the economists and policymakers of today.

According to the theory of human action, any action presupposes a system, or thought process, by which the action is generated. It is precisely within these systems of action generation that an opportunity exists for ensuring a certain rationalized coherence. If the many varied action generation systems could be commonly linked to a normative vision of valued social outcomes, then a certain conjuntural consonance could be expected from the actions thereby engendered. What is to be discussed herein, through the development of a planning methodology, is the normative validation of governmental policy and action related to the improvement of environmental quality and the human condition, in general, and water quality, in particular.

The general planning methodology discussed in this report is superficially similar in basic structure to those traditionally employed in the elaboration of private and public societal action programs. It includes

the familiar stages of policy research, policy establishment and strategic and tactical planning. Specifically, the method described is comprised of a normative policy orientation phase, a policy definition phase and a plan or program specification phase.

In the first phase, general objectives which reflect a variety of present, projected and ancitipated societal values are conceived. An appreciation of the normative stance of involved social systems (towards themselves, others like them, their environment and their future) permits the conception of central actions, or policy guidelines, for the design of effective action programs. The interaction between this phase and the third provides a coherent link between policy intent and actual program performance. In the third phase, operational goals which more nearly reflect the reality situation of local or regional entities are deduced from the central actions conceived, and means to accomplish them (programs and procedures) are evaluated for their feasibility, desirability and performance expectations; the quality of the actions retained is assured by the normative appreciation af-forded in the first phase and by the planning link between policy intent and program development in the second. This methodology will thus incorporate the primary functions traditionally required of a planning process: defini-nition of the problem, determination of objectives, acquisition of relevant knowledge, choice of solutions and the elaboration of plans.

The major difference between this method and traditional ones is the theoretical base to which it is related, a consequence of the nature of the type of problems to which it is addressed. While the method could be adapted to apply to planning problems of any given scale, the intended scope of planning is assumed to be sufficiently large, both spatially and temporally, to permit the conception of more efficient action programs in response to societal problems of an increasingly complex nature. These problems, discussed in the first chapter of this report, have become more complex because of the multitude of heretofore inapparent relations now emerging between environmental and social systems as a result of increased demographic and economic pressures. Purely technical or technological solutions to these problems cannot work since their theoretical bases are insufficient to circumscribe the behavioral complexity of the systems involved. Planning appropriate action programs to respond to these complex problems requires a sufficiently lucid appreciation of many social and environmental factors currently under study through interdisciplinary collaborations among the many traditional disciplines of the social and natural sciences.

Getting to the roots of complex problems involves an appreciation of the internal dynamism of the human action systems which together engender a problem. Then, means can be conceived and evaluated through planning to modify this internal dynamism in such a way as to improve the quality of the action systems and reduce the many reasons for which the problem exists. Thus, the primary theoretical bases of this planning methodology, introduced in the second chapter of the report, include the theory of human action and

"systemology", developed by Sasseville (1978), which together provide a conceptual framework for the synthesis of the knowledge required in the appreciation and planning of quality-controlled action programs.

The general methodology is described in detail in the third chapter whereas the fourth treats a hypothetical application of the methodology to the problem of water quality deterioration. It is not the intent of this latter chapter to elaborate a complete action program for the restoration of water quality in the province, but rather to permit the explanation of the methodology in practical terms of policy formulation and program design as well as to suggest a way in which the use of the methodology, or one similar, could be institutionalized in the governmental sector. Accomplishing this would be a necessary pre-requisite to the application of the methodology in the elaboration of action programs designed to respond to complex problems such as environmental degradation.

CHAPTER I

THE PROBLEM ADDRESSED BY THE METHODOLOGY

1.1 The nature of the problem

Complex societal problems arise from the myriad interrelationships between social and environmental systems, especially land and land-use systems. Problems such as environmental degradation and social alienation have been exacerbared in part by increasing demographic pressures, anarchic technological development and an overall lack of perception of the necessity to adequately plan societal change. In fact, complex problems are interdependent and together form a macro-problem, unique in human history, whose correction virtually lies beyond the scope of current international and national organizational capabilities (Ozbekhan, 1971).

One of the greater forces complexifying societal problems is the fact that the various objectives formulated within a society have become increasingly incompatible to each other and to the environment in which they are pursued. For example, economic growth and development are objectives embraced by every modern world society, yet there are certain limits to the ways in which these objectives can be realized without overly compromising the achievement of other necessary objectives, such as access to a healthy life habitat and to satisfying means of earning a living. Such limits refer to active and passive resistances naturally operating within social, economic, political and environmental systems. As a whole, consideration of the-

se conflicts between societal objectives, as well as those constraints which tend to oppose their achievement, is not adequately appreciately when action programs are elaborated to counter complex problems. Because planning efforts have traditionally externalized such fundamental considerations, societal problems have grown to such a level of complexity as to defy the ability of action programs to resolve them. Not only has a meaningful quality control of action programs been overlooked in the past, it is probably not even possible to achieve at present given the inadequacy of current institutional functions and arrangements.

Perhaps the major reason for which a quality control of action programs cannot be institutionalized at present is closely related to one of the chief causes of complex problems: the sectorialization prevalent in practically every sphere of human activity, be it economic, academic, political or otherwise. The increasing specialization among productive forces has led to an economic situation where no one in particular is responsible for its overall design and functioning. According to Ackoff (1974), "so far as technology is concerned, no one is in charge. It may not be controlling us, but we certainly are not controlling it". As a result, decisional sectorialization in the technical and economic sectors has favorized the creation of a multitude of activities and enterprises with limited objectives. These specialized structures have developed a self-justified competence and super efficiency, yet the will to integrate them for an improved control of civilizational development has heretofore remained unexpressed. Each of these economic and technical agents exhibits little concern for the repercussions of their activities on environmental and social systems which are

not incorporated in their momentary pre-occupations with the establishment or monopolization of their social and economic responsibilities. Neither are they in a position to appreciate the repercussions that increasing social and environmental turbulance can bring to bear upon their activities.

Moreover, sectorialization among the academic disciplines has led in many cases to the establishement and acceptance of entrenched paradigms which serve to filter the perception of problem topics or aspects deemed appropriate for researchers to investigate. Large gaps exist in the interpretation and application of basic research for use in the many new synthetic fields needed to contribute to the solution of complex societal problems. In addition, the ways in which academic organizations reward their participants discourage professional involvement in the newer synthetic sciences, such as ecology and environmental psychology, which have become engaged in research more directly relevant to society's macro-problem. Despite such efforts, actual political structures continue to encourage the identification of limited and distinct objectives within a discipline, often neglecting even the interrelations between the internal sectors of knowledge which comprise the discipline.

In matters of governance, a bureaucracy has evolved which divides its capabilities and responsabilities in a sectorial fashion. Natural resources, health, social welfare, economy, justice, industry, agriculture, forestry and even the environment have become distinct administrative agencies, consolidating knowledge in their narrowly perceived fields and reinforcing the intellectual and emotional profile of individuals composing the

bureaucracy (Sasseville, 1978). Complex problems are only exacerbated by struggles for influence or jurisdiction in those problem areas for which the distribution of administrative capability is limited or ill-defined. Moreover, discretionary power in administrative agencies has grown to the point where legislative bodies are no longer capable of assuring that the powers which they have delegated are actually reflected in bureaucratic performance (Sasseville, 1978). The ill-defined notion of "the public interest", articulated differently by each administrative agency as a function of their perceived responsabilities, replaces the more explicit links that should exist between legislative policy objectives and bureaucratic action programs:

> "...use of the phrase 'public interest' leads to the central myth of our present administrative law: the belief that decisions concerning planning and allocation can be, and are, made on an objective basis. "...decision makers combine expert knowledge and professionalism with judicial bearing. The tools they use for decision are science and reason. At the core of the myth is its cardinal point: decisions are not primarily choices between values. The entire machinery of administrative law serves to deny the role of values in the planning process (Reich, 1966)".

The normative adequation of policy intent and bureaucratic performance cannot at present be sufficiently coordinated within sectorialized administrations to permit the kind of transparent decision making necessary for a rational confrontation of complex problems.

A corollary of sectorialization is the individual unwillingness within a bureaucracy to seek new and more relevant responsibilities:

> "Most people avoid examining the ethical bases for their performance, ... because doing so exposes the ambiguous consequences of their actions. This in turn exposes the questionable extent to which they really do control their world. Thus they avoid, and are encouraged to avoid, reflection about the moral consequences of their role performance by believing that 'that's not my job' (Michael, 1973)".

Such attitudes, in concert with the lack of normative adequation between policy and administration, reinforce the tendency of agencies to continue activities for which they have acquired a reasonable expertise while rejecting those which would require changes in its structure, function or in the formation of its personnel. This tendency is inherent to attempts to continue using methods and sectorial disciplines in unmodified forms which seemed optimal only ten years ago but are plainly inadequate for the scope of today's societal problems (and for taking advantage of newly arising opportunities). For example:

> "Establishment economics provides no conceptual approach to measure and comprehend industrial performance, nor to reform, restructure or control industry. The multi-faceted dynamics of technological advance and industrial transformation - the underpinnings of increased productivity - are almost wholly excluded from the normal purview of Establishment economics. Nor does it offer any guide to a control of price that reflects a rational policy for allocation of resources, for the distribution of income or for incentives for efficiency and technological progress (Michael, 1973)".

Obviously, under such circumstances, those in a position of making decisions cannot adequately consider the many important social and environmental implications involved peripherally within their spheres of responsibility. This ignorance contributes to a neglect of important environmental resistan-

ces that can oppose the implantation of needed action programs and thereby compromise their quality. Many, if not most, complex problems can be understood within this context of sectorial abdication of overall responsibility.

Another source of complex problems, derivative of the natural tendency toward sectorialization, is the incompatibility between different schemes employed in the pursuit of societal objectives, often obscured by the notion of the "public interest". This unfortunate state of affairs could not be otherwise when public leadership adheres to a basic policy as unimaginative as "disjointed incrementalism". This kind of policy does not reflect objectives defined in relation to accessible states of present and future satisfaction. Rather,

> "... it emphasizes the unpredictability of the future, the limited rationality of men, the logical and operational dilemmas of setting goals and priorities, the pragmatic and expedient conduct of politics (both internal to the organization and as it operates in the larger environment), and the constraints of existing structures of governance and statutes.
> "... much of the rapidly accumulating social mess can be seen as the legacy of an indifference to the future that resided in past applications of disjointed incrementalism to the production of knowledge, as well as to the governance of society (Michael 1973)".

This type of approach tends to negate the idea that men make their own social reality, and that they base their future course of action on their perception of futures which they believe to be accessible. As a result, governments have neglected to develop articulated and coherent long-range ima-

ges, or scenarios, of different types of social evolution that could take into account the natural essence of social and environmental systems, an understanding which could guide the formulation of political strategies (economic, social and environmental) capable of appropriately integrating tactical interventions. Men, as individuals, face and accept this kind of planning process for the greater part of their lives, yet taken as a collectivity, an elaborated conception of goal-oriented societal planning has been arrested by the comfortable doctrine of "disjointed incrementalism".

This rather negative regard towards societal planning is more readily understood within the context in which the subject first emerged. Legislatures have traditionally delegated regulatory powers to administrative agencies with the understanding that their activities are to be carried out according to the "public interest". Concerns of allocation and planning later emerged as conflicts between powerful lobbying forces intensified to such a point that some definition had to be found for the "public interest". As it is often judged in the courts, the public interest has become virtually equivalent to that of the primary parties involved in a dispute, and emphasis tends to be placed "on those interests which have a commercial or pecuniary value as against intangible interests such as scenery or recreation (Reich, 1966)". In reality, the legal structure has not evolved far enough beyond provision for reglementation to attempt judgments concerning administrative allocations and societal planning. Decision-making transparency is as essentially lacking from judicial review as it is from the exercise of administrative discretionary powers. By the fact that administration limits its intervention to establishing a balance between various primary inte-

rests, while any persistent disputes, if articulated, are left to adjudication, such an arrangement "denies that the agency has an affirmative duty to undertake (societal) planning on its own initiative (Reich, 1966)". The inadequacy of the current institutional infrastructure to enact meaningful societal planning, as well as the traditional suspicion afforded such activities by a pluralistic democracy, would suggest that societal planning is an extremely problematic activity that must be undertaken with all due humility and by all parties involved through a long and searching mutual learning process, rather than through the perfunctory pronouncements of public officials attempting their particular brand of "social engineering".

To sum up, many aspects of the problem discussed lead to the conclusion that a great many opportunities to alleviate the causes of complex problems have been overlooked or avoided in the past. Systemic perception of the internal dynamism of complex problem situations has not been effectively focused on means for exploiting and applying this knowledge in such a way as to modify the system's dynamism and thereby dissolve the problem situation. Such neglect is hardly surprising given the historic tendency for concepts like "disjointed incrementalism", "the public interest" and especially "the invisible hand", to merge together to form a Western, liberal, laissez-faire ideology fundamentally opposed to an articulated concept of societal planning. The unquestioning embrace of any such ideology produces a false climate of certitude which suppresses the evolution of new ways to perceive and act upon social problems;

> "While the ideology may well contain highly rational arguments, it is characteristically ultra-rational in its overall spirit. It becomes comfortable and protective; and in this way contributes to the emotional security of the participant and to his self-confidence in carrying out the activity. While the ideology thus provides an essential kind of consensus supporting the activity, its self-evident and self-justifying nature may also contribute to a smug and traditional outlook and discourage a healthy self-awareness and sceptical re-examination (Foley, 1973)".

Ideology, another word for representing "world view", or "world outlook", can thereby obscure important aspects of complex problems as well as the much greater range of choice within which administrative agencies could operate. The role of ideology is illuminated in the tendency for public planning to "have been over-concerned with the content of plans rather than with the nature of the process of planning, with physical artefacts rather than with the qualities of human judgment (Chadwick, 1971)". Planning for the optimization of physical sub-systems of complex social and environmental systems, an outlook largely encouraged through sectorialization, often ignores ways in which optimizing one sub-system can cause perturbations in another. In social and environmental systems, such perturbations are equivalent to "external diseconomies" which result in a multitude of social costs (foregone opportunity, etc.). Perturbations, engendered by the incoherence of actions undertaken, have a tendency to coalesce into major system disequilibria or crisis states (economic, social or environmental) demanding significant government attention. Just a few of the more salient examples might include energy supply cuts, deficit public transportation, strikes, innercity crime, chronic under-employment, speculation of agricultural land, water pollution, and radioactive waste disposal. Compensatory measures usually taken are inspired by desperation rather than deliberation,

since once again the same sub-systems are subjected to analytic scrutiny rather than to a synthetic appreciation of their overall relation to each other in the more complex systems of reality. Strangely enough, classical political theory, as developed by Plato and Aristotle in response to what they perceived as social deterioration in their ancient civilization, articulates a broad system perception of the reality of their times:

> "In the process of seeking the explanation for crises involving the economy, technology, and ecology, classical political thought believes it necessary to study the nature of the human soul, the implicit ends of humanity and the inter-relationships of economy, society and politics (Sibley, 1973)".

Perhaps the ancients summarize here as well as anyone could the ephemereal nature of the complex problems that another civilization now faces almost three thousand years later.

1.2 An appropriate response

It should be apparent from the above discussion that the problem addressed by the methodology is concerned as much with the ways in which society has traditionally responded to complex problems as it would be with any particular part (environmental degradation, social alienation, etc.) of the macro-problem itself. Thus the methodology must be employed with the understanding that an appropriate response to complex problems should provide for change in areas of current inadequacy. It has been shown that societal planning in response to complex problems cannot be meaningfully institu-

ted within the confines of existing social, economic and political structures; nor can current knowledge and technique be considered adequate for the undertaking of such ambitious efforts. Rather, a greater appreciation of the many facts and values which structure reality should encourage the conception of innovative programs and techniques for implementing long-range social planning within an adaptive administrative structure. At present,

> "... government organizations, concerned with human social development, are not deliberately and knowledgeably changing toward organizational arrangements that reward their members and their clientele for assuring that the organizations continuously operate so as to meet three requirements:
> - that present actions be deeply influenced by sophisticated conjectures about relevant future societal (as contrasted to technological) contexts;
> - that, at all stages of moving from present actions into the future, the social and natural environment be scanned and the feedback from it be controlling in the unfolding and alteration of the future-oriented plans;
> - and that explicit social goals and the implementation of programs to realize them be intertwined conceptually and operationally, with the goals serving as highly salient regulators of social development rather than as rigid end-points (Michael, 1973)".

Michael (1973) suggests that such change can only be brought about through a form of future-responsive social learning that would catalyze the directed self-transformation of society:

> "Genuine human rationality is essentially a process of learning and any learning process involves not only the acquisition of knowledge and skills but also the development of new values and interests. In this sense, if we are to escape the icy grip of technocratic planning, we must develop a humanist style of learning through planning and a theory of planning as widespread social learning (Gross, 1971)".

Such a response recognizes the need for societal planning and advocates that it can only be achieved through popular participation and organizational involvement by all sectors of society. Indeed, decentralized interactions between publics and their government which encourage expressions of preferences in present and future conditions would probably be a necessary first step for the establishment of such a learning process.

One driving force of such a societal learning process might be the revision of current ideology to reflect an emerging politico-ecological ethic. According to Caldwell (1970):

> "If society is to deal effectively with these problems, political and administrative leadership will be required to help the people to understand the necessity for certain changes in their expectations, laws, and public institutions. A new, ecologically valid politico-ethical ideology is needed to legitimize the tasks of public authority and responsibility that an effective effort to cope with man's environmental problems would require. A dual crisis of attitudinal and institutional inadequacy must be surmounted if the resulting crisis of the environment is to be overcome (Caldwell, 1970)".

In debunking several prevalent myths widely accepted in contemporary society, he suggests that the following beliefs, consistent with environmental and behavioral evidence, be reflected by such an ethic:

> "First, infinite growth is not possible in a finite world.
> "Second, in a finite 'closed system' world, self-renewing processes are necessary to maintain viability.
> "Third, regardless of the economic or social theory prevailing in a society self-regulation by people en masse appears to require institutionalization (Caldwell, 1974)".

The requestioning of many currently held values and ideologies would then seem to be an important activity guiding the conception of an appropriate ethical base for societal learning and planning. The search for new emergent values around which such an ethic could crystallize would appear to be another necessary activity. The Bioethical Creed expounded by Van Rensselear Potter (1971) represents one such attempt to organize humanist values into a politico-ecological ethic.

Another driving force for a societal learning process is afforded by the application of a multitude of general systems theory concepts, providing "a conceptual framework into which knowledge of man and his environment, social, biological and physical, can be organized into a coherent pattern (Caldwell, 1974)". This theory has the potential to bridge the gap between sectorialized disciplines, providing a synthetic frame of reference to which most scientific theory and application can relate. Moreover, this theory provides the rationale for devising strategies of intervention which respect fundamental properties of complex social and environmental systems through such concepts as the maintenance of stability through the preservation of diversity (Bella and Overton, 1972). Use of the theory can help define the pertinence of research and development activities and can show how they might better be applied to the solution of real world problems. The theory encourages an understanding of the present structure of society, the imperatives which social evolution imposes and the measures which are required to respond to social needs as reflected in an articulated perception of the future (OECD, 1976). Perhaps most importantly, a systems perception permits an understanding of the process by which human actions are

generated. The methodology elaborated herein applies this knowledge to the formulation of a conceptual framework within which societal planning can be attempted. Essentially, action programs conforming to the constraints imposed by the maintenance of a viable habitat, as well as to articulated social and economic necessities, can be conceived within this framework through the observation and systematization of reality. Efforts to apply general systems theory to a better quality control of human action programs, in concert with the generalized evolution of a new politico-ecological ethic, would thus seem to be two of the most important components of an appropriate societal learning process for responding to complex problems.

1.3 The specific problem of water quality deterioration

The pollution of aquatic ecosystems and resultant environmental degradation is a multi-faceted and deeply rooted societal problem of continental proportions. It may be perceived in literally physical terms as an accelerated entropy boost due to the growing kinds and amounts of terrestrially generated waste materials and energy (BOD, toxins, heat, etc.) that eventually become randomized in aquatic environments to perhaps find their way to the sediments, estuaries or the sea. This process can be thought of as an accelerated as well as a diversified (complexified) flux of matter and energy when compared to the natural earth processes by which the continents are gradually leveled and their order randomized.

Essentially, water quality can be conceived as a function of waste inputs (point and non-point sources) and natural assimilative capacity, con-

ditioned by high or low flows (regulation) and seasonal changes (Environment Canada, 1975). A systemic perception would nevertheless emphasize terrestrial systems as the appropriate frame of reference for an understanding of the problem of water quality deterioration, situating it within the larger context of land-use problems in general, and all their economic, social and political ramifications. Indeed, with respect to many societal problems:

> "We are reaping the harvest of earlier, indiscriminate land-use patterns. Our ability to deal with environmental and quality of life problems is shackled by yesterdays land use practices. Future generations will reap greater problems unless we can overcome past mistakes while establishing beneficial patterns within the same areas (Giles, 1977)".

The most obvious water quality problem sources would appear to be associated with resource-based industries (forestry, agriculture, mining, etc.), however domestic sewage and a host of non-point sources (erosion and run-off) cannot be discounted. Neither can the effects of man-made interventions (regulation, etc.) be neglected, since they have the potential to severely exacerbate water quality problem situations. However one might wish to conceptualize the problem in physical terms, it represents, in figurative terms, a diversified range of "external diseconomies" for which governments have belatedly been delegated responsibility.

The economic aspect of the water quality problem stems from the paradox that both polluting and abatement activities entail societal cost. Pollution imposes direct costs whenever economic decisions are made to pro-

vide for its treatment or when utilization opportunities are foregone as a consequence of the deterioration. Similarly, if pollution is severely controlled, some polluting activities may be foregone and others incur additional expense, as for example when a paper company decides to transport its logs by truck rather than by river. The result of this paradox is that it is not economically feasible to completely permit nor to completely prevent water pollution. This does not mean to say that one cannot aspire to a comprehensive control of the water quality situation, rather it stresses the difficulty of arbitrating, in cost-benefit terms, how much pollution can be permitted and how much should be prevented. While the economic reality must certainly be understood, decisions of this type should consider a variety of implicated social, environmental and ethical aspects and related human values. If this normative and factual feedback is not employed in decision making, then a coherent link between well articulated and coordinated policy statements and their application in the guidance of interventions cannot be achieved. This link is essential since many environmental and social values cannot be adequately expressed in economic terms and require qualification. What may appear to be optimal land-use in strictly economic terms can engender accusations of mismanagement if a certain threshold of environmental stability or social equity has been compromised.

The environmental aspects of water quality deterioration are related to basic uncertainties over how far a natural system can oscillate from an evolutionarily determined equilibrium state before its integrity, or life-support functions, are threatened with disruption. In effect, pollution and flow regulation can significantly reduce valuable biological production

in rivers and, especially, in estuaries while nuisance forms of biological production may be encouraged. It is not presently known how much the diversity and genetical potential of ecosystem components are compromised by water pollution, nor to what extent this would decrease the quality of habitat and life for men and other terrestrial inhabitants. One of the more salient ecologial incertainties concerns the well publicized phenomenon of biological magnification whereby higher species can be poisoned through the ability of a food chain to accumulate randomized synthetic pollutants. The values which society and government should attach to such situations, and their related uncertainties, are by no means explicit.

Socio-political aspects of the water quality problem define how various manifestations of the problem are perceived. Responses range from immediate action, as in the case of contaminated drinking supplied, to unvoiced complaints over esthetic insults or visual blight. Such views may be considerably altered however if personal and collective economic opportunities are perceived to be jeopardized. In either event, such perceptions neglect the long-term consequences of a failure to find a compromise response:

> "Time-lag effects are characteristic of nearly every aspect of environmental deterioration threatening present day society. For example, pollution of the air, water, and soil, the loss of open space, the destruction of estuaries and coastlines, the depletion of non-renewable natural resources, have developed steadily, and, in the earlier stages, to the unsensitized observer, unobtrusively. The impact of worsening environmental conditions is thus attenuated. An 'atmosphere' of urgency is not present, and the changes in attitudes and institutions are not forthcoming with the rapidity necessary to arrest or reverse the destructive trends (Caldwell, 1974)".

The ethical dilemma posed at this level of socio-political consideration is extremely complex since the values expressed are implicity concerned with economic, environmental, and ultimately, political choices. No one is certain what social values are to be associated with varying degrees of corporate morality and government secrecy, with foregone future opportunities versus foregone present opportunities and a multitude of related emotionally charged ethical questions.

Obviously, in order to conceive policy and action of a requisite variety when faced with such a problematic situation, an evaluation of each of these systemic aspects must be integrated into an appreciation of the entire water quality deterioration system. Evaluation implies that the possible economic, social and environmental outcomes discussed above, each of which has different value for different parties, must be understood and weighted before meaningful policy objectives can be divised which define acceptable water quality and the preferred means to attain or maintain it.

Present institutional systems do not provide for the administrative coordination and development that a systemic perception of the water quality problem and an appropriate strategy of intervention would require. They do not solicit the requisite variety of environmental signals that could permit them to effectively structure their response to the problem. Not only are they unable to articulate the many values associated with different levels of water quality, they cannot effectively harness cooperative action from other institutional agents who may be operating at cross-purposes and thereby imposing unsurmountable constraints to adequate envi-

ronmental protection. "A great need exists for devising arrangements which allow for joint scheduling of different but interrelated planning programs-arrangements which would make possible the joint consideration, in a common time-frame, of the areas of mutual concern (Walker, 1974)". New research concerning the cybernetic relationships between pertinent organizations has yet to be fully tested and applied in government to the advantage of environmental protection. Thus, many fundamental resistances to effective action, and a part of the problem of water quality deterioration itself, arise from organizational difficulties in the institutional environment of planning and intervention.

An appropriate response to the water quality dilemma would therefore seem to revolve around the adequate articulation of values for policy conception and the illumination of institutional constraints impeding the implementation of policy. Present methods have not permitted a general mobilization of the collective responsibility for water quality protection, yet the amount of knowledge and practical experience gained to date is significant (Peterson, 1979). The new approach recently proposed by the SPEQ (Services de Protection de l'Environnement du Québec) appears to be a step in the right direction towards an appropriate response. This approach, recognizing the need for adequation between public interventions and immediate public benefits, and the need for planning to consider the systemic reality proper to each localized manifestation of pollution problems, begins to provide some relevant criteria for the choice of intervention priorities (Gauvin, 1978). Such an outlook, coupled with recent studies on the prospect of administrative regionalization, increase the liklihood that the SPEQ can be

more effective in its future territorial interventions. Nevertheless, a sectorial agency such as the SPEQ cannot coordinate such realistic intervention within the jurisdictional confines of its mandate unless effective liaisons with other national priorities and their administrative interventions can be achieved. Because water quality problems have been shown to be intimately related to land-use activities and their attendant problems, indeed to the macro-problem described above, a mandate for water quality protection cannot be seperated from a national environmental protection policy:

> "... there is no single legal or constitutional base for environmental policy, largely because no generally accepted political or philosophical foundation for environmental or ecological public policy exists. The primary focus of environmental action has differed among countries for historical, geographical, and cultural reasons. We may think of the foundation of public policy for the environment, or human ecology as being made up of a number of large building blocks, the principal among them being public health, conservation of natural resources, economic well-being, esthetics of human settlements and the natural environment, scientific and ethical aspects of the maintenance and protection of wildlife and natural ecosystems, and finally, the long-term stability and renewability of human society (Caldwell, 1974)".

Perceived in this light, it would appear that the OPDQ (Office de Planification et de Développement du Québec), with its broad mandate for assuring administrative coordination in societal planning and development, could resolve many of the institutional constraints mentioned briefly above. Unfortunately, the organization established to undertake this increasingly vital function, the CIPD (Commission Interministérielle de Planification et de Développement) is restricted to a virtual consultant role and is thereby denied the opportunity to catalyze citizen participation, formulate comprehensive policies and assure the adequation of administrative intervention and

the arbitration of conflicting purposes (Comtois, 1979). The potential to effectively respond to the macro-problem facing society clearly rests with such an organization. It could appropriately organize the planning and policy-making expertise requisite to this task and provide the forum where sectorialized planning and action can be harmonized in an atmosphere of public involvement. At present, the institutional potential of both the SPEQ and the OPDQ to effectuate needed societal planning and change in matters of environmental quality, despite considerable efforts in this direction, remains relatively unexplored.

CHAPTER II

THE THEORETICAL BASIS OF THE METHODOLOGY

2.1 Systemology

Systemology, or the science of systems, is a synthetic discipline aspiring to provide a common frame of reference for the many traditional and hybrid disciplines active today in the natural and social sciences, as well as a variety of professions. The increasing interaction which these groups must undergo to effectively respond to complex problems necessitates the adoption of communication mechanisms and semantics that are not only mutually aceptable but which are capable, in addition, of promoting the conceptualization of a systemic perception of reality. According to Ackoff (1974) "systems-thinking" represents a new age in human history, a natural extension of the "Machine Age" in which analytical thinking and reductionism comprised the dominant mode of reality perception:

> "Although eras do not have precise beginnings or ends, the 1940s can be said to have contained the beginning of the Systems Age. The new age is attached to an intellectual framework that is built over and around the one it replaces. The old framework has not been destroyed or discarded; it has been adapted and extended. The new age is a remodeled version of the old. What was "all" in the past has become a "part" of the present. The doctrines of reductionism and mechanism, and the analytical mode of thought are being supplemented and particlly replaced by the doctrines of expansionism and teleology, and a new synthetic (or systems) mode of thought (Ackoff, 1974)".

Systemology, as a mode of systems thinking and acting, recognizes the indissolubility of all objects composing reality. It plays an integrating role in the research and application of activities necessary for a systemic perception of reality. These include general systems theory (systems properties), cognitive systems analysis (system modelling and simulation) and normative systems analysis (system control and design) (Sasseville, 1978). Systemology was chosen as the theoretical basis for the planning methodology proposed herein because of its potential to orient two vital functions of societal planning: a systemic perception of reality, through system-thinking, and a quality-controlled elaboration of action programs, through system-acting.

Systemology is not particularly concerned with the establishment of rigorous theory for the taxonomy of various types of systems, but rather with the structuring of a mode of thought that permits a recognition of system properties and an understanding of relations among these properties. Many system properties and classifications permitting their characterization have been discussed in a variety of scientific literature, yet some are of particular importance to societal planning (Sasseville, 1978). In order to be meaningful to a planning situation, related properties of social, technological and environmental systems should be perceived through their structural, functional and evolutionary aspects. With respect to systems in general:

> "... one can regard them as: having a structure or morphology, i.e. being; undergoing internal (endogenous) changes in time, i.e behaving; and, in the case of open systems, undergoing irreversble external (exogenous) changes in time, i.e. becoming (Chadwick, 1971)".

Inherent to this conception of systems are such fundamental properties as cohesion, exchange and production processes, equilibrium states, state changes in response to environmental impetus and state evolution along a trajectory over time. Systems with which planning is concerned characteristically contain negative and positive feedback loops which influence these properties. Positive feedback usually causes deviation in systems, driving changes towards growth and evolution, whereas negative feedback corrects deviation, tending to favor the maintenance of system equilibrium, or controlling the quality of state changes.

Complexities of this nature tend to bestow systems with a Gestalt quality which cannot be discerned through the simple decomposition of systems and the analysis of their parts:

> "A system is more than the sum of its parts. A human being, for example, can write or run, but none of its parts can. Furthermore, membership in the system either increases or decreases the capabilities of each element; it does not leave them unaffected.
> "Viewed structurally, a system is a divisible whole; but viewed functionally it is an indivisible whole in the sense that some of its essential properties are lost when it is taken apart. The parts of a system may themselves be systems and every system may itself be a part of a larger system (Ackoff, 1974)".

A recognition of the indivisibility of systems leads to the notion of systems having a hierarchical organization, suggesting that a realistic approach to understanding systems of concern to planning would be to perceive them in relation to their environment, or the larger system of which they are a part:

> "In the Systems Age we tend to look at things as part of larger wholes rather than as wholes to be taken a part. This is the doctrine of expansionism.
> "Expansionism brings with it the synthetic mode of thought much as reductionism brought with it the analytic mode. In analysis an explanation of the whole is derived from explanations of its parts. In synthetic thinking something to be explained is viewed as part of a larger system and is explained in terms of its role in that larger system.
> "The synthetic mode of thought, when applied to systems problems, is called the systems approach. In this approach a problem is not solved by taking it apart but by viewing it as a part of a larger problem. This approach is based on the observation that when each part of a system performs as well as possible relative to the criteria applied to it, the system as a whole seldom performs as well as possible relative to the criteria applied to it. This follows from the fact that the sum of the criteria applied to performance of the parts is seldom equal to the criteria applied to that of the whole (Ackoff, 1974)".

This property of systems emphasizes two important considerations for societal and environmental planning. First, well-intentioned interference in certain parts of systems can reverberate throughout the system, potentially causing proportionately larger changes in other parts and perhaps affecting overall system performance. Second, changes which do induce such radical deviation can have irreversible effects within the system, thereby enhancing or compromising its performance. The notion of system hierarchy would also suggest that a system's performance is dependent as well on relations it entertains with its environment:

> "... in systems thinking an attempt is made to evaluate performance of a system as a part of the larger system that contains it. A corporation, for example, is not evaluated by how well it performs relative to its own objectives but rather relative to the objectives of the society of which it is part (Ackoff, 1974)".

Planning for improved systems performance must carefully recognize system properties such as indivisibility and hierarchical organization in its design of appropriate action programs.

Another important property of social and environmental systems is the fact that they are open to their environment, and the relations they undergo with it are probabilistic or nondeterministic cause-effect, rather than simple cause-effect. In the latter case, cause is both a necessary and sufficient condition for its effet, whereas in the former, cause is necessary but not sufficient for the effect. This relationship has also been referred to as producer-product, and has been instrumental in the conception of purposeful systems:

> "Because a producer is not sufficient for its product, other producers (coproducers) are also necessary. Taken collectively these constitute the producer's environment. Hence, the producer-product relationship yields environment-full (open-system), not environment-free (closed-system), thinking.
> "... a theory of explanation based on producer-product permitted objective study of functional, goal-seeking, and purposive behavior. The concepts free will and choice were no longer incompatible with mechanism: hence they need no longer be exiled from science.
> "Thus, in the 1950s, teleology - the study of goal-seeking and purposeful behavior - was brought into science and began to dominate our conception of the world.

> "In mechanistic thinking behavior is explained by identifying what caused it, never by its effect. In teleological thinking behavior can be explained either by what produced it or by what it produced or is intended to produce. For example, a boy's going to the store can be explained either by his being sent there by his mother, or by his wanting to buy ice cream. Study of the functions, goals, and purposes of individuals and groups - not to mention some types of machine - has yielded a greater ability to evaluate and improve their performance than did the study of them as purposeless mechanisms (Ackoff, 1974)".

These notions are indispensable to societal planning insofar as social systems are purposeful systems whose members are themselves purposeful systems. Successful adaptation to changing reality situations through planning and action is one of the most important purposes of social systems and their components. Adaptation may be of a passive nature, whereby a system changes its behavior so as to perform more efficiently in its environment, or it may be of an active nature, whereby more efficient behavior is sought through changes brought about in the environment of the system (Ackoff, 1970). These activities require a deep, self-conscious understanding of goal-oriented systems, their value structures, the way values relate to needs and their satisfaction, how changes in needs produce changes in values and what produces changes in needs. Systemology provides a means for perceiving these components of purposeful activity and relating them to the process by which human actions are engendered.

2.2 The theory of human action

The theory of human action describes the genesis of human action as a systemic process by which single actions are naturally integrated into coherent action systems (Sasseville, 1978). Its relevance to the elaboration of a planning methodology is apparent. If it were possible to understand the process by which human actions are engendered, it would then be plausible to assess the value of these actions and to subsequently manage action programs by favoring their integration into the environment when they are perceived as desirable and by disfavoring those which contribute further to socio-economic and environmental problems. This could be accomplished by the elaboration of a quality control permitting internal adjustment within the very process of human action generation itself. The quality of actions would then be judged through a systemic perception of the conjuncture which makes the actions apparently necessary.

The genesis of human action systems is depicted in the left half of Figure 1, which shows the process by which action systems evolve into real situations. Human actions, or events seen as necessary for attaining fixed goals, are conceived by initiators, or moral persons, called observer-actors. These actions are undertaken to permit access to a certain state of satisfaction, or desired finality, which is related to fundamental human aspirations for security and liberty, as well as to related values. The finality sought is usually related to the overall normative context in which national policies are inspired and thus represents a body of collective ideals

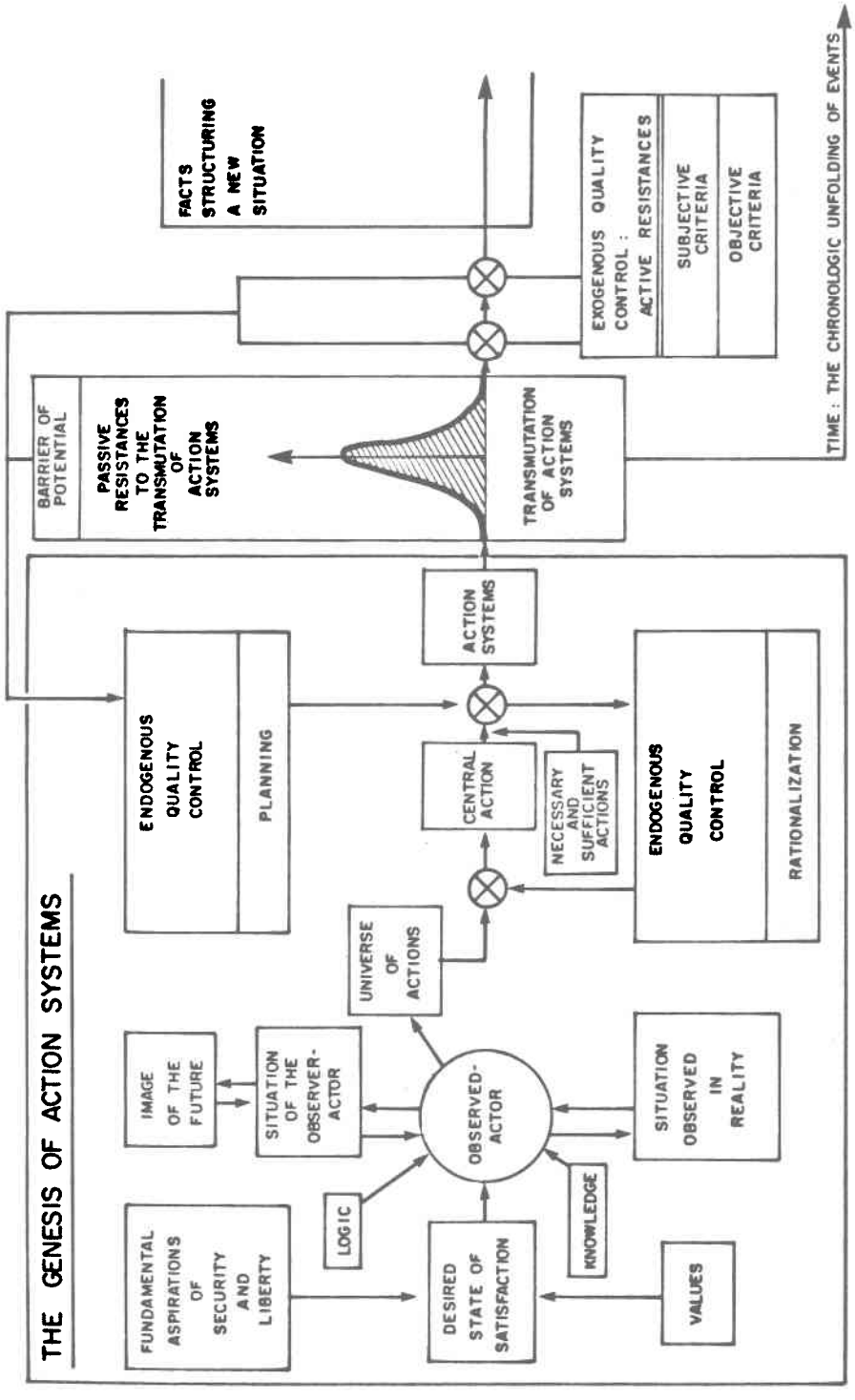

Figure 1. The genesis of action systems and their evolution into reality situations (Adapted from Sasseville, 1978).

La genèse des systèmes d'action et leur évolution en situation réelles (D'après Sasseville, 1978).

described within the plan of twentieth-century civilization development. The desired finality therefore depends upon the perception that observer-actor has of his own situation in reality. The finality conceived is also determined by the observer-actor's activity spheres, which lead him to observe different situations in reality. Finally, it is determined in accordance with an image of the future that the observer-actor retains from several accessible future situations.

With the knowledge and logic that he possesses, and keeping in consideration his desired state of satisfaction, the observer-actor chooses from among a universe of possible actions those central actions which respond best to perceived present and future situations. This effort of appreciation, resulting from the analysis of the conjuncture responsible for the genesis of an action system, constitutes the first of two endogenous quality controls for generated actions. At this stage, there are two potential sources of error in the observer-actor's appreciation of reality that can compromise the quality of actions chosen. First, the observer-actor may only superficially examine his particular situation in reality, thereby losing sight of the reason for which he is charged to carry out certain societal objectives. Second, the observer-actor may retain a biased or irrealistic perception of the future, thereby basing his choice of action on false hopes, fantasy or inappropriate personal visions. In order to control the quality of actions conceived, an appreciation of reality must respect all potential sources of error. In general, the appreciation will be developed to the extent required by the amount of active and passive resistance perceived in the environment.

As a result of the appreciation process, central actions are retained which will modify perceived situations in such a way as to satisfy the observer-actor. He then structures systems of action which are both necessary and sufficient for the realization of the central actions. This is accomplished through a planning process, resulting from the analysis of active and passive environmental resistances, which constitutes the second quality control in the process of action system genesis. Together, reality appreciation and planning techniques are required by the observer-actor so he can better conceive actions in such a way as to minimize frictions that occur when the action system encounters its potential barrier and transmutes into a new situation in reality. The resistances to the implantation of action systems represent the multitute of present and future social, political, economic and environmental necessities. Passive resistances tend to be diffuse in nature and arise from the milieu in which the action is intended to be implanted, whereas active resistances come from established channels of action quality surveillance, such as legislation, adjudication and administrative regulation.

Following the application of quality controls, certain elements of the action system are then realized to modify a perceived sitution and a part of the action system is said to have transmuted into facts or events structuring a new situation. The continuous nature of the process by which actions are generated is apparent since the new conjuncture created in reality will alter the observer-actor's evolving appreciation of this reality. This

alteration, in concert with a continuously evolving image of the future, can be used for increasing the quality control of subsequent elements of the action system to be implanted.

While systemology can provide some insights as to how fundamental planning activities can be structured and carried out, the theory of action provides a conceptual framework explaining why these planning activities are necessary to the elaboration of effective action programs. As such, it enforces a self-conscious realization on the part of the observer-actor of his particular relation to reality situations, his obligations with respect to complex problems therein and the many varied considerations which he must make in the conception of action programs. It forces him to recognize the questionable objectivity of his observations by stressing the fact that he himself is a complex, purposeful system and his interactions with observed reality situations are biased by the common elements between the two which permit the observer conceptual access to the observed reality. In other words, the manifestations of the systems that he observes are necessarily specific to him as an observer. A planning methodology based on the theory of action would permit the observer-actor to recognize the fundamentally subjective nature of his task and the resultant necessity for a normative orientation to guide the design of his action programs.

CHAPTER III

THE METHODOLOGY

The planning methodology introduced in this chapter represents but one suggestion of a way for which long-range societal planning can be organized and carried out. The description provided is generalized for any observer-actor within public administration who is charged with the accomplishment of a given societal mandate. The fourth chapter will explore the different ways in which the methodology can be conceptualized with respect to a specific complex problem and suggest an institutional arrangement which could render the methodology operational for planning action programs in response to this and other societal problems.

The methodology presented is necessarily heuristic due to the absence of a well-articulated theory for societal planning and in view of the indeterminate nature of organized complexity as reflected in societal problems. The theory of human action is thus used as a conceptual framework within which more disciplined learning processes can be coherently organized despite the absence of relevant established paradigms. This theory is believed to be sufficiently broad in scope to assure the comprehension and manageability of a given problem as well as the appropriate association of considerations required for the elaboration of action programs.

Essentially a linearization of the theory of human action, the methodology provides for the design of action programs in three interactive phases:

- a normative phase in which objectives to be achieved are adequated with societal objectives in general;
- a strategic phase in which central actions, necessary and sufficient for the achievement of retained objectives, are conceived;
- a tactical phase in which action systems, necessary and sufficient for the accomplishment of central actions, are elaborated.

These three steps refer respectively to a conception of what "ought" to be, what "can" be and what "will" be (Ozbekhan, 1971; Michael, 1973). Viewing problem systems holistically, planning becomes a means of designing a desired future and finding effective ways of bringing it about. It is a continuous, anticipatory decision-making process which aspires to provide specific links between available knowledge and projected action. The two major concerns of an anticipatory planning process are to avoid incorrect actions and to reduce the frequency of failure to recognize opportunities (Ackoff, 1970). These necessities increase the relative importance of feedback controls in both the use of planning methodology and the design of normatively adequated action programs. These mechanisms provide a quality control to action programs by rendering the three phases of the methodology interactive. Although the phases may be distinguished hierarchically from one another by their content and range of concerns, their relationship is one of producer-product, ensuring a certain vital integration between the three

hierarchial levels. Thus the first phase will determine to a large extent the nature of the last two, yet it will in turn be determined by feedback generated within the other two phases. It is for this reason that although the two main control mechanisms envisaged for this methodology occur in the first and second phase, their primary function is to generate feedback controls for the other phases. In this way they permit the integration among the three hierarchial phases of a reasonably coherent perception of reality common for anyone making decisions relative to societal planning and action.

3.1 The normative orientation of an action program

The normative phase of planning is essentially a policy research process whereby societal objectives to guide future planning and action are conceived. Hierarchically superior to the other two phases, it exercizes a strong influence on their subsequent orientation and execution. Nevertheless, a large part of this phase consists of the recuperation and meaningful synthesis of the knowledge and experience derived from the other two phases.

Within the normative orientation, it is recognized that a profound reality perception is necessary for the conception of societal objectives which, when adequated with a particular image of the future, can be evaluated and chosen to translate policy intent for planned action. Figure 2 depicts the progression of planning considerations envisaged for this phase. At the normative level, some of the fundamental assumptions upon which fur-

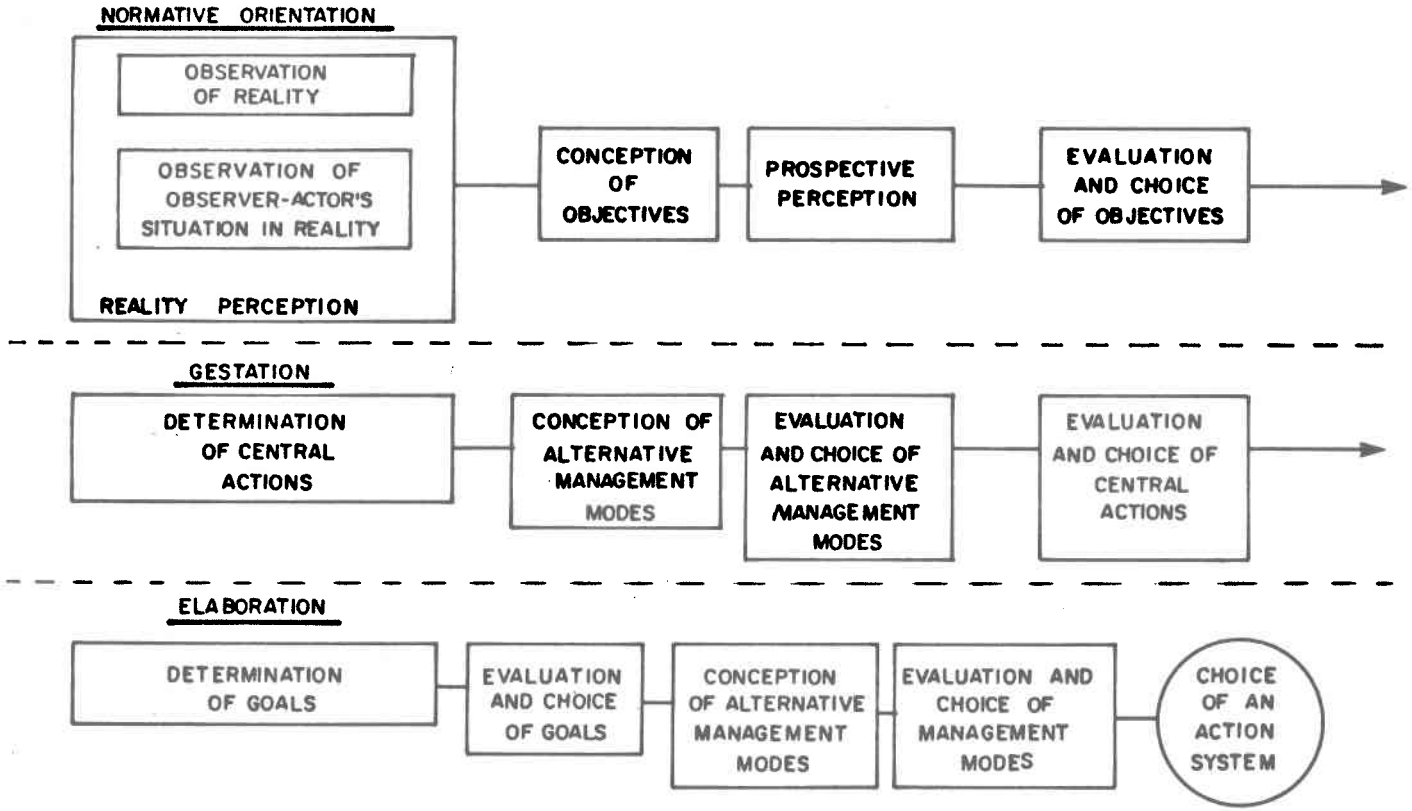

Figure 2. The normative orientation, gestation and elaboration of an action program (Adapted from Sasseville, Marceau and Frechette, 1978).

L'orientation normative, la gestation et l'élaboration d'un programme d'action (D'après Sasseville, Marceau et Frechette, 1978).

ther planning is to be based are made explicit and refined, while at the same time further assumptions of relevance are sought (Mason, 1969). Data acquired at this stage are increasingly of a qualitative and subjective nature. They permit the description of purposeful systems in terms of the different ideologies, values, interests and needs that motivate them. In keeping with the belief that men do indeed create social reality by appropriating the responsibility of action to perceived needs, the ability to explain the behavior of purposeful systems provides a basis for redesigning the systems in some fundamental way encouraging either the dissolution of problems or improvement in system functioning (Ackoff, 1974).

Research necessary for developing an understanding of these aspects of purposeful systems is evidently a primary concern for planning at the normative level. This concern has been witnessed in recent years by the development of such activities as prospective planning, technology assessment and the evaluation of environmental repercussions. These new tools of perception and the integration of the data they afford are vital activities in the formulation of an adequate normative orientation for societal planning. They each relate to the consequences arising from the implementation of action systems designed to achieve human ends or objectives. The normative orientation is mostly concerned with judging the quality of the ends chosen as a function of the values society holds in relation to their future consequences. This phase is a systemic process parallel in nature to the genesis of human action as described in Figure 1.

Reality perception is the fundamental basis of any rational planning process, yet a problem arises concerning the identification of that part of reality that is especially relevant to the observer-actor. Essentially, the composition of the reality he observes, and within which he wishes to act, is specific to him and his particular situation in reality because of the mandate he is given and the various degree of specialization he has achieved in his past plans and activities. Thus, a meaningful observation of relevant situations in reality is predicated upon an equally profound observation of the observer-actor's situation in reality. It will also be influenced by the image he retains of a desirable and accessible future.

Relevant situations in reality can be observed by assembling and integrating those facts which are necessary and sufficient to structure the situation. An attempt is then made to define the proper significance of each fact to the structure of the situation. The observer-actor could seek, for example, the social, economic, political and ecological significance of facts structuring a particular problem situation in reality. Through the clarification of his mandate, the observer-actor considers this "certain reality" and tries to "deduce" certain facts apt to "induce" an understanding of situations (Sasseville, 1978). Such an effort can be partially explained by the definition of an appreciation of reality:

> "An appreciation involves making judgments of fact about the 'state of the system', both internally and in its external relations. I will

> call these reality judgments. It also involves making judgments about the significance of these facts to the appreciator... These judgments I will call value judgments. Reality judgments and value judgments are inseparable constituents of appreciation...for facts are relevant only in relation to some judgment of value and judgments of value are operative only in relation to some configuration of fact (Michael, 1973)".

With this understanding of reality, the paramount importance of values in planning becomes apparent. Since facts are perceived differently by those who hold different values, the observer-actor comes to recognize that his perception of a situation depends upon his values, or his particular situation in reality, and that a different perception of the same situation by others simply reflects their differing value base. Insofar as the observer-actor possesses a mandate to bring about change in reality situations, he must be in a position to understand other value stances related to these situations. Only then can he judge whether actions conceived would make a chosen situation evolve in the manner desired.

Assessing the myriad variety of social values, and the particular pecuniary, esthetic and emotional interests they represent, becomes a primordial yet almost impossible task in the reality perception of a pluralistic democracy. Collective ideals embraced by society as a whole are usually so general as to be devoid of explicit content and they are for the most part subordinate to individual goals and aspirations which are themselves explicit yet more oriented towards immediate gains rather than long-term well-being. Whereas individual values in some societies are kept subordinate to collective ones, either voluntarily or by force, the tendency in Wes

tern society is to embrace collective values only to the extent that they do not conflict with individual ones:

> "Social science has simply been unable to uncover a social-welfare function that would suggest which decisions would contribute to a societally best state. Instead, we have had to rely upon the axioms of individualism that underlie economic and political theory, deducing, in effect, that the larger-public welfare derives from summation of individualistic choices. And yet, we know that this is not necessarily so...
> "Our point, rather, is that diverse values are held by different groups of individuals--that what satisfies one may be abhorrent to another, that what comprises problem-solution for one is problem-generation for another. Under such circumstances, and in the absence of an overriding social theory or an overriding social ethic, there is no gainsaying which group is right and which should have its ends served (Rittel and Webber, 1973)".

Such a view is consistant with the Western conceptualization of individual rights of liberty and security which together form the very foundations of a democracy. Nevertheless, Ozbekhan (1971) has argued quite persuasively that humanity may have already reached a point where individual values may have to become gradually guided by collective ideals related to the quality of life, habitat and the human condition. He, like Giles, sees planning as "beneficient cybernetics" for which "a concept of an ultimately good environment - man interaction must be conceived to act as a (finality) (Giles, 1977)". Essentially, he believes that man evolved with individual and species survival as his primary value, this orientation being necessitated by the amount of uncontrollable disorder in his external environment. As he began to develop tools and practices to bring certain aspects of this environmental disorder under control, he began to value such achievements for

their utility. Once the implications of valuing utility for its role in assuring survival became more fully appreciated, a plethora of other collective and individual values has arisen with the development of civilizations. For example, the collective status or prestige value of a manned lunar landing or the individual status value of an expensive car demonstrate just two ways in which accessory human values can arise from activity of once purely utilitarian value such as transport. Nevertheless, the increasing abundance of contemporary social values may in fact mask the paradox that man, as a species, may have attained a unique point in evolution where, because of a large degree of disorder (turbulence) in his natural and, especially, his artificial environment, long-term survival is becoming the predominant value:

> "... a new situation has now come upon us. Because of our inability, or maybe our unwillingness, to worry about the consequences of actions, we find ourselves on the verge of reviving the oldest and most general value of all: survival. If this be so, as I believe it is, we will have come full circle. But, although we may well have come full circle, our situation is new and imposes new terms of reference upon our actions, for it is the rapid deterioration of our natural and social environment that is now raising the issue of our survival as a species. Under these conditions it might not be too presumptuous to propose a new general value that should be acceptable to virtually all people, and would not add another divisive factor to those that are already pulling us asunder. Such a value would be: survival through the achievement of a global, dynamic ecological balance.

> "It seems to me that action and planning in the light of such a general value might gradually lead to greater consonance between individual objectives and goals by providing them with a global base; and that further, it would help us begin to evolve the next generation of institutions--institutions within which all the needed operational modalities and norms derivable from such a value could be worked out over time, without ideological ruptures and the violence-breeding divisiveness that would exacerbate, or at best keep us prisoners in, the state of confusion and disorder where we now find ourselves (Ozbekhan, 1971)".

Thus, while individual and collective values and aspirations must be included in the observer-actor's observation of reality situations, he may prefer to articulate them, as well as his own, in terms of an overriding collective value, or a politico-ecological ethic, which has been adopted by consensus among other action initiators operating in reality. The objectives he will later conceive, which vary over time as a consequence of the evolution of situations, would then be subordinate to this finality reflecting the global normative context of collectively embraced ideals.

Having structured an observation of relevant situations in reality, the observer-actor attempts to further structure his observation of his particular situation in reality by requestioning the pertinence of his mandate, its limits, problems related to it and the resources he has available to realize it. He is interested in seeing how his own perception of his role in changing reality corresponds with others' perceptions of his role. Thus he wishes to identify and characterize the institutional environment within which he must carry out his actions. This environment is usually composed of some configuration of:

> "... formally linked superior and subordinate organizations, organizations that supply resources, groups that are the beneficiaries of the organization, and groups that suffer adverse consequences from it, organizations it controls or regulates, and organizations and groups that are sometime allies, competitors, or enemies. Some components of the environment are essentially stable and permanent; others arise and disappear in response to the organization's actions or inactions or to other happenings in the environment that, rightly or not, implicate the organization. The 'environment' then would be the interdependent cluster of persons, groups, organizations, political parties, and so forth, to which the organization must respond (Michael, 1973)".

An understanding of his context within his organizational environment will be instrumental in the design of action programs since it gives the observer-actor an idea of those groups whose activities will complement his own and those representing sources of active and passive resistance to his success. Moreover, it brings up the normative problem of legitimacy, "the belief that present institutions are the most appropriate ones for society and that they reflect individually held views (DeGreene, 1973)". It also introduces to him notions of the possible ways in which individuals and social collectivities may exhibit "counter-intuitive behavior" or manifest irrationality with respect to values underlying long-range societal goals (Forrester, 1969). An example would be the "technological imperative", or the belief "that any breakthrough that can be profitably developed should be, without concern for market saturation, resource depletion, or unregulated growth (DeGreene, 1973)", or, one might add, the quality of life, habitat and the human condition. Another example would be the "manana" attitude which "expresses itself in the belief that when one resource is exhausted we simply will have to shift to another (DeGreene, 1973)". As a result of understanding such notions, the fact that the observer-actor's situation in reality is largely defined in terms of his own internal organizational capa-

city and his institutional and broader environment permits him to focus his perception of the problem he faces as a result of his mandate. In short, he must design an action program responding to fundamental societal needs, which themselves arise from complex problems, while keeping in mind that he himself, his organization and his environment are in fact hierarchically structured purposeful systems:

> "... there are three central problems that arise in the management and control of purposeful systems: how to increase the effectiveness with which they serve their own purposes, the purposes of their parts, and the purposes of the systems of which they are part. These are, respectively, the self-control, the humanization, and the environmentalization problems.
> "The self-control problem consists of designing and managing systems so that they can cope effectively with increasingly complex and rapidly emerging sets of interacting problems in an increasingly complex and dynamic environment. The humanization problem consists of finding ways to serve the purposes of the parts of a system more effectively and to do so in such a way as to better serve the purposes of the system itself. Finally, the environmentalization problem consists of finding ways of serving the purposes of environmental systems more effectively and to do so in such a way as to better serve the purposes of the system itself (Ackoff, 1974)".

Considering his particular situation in reality from these points of view, the observer-actor attempts to fuse this knowledge with that gained from his general observation of relevant situations in reality. He guages his possibilities for intervention in function with his observed reality and in this way attempts to conceptualize the conjuncture linking his mandate and the reality in which it will be planned and carried out. Study of this conjuncture permits the conception of objectives believed to be attainable through

future action and provides a context within which future intentions to act will be progressively articulated.

Thus, the conception of objectives by the observer-actor provides him with the initial normative context which will guide the formulation of central actions and their subsequent translation into operational goals. Objectives here refer to valued states or outcomes which are unattainable yet approachable during the planning period whereas goals refer to outcomes which are attainable and in fact scheduled for achievement within the planning phases which follow the normative orientation. Performance objectives relate to instrumentally valued states and outcomes whereas stylistic objectives relate to intrinsically valued states and outcomes (Ackoff, 1970). The former will eventually require operational definition through the gestation and elaboration of action programs whereas the latter will serve as normative criteria for such a process. Both may be essentially acquisitive or retentive, striving respectively to attain something one does not have and to retain something one has (Ackoff, 1970). They will represent the observer-actor's "own" objectives, as a mandated public administration, and his "extraneous" objectives, which reflect the necessity to maintain the functioning of the super-systems forming his environment (Shchedrovitsky, 1977). Finally, objectives must be re-studied, re-formulated and arranged in hierarchial sets according to their value content. Unfortunately, such operations in the normative orientation cannot be computerized or otherwise methodically treated. Rather:

> "The hard truth is that goal formulation is a difficult art, both technically and politically: it is nonetheless essential, and the difficul-

> ties have to be faced--sometime--if a rational approach to the planning process is intended (Chadwick, 1971)".

Considerations such as these enter into the construction of one or several preliminary sets of objectives, each of which reflect the normative interpretation thus far articulated from the observer-actor's reality perception.

Objectives must however be adequated with the observer-actors image of a desirable and accessible future before they can be evaluated and finalized. Here the observer-actor has two major tasks: to construct one or several images of politically desirable and socially acceptable future situations and to project present and eventual societal trends and transformations in such a way as to reveal likely and probable future situations. Ackoff refers to these future studies respectively as wishful projections, reflecting "a concept of where the organization wants to be and when it wants to be there", and reference projections, or "attempts to specify what the future states of the organization being planned for will be if nothing new is done (Ackoff, 1970)". Enlarging Ackoff's concept of organization to include the entire purposeful environment of societal planning, objectives to be retained and elaborated upon correspond to the difference perceived between the wishful scenarios and the reference scenarios. This gap represents the action space for which strategic and tactical planning will subsequently be elaborated. A description of how close the observer-actor could come to realizing the wishful scenario, or a planned projection, is of use to this process. It represents the search for a set of objectives which would polarize action systems in the direction of the desired future image.

This type of future study is normative rather than exploratory because one constructs a distant image of desirable future situations and then returns to present reality in the search of links to guide the future evolution of actions. It links that which is feasible to that which is desirable in such a way as to provide the basis for a plan capable of recognizing the range of feasibility. If focuses on long-term considerations in the recognition that the consequences of short-term actions can foreclose future opportunities. This exercise in prospective perception is intended to "provide a capacity to invent and create a new social system recognizing human fulfillment (de Jouvenel, 1977)". In essence, it recognizes that if a desirable future situation can be conceived and the present situation can be understood, then events leading to the desired future become determined by human will. Whereas this method reflects the "world view" that man creates his social reality, or at least can, the exploratory or tendencial future study tends to reflect a somewhat practical belief that events tend to more or less occur as they always have. Admittedly practical, it recognizes the uncertainty of the future and any prediction related to the occurrence of profound change. Exploratory forecasting is however useful when compared to the normative prospective indeed because it illuminates the differences between future situations under the objectives and those which would occur through the evolution of present trends. The progression it describes can be used to explore the nature of strains and conflicts between trends that would be incompatible with the progression envisaged by the normative approach and to suggest possible alternative courses that such trends might hereinafter follow. Thus, with an adequate future perception, the observer-actor can delineate

specific problem areas of concern in the planning of action programs to encourage the adherence of future trends to societal objectives.

The normative orientation of the methodology is completed with the final evaluation and choice of objectives. Much of this evaluation has been attained during the fusion of reality and future perceptions, a rationalization or conjunctural adequation applying the first quality control to the efficient gestation of action programs. Here, the observer-actor has recognized two possible sources of error in his conception of objectives: that he has not sufficiently examined his situation in reality or that he has retained an irrealistic or biased perception of a desirable and acceptable future. Nevertheless, basically objective and subjective criteria, comprising a further quality control, must be additionally considered in the evaluation of retained objectives. The objective criteria refer to values which can be normalized by universal consensus whereas subjective criteria cannot be normalized on a national scale but must reflect regional disparities particular to localized situations. Both of these criteria presuppose the elaboration of a politico-ecological ethic relating the concepts of quality of life, habitat and the human condition (Sasseville et al., 1977). The criteria should represent systemic characteristics necessary to a harmonious functioning of the "man-habitat" system and capable of monitoring its future evolution. This process, as with the reality and future perceptions, requires an immense feedback from activities related to the two following phases of planning. Stylistic objectives can usually be concretized at the time of the prospective perception into what the future ought to hold, yet feedback will be of the utmost importance for setting performance objectives

as they are limited in practice by the availability of programs and resources to plan and carry out action. Finally, it must be recognized that:

> "... objectives operate as follows: (i) they are governed by "ends", that is, values; (ii) they are also governed by a long-term spectrum of options which the consequences of action create; (iii) adjusted, in this way, by the interplay of two sources of information--present values, and future consequences defined as preferred outcomes--they dictate goals (Ozbekhan, 1971)".

The coalescence of chosen objectives concludes the normative orientation phase of planning and provides guidelines for the conception and elaboration of action programs. At present:

> "Essentially no policy analysis deals with the normative and conceptual problem levels, even though recognition and management of differences at such levels itself presents a key problem area. Thus, there may be a serious lag between policies based on anachronistic individualistic-materialistic-competitive values and emerging humane-regulative-cooperative values (DeGreene, 1973)".

Rather, a normative orientation provides the observer-actor with a basis for adequately judging the value of action systems to be elaborated. It will help him to arrive at a choice of the central action the most pertinent to situations observed in present reality and in the future.

3.2 The gestation of an action program

The gestation phase in action planning is that in which normative definitions of progress and development are translated into declarations of intention to act. Its essential activities are summarized in Figure 2. Briefly, in order to specify policies for the elaboration of an action program, central actions perceived to be essential to the pursuit of objectives are sought. This process is used to structure a conception of alternative modes of administering and managing these actions. These modes could take the form of legislation, judicial reform or administrative regulation as well as physical construction. The various means are evaluated and judged for their pertinence to the conjuncture in which they would be introduced, their quality, or socio-political viability, is assessed and they are arranged preferentially as a resource inventory for policy implementation. This evaluation will consider the various resistances arising within the organization and its environment as well as the likely future consequences of policy implementation. With a clearer idea of normative and operational feasibility, the central actions are re-formulated and chosen to serve as a comprehensive strategy framework for subsequent tactical operations. The normative orientation obviously exerts the greatest influence on this phase, as it is instrumental to the evaluation and choice of management modes and central actions. Nevertheless, feedback generated in the third phase is as necessary here as it was for the conception of objectives. Once formulated, the central actions will exert a proportionate influence in the performance of the third phase and will themselves provide feedback to the normative

orientation, providing an indication of the new directions in which reality is intended to be changed.

Basing his determination on the reality and future perceptions reflected in the objectives he retains, the observer-actor chooses from a space of possible actions those which are sufficiently broad in scope to fully circumscribe the root causes of perceived problems. In other words, after having interpreted the conjuncture, or a situation in reality observed in the light of the interpretation of his own situation polarized towards the image he holds of an improved future, the observer-actor proposes an action adequate to his interpretation of the conjuncture (Sasseville, 1978). These become the central actions, and they should essentially be as complex in content as are the problems which they address, these problems representing the gap between a desired reality, as reflected by the objectives, and contemporary social reality. As a general rule, the more elevated that the hierarchial level of a central action is, the number of actions required to realize it is greater, their realization will be more complex and the perturbations which it produces in the environment will be more important (Sasseville, 1978). Given their hierarchical importance, central actions are necessarily general policies which later provide for the organization of action systems, or more specific means such as programs, procedures, practices and courses of action. Reflecting the normative intentions of the objectives, policies become the "decision rules that can incorporate all the relevant information available at the time of decision, and hence...provide maximum flexibility and adaptability (Ackoff, 1970)". Policies can reflect two different kinds of strategies: "adaptation to the environment, whereby

we include ourselves in its natural processes, and transformation of the environment in accordance with our own goals and problems (Shchedrovitsky, 1977)". Essentially, this means that policies will be concerned as much with current operations in existing systems as it will be with changing these systems. The coordination of these policies is a major difficulty that must be faced at the time of the final evaluation and choice of the central actions. From this point on, the gestation phase of planning becomes specific to the central actions envisaged and to the environment into which they will eventually be introduced.

Without yet detailing the exact nature of the action systems which will eventually render the central action operational, the observer-actor nevertheless begins to conceive alternative modes for administering and managing the realization of the central action. Essentially, he prepares an inventory of means, ranging from programs to simple courses of action, which can potentially provide access to desired outcomes. These include disturbance-reducing activities which "constrain variety so that 'pathological' situations are avoided "as well as adaptation-increasing activities which promote variety by the creation of greater opportunities for improving future situations (Chadwick, 1971)". They may include the traditional mechanisms of legislative, judicial and administrative procedure however they should also include experimental means currently under research which reflect the potentialities inherent in societal participation, learning and adaptation processes. Implicit in the inventory of these latter means is a recognition that new organizational structures must often be designed to carry them out. Ths is what Ackoff refers to as "organizational planning",

the task of "determining organizational requirements and designing organizational arrangements and the management system that will make it possible to follow the prescribed means effectively (Ackoff, 1974). Thus, due to their interrelatedness, both means and organizational capacity are inventoried at this stage of the gestation phase.

The alternative management modes conceived for each central action are then evaluated for their social, economic, political, ecological and cultural viability by taking into account the particular endogenous and exogenous resistances inherent to the use of each. Endogenous resistances refer to constraints arising within an organization which can often be overcome through planning organizational change. Exogenous resistances, on the other hand, arise within the environment and are often beyond the control of organizational planning. Their presence is taken for granted as part of the general environmental context and they can be for the most part characterized as laws, whether physical, ecological or man-made. To the extent that endogenous resistance cannot be eliminated through planning, both types of resistance should seriously be considered in the evaluation of alternative management modes. In fact, this evaluation should be as profound as the number and significance of the resistances perceived would demand. In the further evaluation of the alternative management modes, the observer-actor attempts to compare the relative value of potential consequences of actions to the outcomes desired in the normative orientation. This activity is especially important for actions which may entail a high degree of commitment and irreversibility. Methods of evaluating environmental repercussions (ecological and social impacts) are particularly pertinent here as they per-

mit a judgment of the self-evident value of human actions as a function of the type of perturbations they induce within the environment into which they are implemented. Thus, actions are evaluated in relation with both the resistances to and the consequences of their implementation. It is important then that the scope of evaluation respect both the complex nature of the conjuncture (reality) from which the central actions were conceived and the environmental situation in which they would be realized, as well as the inherent quality of the actions themselves. A choice is then made of a combination of management modes through which the central actions could potentially be realized. Not yet a prescription for direct action, this inventory would rank alternative modes and their components by their relative pertinence to the policy intentions of the central actions and would serve as a detailed resource of adequated programs, procedures, practices and simple courses of action for those undertaking the elaboration of action systems in the third phase.

Finally, once a valid idea has been gained of the organizational requirements that each central action would involve, they too are evaluated and finalized to articulate a chosen policy. The observer-actor seeks to compare the advantages and inconveniences of each central action as a function of the management modes previously conceived and their associated exogenous resistances. He then incorporates his findings into an evaluation of the congruence of the central actions within perceived actual and future situations by emphasizing their perceived weak and strong points as a function of the actual and future contexts of their management modes and attendant constraints. He is interested in knowing with what likelihood the central

action may achieve results as well as how representative it is of the objectives retained. The evaluation of the central action constitutes the second part of an endogenous quality control mechanism within the methodology. Thus, in the first phase, the observer-actor sought an understanding of the internal dynamism of relevant systems, or the reality associated with situations. In strategic planning, however, the observer-actor is interested in understanding those changes in the internal dynamism of systems, or action systems transmuting into facts structuring situations, which are consistent with the satisfaction of objectives. "The analysis must involve both the objective social components of the situation and the subjective aims of the various groups of actors included in it (Shchedrovitsky, 1977)". He wants to ensure that the central actions are capable of directing future situations in the sense desired by himself, his organization, other observer-actors, their organizations and the citizenry in general. In doing so, the observer-actor must realize that the central actions form one cohesive, interactive whole and that their synthesis may in fact bring into question some of the objectives already formulated, thereby providing an important feedback link to the normative phase. Enlarging the studies made during the choice of alternative management modes, the observer-actor attempts to re-evaluate the repercussions of the central actions together on the observed situation in reality, as well as the consequences these would hold for other situations in the environment. He wishes to judge the intrinsic value of the central actions by their ability to:

- perturb the environment in such a way as to improve collective well-being without compromising fundamental individual liberties;

- stimulate a trajectory towards a future compatible with the type of human aspirations expressed in emergent values;
- respect the natural capacity of the environment to provide resources and other support, or withstand abuse;
- respect the delays in implementation which would be inherent in the systems affected by policy (Sasseville, 1978).

Having incorporated the above considerations into a quality control of the proposed central actions, the observer-actor decides his policy orientation with respect to those situations in reality appropriate to his mandate by choosing central actions that will become largely determinant in the elaboration of specific action programs.

3.3 The elaboration of an action program

Within the elaboration phase, or the tactical level of planning, the observer-actor translates central actions into operational goals for which action systems are designed, evaluated, chosen and implemented. In simple organizations, the central actions themselves would be sufficient for guiding the elaboration of action systems, yet in multi-level organizations undertaking societal planning, action systems, while being primarily guided by the national normative context implicit in the central actions, must also be guided by a consideration of regional or local particularities that are a part of reality situations. In other words, the normative orientation is necessary and sufficient for decisions upon central actions, yet it is not sufficient for the determination of operational goals since localized norma-

tive contexts must be considered as well. Referring to this tactical phase as an "instrumental system", Ozbekhan (1971) says:

> "The prime function of this system is the implementation of decisions that have been reached at higher levels. However, such implementation is never automatic: confronted with an ever fluid situation, day-to-day modifications in applying available means and resources must be made. All decisions of "how" to attain the goal are made at this operational level of the overall planning system. It is at this level that what will be done to satisfy the "oughts" and the "can", that have been established at higher levels, is determined in an ongoing manner (Ozbekhan, 1971)".

Thus, central actions, or what can be done, provide the major guiding considerations of planning strategy, yet they are complemented by the reality particular to localized situations when goals, or what will be done, are determined. In this way, the goals may be conceived within the overall context of national and regional policies while remaining directed towards the daily life of the citizens comprising a localized reality situation.

In the process of goal determination, "time-specific outcomes are related to their more distant consequences (Ozbekhan, 1971)". These outcomes represent known and available options which must be organized in such a way as to conform to the desirable consequences of planning action. Thus, their coherence must be ensured by a specification of the relations they must eventually entertain between each other and the environment they will affect, as well as the different endogenous and exogenous resistances inherent to their achievement. Much of what has been said about objectives above applies to the determination of goals. In many cases, "they cannot all be

attained simultaneously, and the attainment of some conflicts with the attainment of others (Chadwick, 1971)". Thus, when goal achievement is not a clear and straight-forward course of action, goals are not optimized but rather maximized subject to achievement of all the other goals (Giles, 1977). This type of evaluation recognizes the fact that "a sub-policy of an overall system policy... can only be seen in the light of the whole system (Chadwick, 1971)". Once again, the criteria for setting goals are both objective and subjective. Hence the evaluation cannot be made on the basis of commensurate measuring units but must be a continual process of reality and value judgment applying to each goal as it relates to the others. Such a process is based on at least three types of feedback:

> "(1) goal seeking--feedback of new external data into the system net whose operational channels remain unchanged; (2) learning--feedback of new external data for the changing of these operating channels themselves, that is, a change in the structure of the systems; and (3) consciousness, or 'self-awareness'--feedback of new internal data via secondary messages, messages about changes in the state of parts of the system itself (Chadwick, 1971)".

Keeping in mind that this is precisely the kind of feedback which is required in the normative phase for reality perception, a tactical goal-seeking evaluation permits "elemental units or sub-systems to respond creatively, to learn, to include 'overlayers' which enable the system as a whole to use knowledge, to commit itself to policies, to guide action towards realization of these policies (Chadwick, 1971)". The final choice of goals must reflect a conscious effort to harmonize the many values and interests within a system, its parts and the environment, or more literally, an organization, its personnel and society. By seeking a high-variety of action response to po-

licy intentions related to complex societal problems, planning attempts to increase the range of options, choices and opportunities open to individuals and communities. In response to the traditional fear that societal planning can only restrict individual and collective liberty, it can at least be imagined that the inverse is potentially true:

> "Planning in an open society can only facilitate democracy by reducing the inequities, maximizing the range of choice, educating people to use the choices they make, and making these choices more widely available (Chadwick, 1971)".

Nevertheless, such planning can only be based upon goal-seeking and evaluation procedures which establish a quality control for projected actions. Once established, and although they are automatically subject to modification, the goals serve as a prescription, or genetic code, for the further elaboration of action systems.

Planned action systems begin to crystallize when the observer-actor conceives alternative procedures, practices and courses of action for the achievement of goals. Much of this work has already been done during the gestation phase where strategic modes for the execution of central actions were elaborated and ranked by preference. At the tactical level, one or several strategies adequate for the attainment of goals is chosen by the observer-actor and its various means are specified in operational detail. The extent of planning required to adequately structure a relevant action system will be proportionate to the perceived amount of exogenous resistance posing a potential barrier to the successful realization of actions. More-

over, the more that active and passive resistance is perceived, the greater the need for a cohesive, politico-ecological ethic to motivate cooperation and acceptance of the actions.

Once envisaged, these means are subjected to the criteria which they must meet to adequately enter into their environment as desired situations in the evolving conjuncture. These criteria will have in part been articulated when the management modes for central actions were evaluated, yet criteria relevant to local contexts, as well as particular endogenous and exogenous constraints, enter into this evaluation too. Other criteria may be conceived by simulating the implementation of the projected actions into their target environment, that is, by scenarizing their direct and indirect effects in reality and comparing these consequences with the normative image of the future. Such criteria reflect the recognition that most modern societal functions are so closely interrelated that a comprehensive action system must be designed accordingly. The observer-actor will thus have to apply criteria arising from his environment and other action initiators operating in the same reality. This effort constitutes the final choice of an action system to render goals operational. The action system then transmutes into a series of facts structuring new situations in reality. Nevertheless, it remains within the purview of planning insofar as it contains within its genetic code the strategic scheduling of its implementation and the necessary monitoring feedback (control) required for reality perceptions and action evaluations performed in the other phases of the methodology.

3.4 A summary of the methodology

It is evident from the above discussion that the normative orientation phase is an integrative component of primordial importance for the planning of coherent action programs. In effect, the elevated quality of human actions can only be assured through the achievement of coherence in the system by which the actions are generated. If some kind of normative consensus can be achieved with respect to present reality perceptions and desirable future prospectives, then this coherence, once established in the normative orientation, will serve as a quality control in the choice of coherent central actions. These and their associated action systems, integrating a coherent system of values, can be more meaningfully judged for their compatibility with the image retained of a desirable future through a simulation and prediction of their eventual evolution in the environment for which they are proposed. In this way, specific decisions to undertake various action systems will possess an inherent quality control assuring their conceptual and operational coherence with other decisions and actions taking place in the environment.

The methodology within which such normative adequation can be effectively achieved must be based on radically new planning principles which together reflect a basic philosophy for long-range, future-responsive societal planning and research. Table 1 provides a comparison of this new philosophy with that predominantly used in current societal planning and action. It summarizes many of the major pre-occupations of the planning methodology described above. More explicitly, at least four basic principles of supreme

TABLE 1: Comparison of the Traditional View and the Systems View of Planning
Une comparaison de l'optique traditionnelle et l'optique systémique de la planification (Van Gigch, 1978)

	Traditional View	Systems View
Process of planning as a system	A closed system that acts on other systems and subsystems, excluding the environment.	An open system that acts on the totality of all systems, including the environment.
Purpose of planning	Designed to solve specific problems with feasible alternatives.	Designed to induce changes in the value system and in the state of the environment to bring consonance between them.
Method	Planning, a problem solving activity emphasizing means rather than ends; the formulation of sequential programs for meeting crisis; leading to "hardware" approach.	The continuous organization of progress to change what "is" into what "ought" to be be; leading to "software" approach.
Approach	Plans handled at strategic or operational levels in the organizational hierarchy.	Normative approach to the future, where emphasis is on the selection of values and the invention of objectives at the policy-making level in the organizational hierarchy.
Goals	Established outside planning, not as a part of strategy or operations; influenced by view of the "possible".	Goals derived from norms, values and objectives and directly controlled by them.
Future	"Logical", i.e. extension of the present; linear, deterministic, predictable from the present; technologically feasible.	"Willed", i.e. cannot be imagined from the present; must be postulated or invented; non-linear, multi-valued, not predictable or causal; beyond present technological feasibility.
Values	Love underlying human action, objectivity underlying science and utility underlying technology.	Ecological balance to implement integrative solutions that reduce entropy and organize the ecosystem at a higher level.

relevance to the process of societal planning can be extracted from this new philosophy:

> "Participative planning. The principal benefits of planning are not derived from consuming its product (plans), but from engaging in their production. In planning, process is the most important product. Hence, effective planning cannot be done to or for an organization; it must be done by it.
> "Coordinated planning. All aspects of a system should be planned for simultaneously and interdependently. No part or aspect of an organization can be planned for effectively if planned for independently of any other part or aspect.
> "Integrated planning. In multilevel organizations like governments or corporations planning is required at every level and planning at each level should be integrated with planning at every other level. Both (strategic and tactical planning) should be done interdependently, consciously, and explicitly.
> "Continuous planning. Because purposeful systems and their environments are changing continuously, no plan retains its value over time. Therefore, plans should be updated, extended, and corrected frequently, if not continuously. Continuous planning is necessary if a system is to learn and adapt effectively (Ackoff, 1974)".

Furthermore, the content of this new planning process must include consideration of the ends which are to be achieved, the means for arriving at these ends, the organization and resources required to implement the means and the control system which assures that the means are indeed achieving the desired ends. The ultimate aim of the planning methodology described above is to wed the societal planning process with the type of content appropriate for designing action systems in response to complex problems in complex environmental settings. It recognizes that such action systems cannot be rational-

ly designed in even partial isolation from other action systems operating in and proposed for the environment. Rather,

> "... the next evolutionary step that we must try to envision is the infusion of rational behavior into the whole system. This is the same as saying that the rationality of the parts must be reorganized at the level of the whole (Ozbekhan, 1971)".

In other words, coherent adjustments in the internal control of action generation systems must be sought which permit their normative adequation with the "whole" system. The following chapter will explore the organizational feasibility of "whole" system planning in Quebec as well as the role that an administration mandated to improve water quality might play in planning the coherence of its action programs with those of other observer-actors operating within this "whole" system.

CHAPTER IV

AN APPLICATION TO THE PROBLEM OF WATER QUALITY DETERIORATION

It is beyond the scope of this paper to provide a complete conceptual application of this planning methodology to the problem of water quality deterioration in such a way as to be of immediate use for the design of an action program. Although various concepts are offered as suggested underpinnings for program design, the primary reason for attemptng to apply the methodology to a current complex problem is to arrive at an institutional design which would facilitate its use. In view of the planning principles which underlie it, it appears doubtful that the planning methodology could be reasonably developed outside the institutions in whose interest it would be to apply it. The basic institutional environment necessary for such planning is currently in an embryonic form, thus the institutional arrangements through which the methodology could be developed and applied do not yet exist.

Returning to the problem of water quality deterioration discussed in the first chapter, it may be concluded that an organization such as SPEQ (Services of Environmental Protection) or the projected Ministry of the Environment, with its mandate for improving or maintaining environmental quality in general and water quality in particular, is justly concerned with most aspects of land-use in the watershed. A superficial list of other ministries concerned with land-use and developement in the territory of Quebec would include, at least, the MAQ (Ministry of Agriculture), the MTF (Minis-

try of Lands and Forests), the MRN (Ministry of Natural Resources), the MIC (Ministry of Industry and Commerce) and the MAM (Ministry of Municipal Affairs). In addition to policies elaborated by these ministries, the SPEQ is also subject to influence from both the legislative and judicial branches of provincial government. Given this complex, interactive matrix of governmental interest in land-use and territorial development, it becomes evident that policies for water quality improvement cannot be conceived independently from other equally important government pre-occupations. Before discussing the particular ways that the methodology could be applied to the problem of water quality deterioration, it is necessary to envisage the type of social and governmental setting which would be appropriate for such an undertaking.

An application of this planning methodology to the problem of water quality deterioration presupposes two fundamental conditions in Quebec society and government. The first is a willingness to articulate a politico-ecological ethic, related to actual reality and perceived futures in Quebec, which could then serve as a template for the myriad reality and future perceptions undertaken by the different ministries in their processes of generating action systems. This template would, of course, be subject to continual modification as the future gradually unfolds and change occurs. At present, the prevalence of sectorialized policy and action elaboration, the lack of transparency in governmental decision-making and a lack of effective citizen participation together present a major obstacle to the emergence of such an ethic:

> "The procedural tactic of secretive operation, along with fragmented responsibility for environmental action, contributes to the substantive problem of public and private decision-makers undervaluing environmental considerations. It helps obscure what is really happening to our environments, the extent of the damage occurring by whom to whom, trends in environmental quality and the total costs of maintaining a high-consumption resource-intensive lifestyle (Lang and Armour, 1977)".

Beyond these considerations, the conception and elaboration of such a normative template would depend upon the adoption of a normative planning methodology and an acquisition of familiarity with its use. Thus, it shares with the methodology a need for the existence of a second fundamental condition: a cybernetic organizational structure capable of ensuring the coherence of different observer-actor's action generation systems, thereby controlling the quality of subsequent actions. This organization would have as a mandate to integrate, on a normative level, the diverse activities of public (and, indirectly, private) moral persons in such a way that these activities reflect a common, coherent orientation for the evolution of planning and development in the province.

Figure 3 provides a rough illustration of a hypothetical guidance system capable of coordinating the various processes through which governmental action is generated. Each one of these guidance systems represents an established or potentially realizable government structure operating at either the central, regional or local level. These systems are then composed of representatives of legislative, judicial and ministerial branches of government, as shown by the crooked arrows, which conduct activities at

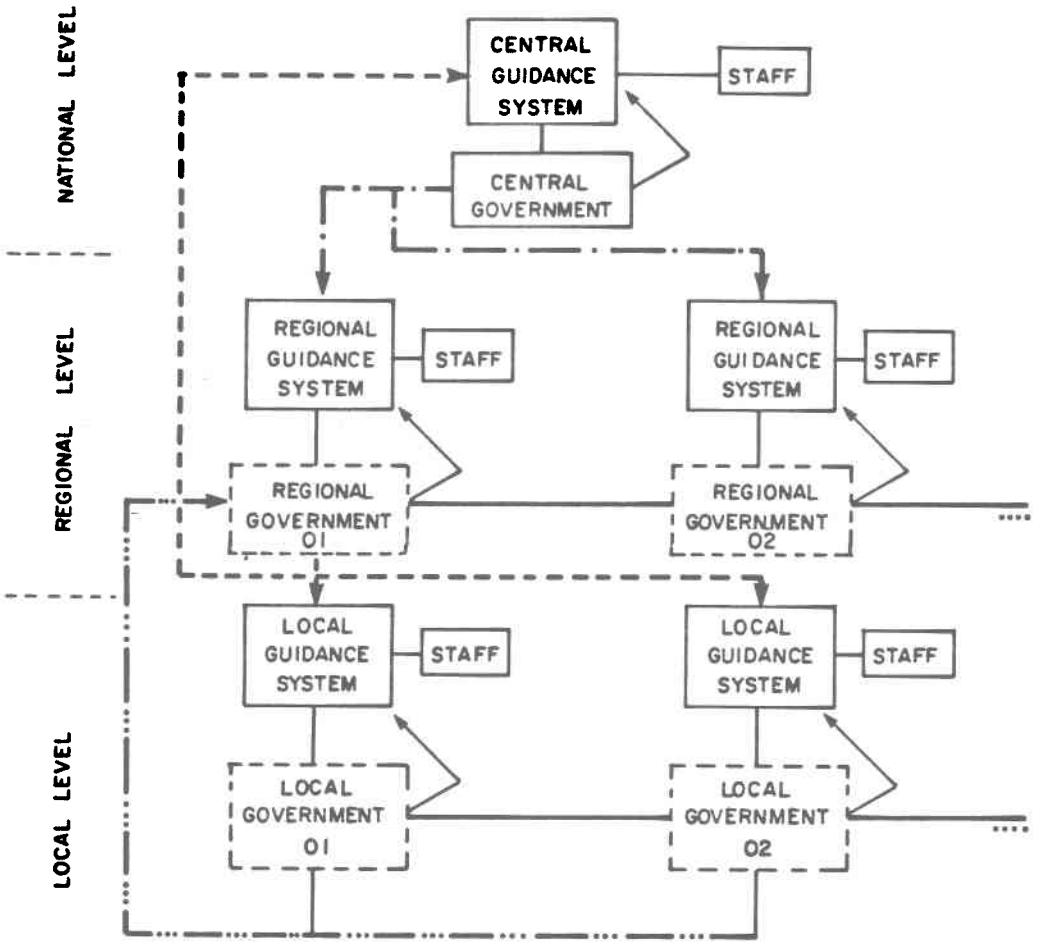

Figure 3 . A government coordination service based on the concept of a circular organization (Adapted from Ackoff , 1974) .

Un service de coordination gouvernemental basé sur le concept d'une organisation circulaire (D'après Ackoff , 1974) .

the appropriate territorial level. The regional guidance system provides the essential link between local government or citizens and provincial government since the managers of guidance systems at all three levels are grouped here. Moreover, the manager of the regional guidance system is a member of both the central guidance system and the local guidance systems. Accoording to the planning principles established in the preceding chapter, planning must be done by the implicated organizations which, in this case, are the guidance systems. Nevertheless, staff support is necessary and is provided for each guidance system in the form of a supra-disciplinary and interdisciplinary research team appropriate to the scope of planning considerations required at the three governmental levels. They assemble the technical data gathering and synthesis functions which managers in the guidance systems would require for making informed planning decisions. Such an overall management system would "require both centralized and decentralized management; an integrated, holistic approach; flexibility; more functional organization; and more rapid system sensing and response times (DeGreene, 1973)". This guidance system would be committed to developing and exploiting the inherent potentialities of existing government organizations as well as to conceiving more adaptive organizational arrangements. Moreover, in recognizing the inherent limits in individual capacity to observe reality and decide upon an image of a desirable future, the system provides for the broadest and most informed representative base possible for the conduct of these increasingly essential planning tasks. Given this basic sketch of a potential coordinating guidance system as well as a willingness to normalize activities undertaken in the public interest, an application of the planning

methodology in relation to the improvement or maintenance of water quality can be properly situated.

4.1 The normative orientation phase

It is in this primordially important planning phase that the various observer-actors undertaking action programs in reality attempt to arrive at a normative coherence in the systems through which their actions are generated. Since these observer-actors may operate either centrally, regionally or locally, the normative orientation itself must be articulated in a coherent manner at each of these three levels by the appropriate guidance systems. These are responsible for arriving at the most profound and comprehensive reality and future perceptions possible, thereby permitting the conception of general objectives defining a trajectory of desired societal (national, regional and local) development. Hence they provide the basis by which observer-actors, such as the SPEQ and other administrative entities, can adequate their reality and future perceptions, and subsequent conception of sectorial objectives, with societal objectives in general. The major tasks of the guidance systems are thus to define the overall normative orientation of societal planning for sectorial administrations and to assure that objectives contained in their individual mandates are consistent with each other and retained societal objectives as a whole.

The reality perception undertaken by the various guidance systems reflect all of the many values, interests and needs of those populations, or purposeful systems, pertinent to their respective spheres of influence. As

for any observer-actor, this perception lies on a continuum from low perspective and high detail within the local guidance systems to high perspective and low detail at the central level (Bella, 1975). The reality perceptions undertaken by observer-actors, on the other hand, reflect those values, interests and needs of purposeful systems that are related to their given mandates. In other words, their observation of reality is necessarily linked to an observation of their particular situation in reality. Thus, while SPEQ is primarily involved with problems related to water quality deterioration and other manifestations of environmental degradation, the guidance systems are concerned with all of the many complex problems and obscure opportunities that society faces and are mandated with the task of assuring that SPEQ and other ministries consider the relevant aspects of these other problems as they elaborate appropriate action programs.

Turning now to a reality perception proper for an administration concerned with the problem of water quality deterioration, several aspects of natural, man-made and purposeful systems and their many interactions must be articulated and synthesized. This is because the SPEQ is essentially an inter-sectorial agency unlike the other uni-sectorial ministries which are vertically organized; its specific task is to manage the interdependancies that exist between the many activities taking place in both the public and private sectors (Descôteaux and Ouellet, 1978). It has no direct object of administration but rather it has a general preoccupation with the environmental quality of natural and man-made systems whose characterization must be included in its perception of reality. Natural and man-made systems can probably best be perceived through the use of a compartmental model describ-

ing land-use in a watershed or other territorial unit (Regier, 1978). This model divides land-use into four categories: urbanization, agriculture, waste deposition and habitat preservation. Purposeful systems can be partially characterized through the study of present values, emerging values and popular myths which together underly collective and individual goal structures. Perhaps the best way of linking these systems together in a fashion relevant to a mandate aspiring to combat water quality deterioration is through the conceptualization of a water deterioration system. Such a system would have four fundamental components:

- sources of pollution, or the polluters;
- agents of pollution, or the pollutants;
- effects on receptive ecosystems, or ecological impacts;
- effects on human health, economy or land-use, or environmental repercussions on the human condition.

The compartmental land-use model may be of some use in organizing study of the various point and non-point pollution sources affecting water quality. Of equal importance would be a characterization of the values which the polluters represent. Adhering essentially to the status quo, these values underly the myriad financial, practical and moral reasons that these interests find to rationalize the externalities which they generate. Goldstein (1973) refers to such reasoning and its representative value structure as "the logic of inaction", and, with respect to pollution control, he maintains that:

> "... until the political obligations and the economic burden of financing the work have been determined, it is likely that future efforts will be limited to a few token and scattered gestures. Unfortunately, the opportunity costs resulting from the delays and the half-hearted measures fostered by this approach will soon reach astronomical dimensions (Goldstein, 1973)".

Nevertheless, whether present values are valid in the long-term or not, they must be identified and analyzed within the framework of a meaningful reality perception.

Beyond value considerations the SPEQ must also contend with other realities such as, for example, the fact that it must depend upon some of the more sophisticated pollution sources for a technical understanding of their highly specialized degrading activities. The pollutant component of the deterioration system is conceptually much more straight-forward to characterize. A quantitative evaluation of amounts and concentrations diversed is laborious yet feasible to realize. A qualitative distinction of pollutant types, however, may be obscured by transformations that such substances undergo synergetically once released into the milieu. Among other classifications, these substances may be characterized as conservative or non-conservative or as toxins or growth factors, for example. An examination of effects on natural habitats is more complex yet less problematic than an evaluation of the overall environmental repercussions, or cumulative ecological, social, cultural, political and economic impacts of pollution, on society. The former effects would imply an understanding of natural laws regulating, for example, the assimilative capacity of aquatic systems and the

food webs of biological communities. The latter effects imply an understanding, for example, of foregone uses, possible health menaces and, once again, the many value structures related to such outcomes of environmental degradation:

> "The water problem, once viewed in terms of local and somewhat isolated instances of pollution-creating crises of particular times and places, is now seen as temporally and geographically pervasive, requiring centralized and coordinated treatment. In this same sense of moving away from the knee-jerk, crisis-response approach, water pollution is increasingly seen as a problem to be avoided rather than merely corrected after the harm has been done. There is a recognized need for greater emphasis on positive planning for water use in conjunction with pollution control measures of the past. Finally, water quality is being seen as an aspect of the quality of life generally. Pollution is not merely a health hazard and one minor aspect of the general concern with physical health. It detracts from the very dignity of the human condition because of its degradation of the habitat with which man must live harmoniously if he is to survive (Hines, 1971)".

The elaboration of such a deterioration system is by necessity complex yet it can provide a relevant circumscription of the basic water quality deterioration problem to which the SPEQ must address its reality perception.

The organizational environment within which SPEQ operates is another subject of concern which must be understood in a reality perception of this particular observer-actor's mandate. This necessity is due to the fact that "fractured water quality authority is a structural phenomenon sufficient unto itself for retarding aggressive pollution abatement (Hines, 1971)". The SPEQ must recognize that:

> "... (the) society of water managers is a complex, pluralistic array extending vertically from the federal government to private individuals and extending horizontally to various interests at each vertical level. As in any other society, effective communications within the vast and

> complex water management society is necessary if coordination and cooperation is expected. Since individual users make up a substantial body of this management society, the consideration of their interests and solicitation of their cooperation form an important part of the management task (Thomsen, 1973)".

Furthermore, each of these influential individuals and groups operates with different definitions of exactly what the environment is and what means are available, practical and ethical to respond to problems related to environmental quality. They operate amidst a general confusion of exactly how responsibility is delineated and they must face varying degrees of competition for scarce financial and manpower resources. Moreover, minorities are often poorly represented in decision-making circles and public participation is often diluted as considerations move from the local to central levels of decision-making (Thomsen, 1973). Within this reality perception of its institutional environment, the SPEQ must be able to identify which groups operate complementarily with its mandate and which are fundamentally in opposition. This information will be important during the later planning phases where SPEQ must attempt to improve the efficiency of the former by promoting their coordination and, through the mediation of the guidance systems, attempt to negotiate some sort of consonance with the latter. It must recognize that the problems caused by externalities require both the cooperation and centralization of water quality management (Thomsen, 1973).

The fusion of its intentions to fulfill a mandate with its observation of reality provides the SPEQ with a sufficiently coherent understanding of the conjuncture to permit a preliminary conception of objectives to

pursue. These, however, may not be concretized until they have been adequated with an acceptable image of a collectively desired future. Once again, this task of prospective perception is articulated by the guidance systems in relation to the mandates of all administrative entities in order to provide a coherent normative vision of the future for each. An organization such as SPEQ would develop a profound future perception for its own activities which is in keeping with that arrived at through a consensus among the various members of the guidance systems and their constituents, the public. Using the normative vision of a desired future as a wishful projection, it would develop trend extrapolations which predict present and future societal driving forces as well as eventual social, political and economic transformations that could be of relevance to the continued fulfillment of its mandate.

Elgin et al. (1975), in a prospective study of likely future social settings within which the United States Environmental Protection Agency (EPA) must operate, have identified four major driving trends: energy, climate, values and food. Ten extrapolative reference scenarios to the year 2000 were constructed my manipulating assumptions concerning these important trends, developing skeletal future scenarios, reviewing relevant futures literature and expanding the skeletal scenarios in greater detail. Three basic categories of likely futures emerged. The first group predicted the success of the contemporary industrial society accompanied by essentially the same value structure as at present. The second forecast the collapse of the current economic order, once again accompanied by no fundamental value

changes. The third category predicted both a transformation of the current order and societal values as well:

> "Among the plausible 'paths to the future' that emerged from the analysis, most were intolerable in the sense that no society would deliberately choose them (though they might end up there through inadvertence and ineptness). The only practical paths that led to a generally desirable future seemed to require a monumental task of social learning and a major transformation of social institutions to be substantially accomplished in the period before the mid-1980's (Harman, 1975)".

Many authors have commented on the possible forms that such a transformation might assume. The group GAMMA (1977), for example, has studied the form which a future conserver society might assume. Sasseville et al. (1977) suggest that societal values of justice, beauty and benevolence will become at least as important as the value of material abundance in the future. Giles (1977) believes that relations between public and private property will change, that territorial units will become more closed to each other by an increasing trend towards productive self-sufficiency and that concepts of energetics will supercede financial considerations as a basis for regional and national economy. He maintains that "political realities associated with allocating scarcer resources for the maintenance of living standards may force a reduction in dependencies and trends favoring self-sufficiency (Giles, 1977)". Harman (1975) is of the opinion that:

> "...technically advanced societies like the United States are undergoing a major historical transformation to some sort of 'postindustrial' age, characterized by diminished labor-force employment in industrial production, by increased prominence of service activities, by increased concern with value questions relating to quality of life, and presumably by institutional changes that will provide some satisfactory resolution of ... fundamental (problems) (Harman, 1975)".

Many important policy conclusions can be drawn from such future studies. The major conclusion drawn by Elgin et al. (1975) in relation to EPA activities was that economic concerns will continue to overshadow environmental concerns well into the 1980's, at which time new values supportive of environmental protection will become more pronounced. The implications for EPA policy of such trends are discussed:

> "Given the strength of the antienvironmentalist position until the late 1980s, it would seem that a strong regulatory posture and policy may not only be ineffectual--given a lack of public support--but it might also result in the reduction of EPA capability to act effectively in succeeding periods. To draw on a military analogy, the planner might consider the maxim that the only reason for going on the defense is to gain time for amassing sufficient resources (in this case, public opinion) to resume the offense. Therefore, one possible response to the social climate anticipated herein is to concentrate on maintaining credibility, husbanding resources, and preparing for the resumption of an even more active program when circumstances are more favorable (after the late 1980s). However, the avoidance of confrontations that cannot be won in the atmosphere of the late 1970s and 1980s does not mean adoption of a spineless policy of concurrence on environmentally harmful activities. Rather, what is implied is the defense of previous gains, continued research, expansion of environmental education, and preservation of the integrity of EPA to the end of ensuring environmentally sound practices ... in anticipation of the period when an activist policy can be resumed (Elgin et al., 1975)".

They further project the likelihood that, given such a social setting, EPA must expand its research capacity in anticipation of eventual needs to provide "hard" proof as a firm basis for regulatory actvities. They also maintain that the major future issue with which the organization must deal will involve public attitudes concerning energy sufficiency versus environmental quality. Such a possibility underscores the advocated need for normative planning which is capable of harmonizing environmental quality objectives and action programs with those of continued economic well-being. In view of

this necessity, five fundamental principles for EPA action conception and operationalization were identified:

> "Live with and acknowledge uncertainty -- By openly acknowledging the uncertainty revealed in this analysis, what we do not know and what we need to learn to act knowledgeably becomes clearer. Living through periods of uncertainty is a difficult planning requisite in contemporary bureaucracies, and civil servants should not be reluctant to admit that they just do not know the answer.
> "Embrace error -- Instead of avoiding acknowledgement of error, it is increasingly necessary to expect error, to seek out its manifestations, and to use information derived from error as a basis for learning. Too often error is equated with poor judgement; however, a failure to embrace error makes future judgments all the more difficult since it eliminates both the feedback and learning element of policy formulation.
> "Engage in goal setting -- Goal setting is a useful but difficult process; it clarifies dimensions of conflict and may well increase the stress of decisionmaking. Goal setting also clarifies the difference between policy that is reactive to a probable future and policy that is anticipatory of a desirable future. Goal setting provides a way of stating what is to be learned, and it is a necessary process for discovering whether we are learning. As Michael notes, 'We cannot evaluate whether we are approaching a desired future condition without having specified how that condition is to be recognized'.
> "Foster first-hand experience -- Reading or listening to someone speculate about the future is not the same as speculating for oneself. To understand fully a range of future possibilities, the policymaker himself must so address the future that his intellectual understandings are stretched, images of the future based on projections of past experience are tested, and 'visceral' appreciations of the future are developed.
> "Span boundaries -- Most of the driving forces that will likely be the source of discontinuous social change (e.g., energy, climate, food, values) are beyond the purview of most of EPA's immediate policy-planning concerns. This is one example of the need to transcend institutional boundaries in assessing realistically the primary sources of change. Thus, in the future there will likely be an even greater need for spanning the boundaries between institutions like the EPA and the society within which they operate and among the various units within institutions (Elgin et al., 1975)".

These planning considerations emphasize the need for a sectorial organization to expand its policy domain to include consideration of major driving trends that will potentially affect future agency performance. They indicate the potential value of continually monitoring trends, scenarios and the policy conclusions derived from them. They stress the value of contingency planning responsive to several plausible future trajectories of social, economic and value trends. They uphold the fact that "critical-area planning" is wholly insufficient as a basis for planning since it "specifies only what not to do and provides no goal thrust for the inner-spaces (Giles, 1977)". Finally, given the overall incertainty of such a creative process as future perception, a realization of the paramount importance of arriving at objectives which permit a great deal of flexibility in the gestation and elaboration of action programs is emphasized.

With the elaboration of a reality and future perception, rendered coherent with those of other administrative entities by means of the guidance systems, SPEQ would then evaluate and choose possible objectives to guide its policy formulation and action elaboration activities. The guidance systems, despite the fact they do not directly initiate administrative activities, would themselves evaluate and choose objectives for society as a whole on the basis of their centrally, regionally or locally oriented reality and future perceptions. This articulation would serve as a template from which the various administrations, such as SPEQ, would ensure the relevance of their objectives as coherent sub-sets of the global objective set established within the guidance systems. Table 2 gives two examples of global objective sets that have been proposed within federal and provincial government.

TABLE 2: Societal Objectives Articulated at the National Level
Les objectifs societals articulés au niveau national (Loftus et al., 1978; OPDQ, 1977).

Office of Planning and Development of Quebec (OPDQ)	Federal Fisheries and Marine Service (FMS)
Objective of economic growth and development	Environmental Harmony
	- conserve harvestable productivity
Objective of optimal and rational land-use	- control interaction of society and biosphere
	- develop ecological conscience
Objective of a just distribution of resources and a reduction of inequalities	Material Well-Being
	- regional economic growth
	- increased employment
	- returns to production
Objective of decentralization, deconcentration and participation	- equitable distribution
	- economic stability
	Cultural Opportunity
	- recreation and personal development
	- freedom and security
	- international peace and progress

As for the SPEQ, two very sound objectives, conceivable as a sub-set of either objective set in Table 2, have been articulated to guide a new, proposed water purification program in Quebec:

- improve and conserve the quality of waters to satisfy the needs of the populations;
- obtain and maintain equilibrated aquatic environments permitting biological resources to evolve normally (Gauvin, 1978).

These refer essentially to extraneous objectives inherent in SPEQ's mandate. Similar extraneous objectives would of course have to be articulated with respect to other aspects of environmental degradation implicit in this organization's mandate if the aforementioned two objectives are to be feasibly pursued. In addition, the SPEQ and other agencies would wish to set down objectives for itself as an organization, which might include committments to catalyze public participation and ensure the increasing legitimacy of the organization, its mandate and its activities within society (Thomsen, 1973). Descôteaux and Ouellet (1978) maintain that the regionalization of SPEQ can both valorize public participation and establish the agency's legitimacy in a conjuncture of budgeting restrictions and economic difficulties. The sum of these two types of objectives, articulated centrally, regionally and locally, would serve to guide the gestation of action programs required to transform problem situations in reality in the sense directed by a collective image of a desirable and acceptable future.

4.2 The gestation phase

The essential task of this planning phase is to determine, evaluate and choose central actions to orient the subsequent design of action programs necessary for the pursuit of the objectives adequated normatively in the preceding phase. They are decision rules, polarized by the normative perception of the present and future, which help to define policies permitting the conception of various possible operational strategies. As such, they provide "a relevant framework to order information so that real alternatives will emerge in some order of preference (Nickel and Wallace, 1974)". These policies may be enacted into legislation and law or may simply serve to orient the fulfillment of an administration's mandate by providing the criteria for elaborating and implementing strategically balanced action programs. The SPEQ, for example, has defined five central actions to orient the elaboration of new environmental protection programs. These are: knowledge and research, public participation, prevention, correction and purification (Gauvin, 1979). The managers of these five highly interactive policy domains, at the central, regional and local levels, would probably form the delegations representing the SPEQ in the appropriate guidance systems. Insofar as this link exists to assure the continued normative adequacy of SPEQ policies, the delegations might be chaired by the manager for knowledge and research since he would be charged with the basic intelligence gathering and synthesis required for SPEQ's particular normative orientation.

Returning to the five central actions posited above, knowledge and research policy formulation would largely be concerned with developing an

understanding of the environmental deterioration system appropriate to the territorial level within which it is operating. With respect to water quality deterioration, it would be primarily concerned with researching and defining natural and artificial, point and non-point deterioration sources, evaluating their relative importance, understanding the assimilative capacity of aquatic systems, delineating the repercussions of impacts on these natural habitats, defining actual and future needs of the population and, ultimately, devising criteria to guide the interventions to be undertaken within the four other policy domains. Policy related to this central action would not only be designed to provide vital information and research support to departments undertaking other central actions, but would equally be required to accumulate and synthesize relevant feedback generated by the monitoring of their activities and assure its dissemination within the SPEQ, the guidance systems and the population.

With respect to public participation, policy developed within the framework of this central action would be essentially similar to that of the guidance systems:

- assisting citizens in the articulation of goals and obtaining the weights they attach to these goals;
- organizing and coordinating organizations for improved goal achievement;
- soliciting suggested alternative goal-achievement strategies and their likely consequences;

- educating and advising citizens in the ways they may contribute to the protection of their quality of life, habitat and the human condition (Giles, 1977).

Above all, it is through this central action that the elements of the decision process, decision makers and decision enforcers, and their performance, would be made transparent to the public.

The central action of prevention would be concerned essentially with protecting currently viable habitats against deterioration and preventing further deterioration where pollution has already occurred. Policies developed by the SPEQ in relation to this central action include:

- measuring the impact and minimizing the damages which can be generated by development;
- implicating and conscientizing the population to conservation actions, rational uses and the protection of ecological sites;
- allocating water resources according to utilization choices and applicable criteria (SPEQ, 1978).

Ultimately conceived to protect the self-purification capacity of waterways, this central action depends to a large extent on the efficiency of education, participation and purification programs elaborated for the other central actions.

The central action of correction is similar to that of prevention in this respect. Its policy content might include:

- adding the costs of preventing or correcting environmental damage to the prices of goods and services that produce the damage;
- providing positive incentives to encourage individuals and organizations to engage in environmentally constructive activities (Ackoff, 1974).

Programs designed to execute this central action would favorize activities contributing least to deterioration while seeking cooperative change from those which contribute the most.

The fifth central action, purification, would define the forms that changes in pollution discharge would asume within concrete programs to restore the quality of deteriorated waterways, recuperate perturbed biological habitats and return foregone uses to the population. Two major policy thrusts have been considered by SPEQ for this central action:

- de-pollution or the elimination, at the source, of certain point and non-point pollution agents;
- purification or the interception, separation and treatment of wastewaters and the repair or upgrading of present facilities (Gauvin, 1978).

Policy elaborated for this central action implicates all major pollution sectors yet concentrates particularly on the industrial, agricultural and

municipal sectors, with the establishment of priorities as a function of the relative contribution of each sector to water quality deterioration. Finally, in addition to these five central actions, related policy must be elaborated which concerns both the decentralization and financing of programs conceived to execute the basic central actions.

The conception of central actions, whose execution is necessary and sufficient for the achievement of objectives, provides a frame of reference for an inventory of alternative means through which the central actions can be realized. Such an inventory would hopefully be exaustive so as to provide the widest range of choice for the subsequent elaboration of action programs within the particular constraints of regional and local contexts. According to Brinser, "alternatives should embrace various levels of activity, different types of activity, agencies carrying out activities, a wide spectrum of planning horizons, and shifting definitions of the real questions to be answered (Nickel and Wallace, 1974)". The alternative means would be pre-occupied at the gestation phase with:

- determining facts related to reality situations of relevance to the policy intentions of central actions;
- achieving the results expected from the socio-political decisions inherent in the policy intentions of central actions.

They would consist of a complementary mix of both traditional and experimental means so that the learning effectuated through the latter could be applied to the improvement of the more familiar means. Furthermore, the above

discussion of central actions alludes to the pronounced interactions between their policy intentions, implying that means must be elaborated which complementarily satisfy the purposes of each. It would thus appear that the manager of the knowledge and research function would be situated best to coordinate the necessary interactions among the various means articulated by the other departments pursuing the central actions of participation, prevention, correction and purification.

The SPEQ is currently undergoing extensive research for alternative modes of effectuating their central actions. These include protocol agreements with municipalities, programs to assist municipalities, industries and agriculturists through technological support, subsidies and loan arrangements, an effluent charge system and programs of public participation (SPEQ, 1978). Descoteaux (1977) summarizes these various means under the headings of juridicial action, economic action, administrative action, technological action, judiciary action and political action. Just a few more examples of related alternatives modes for the realization of central actions will be presented here.

With respect to the central actions of purification and correction, Dewees et al. (1973) cite several economic means of externally controlling industrial water use for which there has been established a rich and varied literature. These include effluent charges, effluent standards and user charges among others. Five essentially technological means are suggested as internal water use controls that industries can use to avoid external control (Dewees et al., 1973). David et al. (1971) discuss methods

of reducing waste generation, reducing waste after generation and increasing or making better use of the assimilative capacity of receiving waters. They develop a formulation of the costs of alternative water quality management systems for comparison purposes and advocate the implementation of an "order system-cost sharing arrangement:

> "This alternative is based or the use of (a) predictive water quality model and the selection of a least-cost system by a management agency in consultation with the waste dischargers. Total systems costs would then be determined... Costs would be shared by the waste producers in proportion to total wastes generated... subject to audit by a public agency (David et al., 1971)".

Ackoff (1974) recommends further that tax or charge rebates be used as positive incentives "to reward those polluters who began to make plans for improvement (Ackoff, 1974)". Demard (1978) recommends other corrective measures for the conservation of domestic water supplies and the reduction of wastewater for treatment and its associated costs. Finally, the SPEQ should take advantage of the fact there is so little municipal treatment at present to experiment with a variety of regional water quality alternatives of a scope similar to the one envisaged by Pennsylvania's Comprehensive Water Quality Management Planning Program (Kampschroer, 1976).

Given the data required for the more sophisticated purification alternatives, an example of one means adopted for the execution of the knowledge and research central action might be a regional quality model of the type developed by Russell and Spofford (1977). This model starts with a

linear-programming model of residuals generation and discharge, a complex non-linear aquatic ecosystem model and an atmospheric dispersion model to arrive at a simulation of ambient quality levels in particular localities. These are compared to ambient quality standards in an environmental evaluation section and the results form a basis for a model determining the penalties, or geographic distribution of costs, for residuals discharge. Another tool of interest to a research function coordinating the means adapted by the other functions would be technology assessments. These would project social, economic, political, cultural and ecological outcomes associated with both the means invoked by the SPEQ to combat pollution and the technologies of those pollution dischargers implicated in the water deterioration system. It is certain that both SPEQ and the guidance systems should be involved in such research exercizes whenever major projects are proposed for a given locality or region. The knowledge function would also be interested in regional fact-finding missions of a sufficient scope to be of use in balancing present and future development with the protection of water and related land resources. The Southeastern New England Study (1975) provides an exemplary format which such regional studies might assume (New England River Basins Commission, 1975). The California Tomorrow Plan, edited by Heller (1972), discusses a method of conceptualizing contemporary major disruptions related to the misuse of resources which reveals the many interactions taking place in a deterioration system. These interactions are isolated by relating the different disruptions to various causes, permitting the synthesis of a few underlying causes of environmental disruptions and the areas where major policies and programs should be conceived and coordinated. Finally it describes how alternative policy responses to these manifesta-

tions of resource misuse, as opposed to present trends, can arrive at socially valued outcomes (Heller, 1972).

Turning to the central action of public participation, White (1966) suggests that the public be given opportunities to express consumer and political choices, for example, in the type of technologies they would like to see used in the production of power and other daily needs. Furthermore, groups in both rural and urban areas could be subsidized for experimentation with alternative means of renewable resource use and energy supply. Similar support could be made available to others embarking on experimentation concerning new types of "humanly and comfortable functioning social orders (since) societies cannot easily experiment, and seem increasingly unable to judge what is possible or what is necessary (Paehlke, 1973)". Thomsen (1973) advocates that public participation be catalyzed through the use of universities in a public extension role and public hearings in the consolidation of an agency's regional and local mandate. The land-grant philosophy institutionalized in American universities to stimulate rapid, small-scale experimentation in agriculture would be particularly appropriate today for environmental protection. Its meaning should be expanded to encourage rapid and effectual research into means of undertaking the societal learning necessarily implied by public participation.

Considering finally the central action of prevention, programs have been advocated for the conservation and efficient use of resources, including energy, water and fertilizers, among others. Pollution Probe of the University of Toronto, for example, outlines ten concrete measures to

curb the exponential growth of energy demands (Kelly, 1973). Ackoff (1974) proposes legislation as "an instrument of social education... that will facilitate learning by the public about those aspects of ecology involved in (environmental degradation) (Ackoff, 1974)". Inherent in such a learning process is the realization that the limits to which the environment can be stressed are relatively unknown. Bella (1975) suggests that the potential irreversibility of various actual or proposed deteriorations be evaluated in relation to their aptitude to represent evolutionary departures for the habitats in question. Many studies have been made of the use of zoning for favoring healthy environmental activities and protecting prime agricultural land, greenbelts around cities and wildlife habitat. Environmental protection can also be achieved through the use of strategically situated individuals which volunteer, perhaps because of some personal stake, to monitor deterioration situations and thereby provide a wealth of feedback to agency decisionmakers. Finally, technological thrusts aimed at utilizing renewable resources, closing energy loops and encouraging secondary industries through the recycling of wastes cannot be under-emphasized. The private sector is slow to examine the potential of such measures without the provision of incencentives and many feel that this fact justifies significant government expenditures on basic and applied research. The above discussion serves to give an idea of the range of alternative means which need to be examined in relation to such involved central actions as the five conceived by SPEQ. Many of these measures could only be effectual through the cooperation of several ministries working in concert with SPEQ through a coordinating structure such as the guidance systems.

The variety of management modes inventoried for the execution of the central actions must then be evaluated for their pertinence to the solution of deterioration problems within the normative and situational conjuncture developed in the preceding planning phase and their feasiblity in view of constraints arising within the organization and its environment. Exogenous constraints would come from such specific sources as established legal, financial and operational arrangements, and diffuse sources such as public attitudes. Endogenous constraints refer essentially to the organizational capacity of SPEQ, its legitimacy as perceived by others and its local capacities to effectively harness manpower and resources. In its assessment of the feasibility of different operational modes, the SPEQ should decide which obstacles are relatively permanent and which are within the purview of its mandate to remedy. Feasibility must also be based on the predicted incidence of the alternative means on reality situations and their potential to modify reality in the sense of the normative image of a desirable future. For example, the choice of wastewater treatment should be determined not only by the type of wastewater generated but as well by the image of quality one expects of the receptive environment in which it is supposed to cause an impact (Frechette and Marceau, 1977). Ortolano (1974) describes a process by which "evaluative factors" can be employed in relation to constraint sets depicting alternate visions of the future to evaluate and rank alternative means for accomplishing central actions. Quality of life criteria including ecological, social, economic and cultural considerations could also be of use in such a ranking, as would efficiency, equity and allocation criteria. While all of these considerations must be taken into account, the evaluation should respect the fact that "a far broader, more flexible arsenal of con-

trol techniques is likely to be needed in the future, not only to carry out the enforcement functions of existing and new institutions for environmental control, but also to implement the chosen policies and priorities for the future (Grad et al. 1971)". Continued experimentation and learning will be necessary to find new means which are truly capable of rendering cooperative the diverse needs of public and private entities. Once these means have been ranked according to their expected or hoped results, the central actions are modified so as to express only those intentions which are within the organization's strategic capacity to fulfill, considering inherent organizational delays, the relative local importance of pollution sources and other practical criteria. The final quality control of strategic planning is achieved with a global evaluation of the synergic effect of the central actions and their alternative means of realization together on reality situations at present and along the future trajectory defined by the normative prospective perception. These adequated policies and programs will serve as a reservoir of alternative decision rules and organizational means for the elaboration of action programs in consonance with the goal structures specific to the actual circumstances of regional and local populations.

4.3 The elaboration phase

The purpose of this planning phase is to arrive at a set of operational goals, translating the political imperatives of central actions, in response to which realistic and effective intervention or action systems can be designed, evaluated and chosen. For example, appropriate regional and local goals, articulated through the normative orientation activities of the

decentralized guidance systems, would be developed further by SPEQ, in adequation with the policy intent of its central actions, through its own normative orientation and related public participation. Action systems comprising a water quality restoration program would then be designed to respond to the particular nature of the problem, within its regional and local contexts, as perceived by the public, SPEQ and the guidance systems. The final evaluation and choice of action systems to be undertaken by SPEQ, as with other ministries, would require the mutual collaboration of all administrative entities, through the mediation of the guidance systems. These, being themselves decentralized, would be equipped to facilitate public understanding and participation in such decisions as well as to recuperate the relatively unappreciated efforts of those social groups disseminating locally or regionally oriented research in an applied, socially meaningful form. Moreover, they could undertake monitoring activities, or a form of continual impact assessment, related to the action systems of all administrative intervenants and other actors operating within its territorial jurisdiction. All of these activities combine to form the tactical level of planning, designed in consideration with the strategic plans of each ministry.

Goal formulation is the foundation of tactical planning in the elaboration phase of the methodology. Giles (1977) describes a method for devising and weighting citizen goal statements and provides an example of a general goal system for citizens containing 27 topic headings and 340 goal statements. This list, which would be compiled and revised by the guidance systems, represents all of the highly valued goals of the citizens in a territorial unit whose achievement is to be maximized subject to the achieve-

ment of other goals. Giles foresees the following sequence of events in goal formulation:

- the first draft goals are prepared by analysts;
- the list is reviewed by representative decisionmakers and revised;
- public meetings are held to gain insight into citizen goals;
- the revised list is then prepared (Giles, 1977).

While goals may be subsequently added or deleted, the goals system would soon stabilize, "reflecting a near-universal list of wishes and desires of mankind (Giles, 1977)". Giles maintains that goal structures would probably be common throughout a national territory yet citizen weights associated with these goals would be likely to differ considerably from one locality to another. Interesting insights into value discrepancies can be achieved through the use of statistical tests to compare the weights assigned to goals by different social groups, areas, citizen "representatives" and a sampling of the citizenry in general. These goal systems form the basis for a more pertinent and timely response to local problems and needs by providing an explicit description of the normative conjuncture within which action systems will be implemented. They are primordially important for the subsequent orientation of data acquired for the design, evaluation and choice of action systems. Along with learning acquired through the monitoring of action system implementation, and a consciousness of outcomes of change produced through such implementation, general goal systems provide an essential feedback to the reality and future perceptions of the normative orientation.

An administrative entity such as SPEQ would be interested in deriving a subset of the general goal system which is of particular relevance to its chosen central actions. This subset would include all of the extraneous goals which relate to the mandate that society has conferred to this agency. Once these are adequated through the guidance systems and the SPEQ's own public participation procedures, environmental quality goals, in general, and water quality goals, in particular, can then be maximized subject to the achievement of the other general goals of societal well-being. In order to achieve these extraneous goals imposed by its mandate the SPEQ would have to derive its own operational goals. For example, SPEQ would develop goals pertaining to its knowledge and research central action which insure the identification of pollution sources and the evaluation of the effects of pollution. In the case where insufficient data is available to achieve such goals, another might demand the use of phenomenological scenarios, such as those developed to describe mercury aggression in Northwest Quebec, in order to fill knowledge gaps (Sasseville, 1977). Another goal for this function would be to develop criteria by which the action systems comprising interventions related to the other central actions are to be judged. These criteria would measure both the extent of localized ecological deteriorations and the relative intensity of the phenomenon on economic, political and social systems. SPEQ, for example, cites the following criteria as guides for the choice of intervention priorities:

- the importance of habitat degradation in relation to affected uses;
- the recuperation of biological habitats necessary to ecological equilibrium;

- the population base affected by habitat degradation;
- the will of the population to bring about an immediate solution (Gauvin, 1978).

Once these criteria are established, another goal would then be to associate the different deteriorations together to arrive at a "whole" system view of their collective consequences through a spatial and temporal simulation (Frechette and Marceau, 1977). Specific goals could then be elaborated for designing interventions which effectively carry out the policy intentions of the remaining central actions. With respect to the central action of purification, for example, another one of SPEQ's own goals might relate to the development of a particular technology for industrial or agricultural wastewater disposal. Other goals, once again adequated to regional and local contexts, would be elaborated in relation to the central actions of correction, prevention, public participation, financing and decentralization. The mandate created by SPEQ for its intervention units might serve as a framework for organizing SPEQ's own goal set within the context of its extraneous goals:

- understand the biophysical milieu;
- identify problems according to usages and ecological disequilibrium;
- identify polluting agents and their nature;
- define objectives to attain and prioritary actions to recuperate milieus with the local participation of citizens;

- define solutions and prepare purification and restoration projects;
- prepare intervention plans defining their administration, scheduling and financing;
- negociate agreements with intervenants;
- monitor recuperation works;
- prepare programs to follow intervention (SPEQ, 1978).

Once they have been evaluated by SPEQ and the guidance systems for their potential to achieve results consistent with local, regional and national images of a desired future, the goals provide a framework for the conception of alternative action systems which can be implemented for their achievement.

Alternative means for realizing SPEQ's central actions have already been inventoried and ranked according to preference in the gestation phase. At the tactical level of planning, a synthesized inventory of those means most pertinent to the achievement of the particular goals related to each central action is made. Many available action systems have already been discussed, yet a few more will be introduced. Considering once again the central action of knowledge and research, for example, SPEQ might wish to employ means of achieving its goal of establishing criteria for determining intervention priorities. Darby et al. (1976) have developed a method of establishing priorities for designing interventions in small, urbanizing watersheds where "data available to accomplish this task are often sparse, disaggregated and discontinuous in nature (Darby et al., 1976)". This method is based on three kinds of data: basic water quality parameters, water

quality as perceived by local experts and activity indices as indirect indicators of water quality. These are analyzed to develop adequate, yet minimum-cost, sampling strategies to preclude extensive monitoring programs while assuring the par-ticipation of local authorities in water management. With respect to the same central action, Rickert et al. (1976) have elaborated a framework for conducting intensive river-quality assessments which could partially satisfy the goal of simulating "whole" systems deteriorations. This method concentrates specifically on the four following problem areas:

- the effect of population and industrial growth and resulting waste discharges on dissolved oxygen;
- the potential for nuisance algal growth;
- the possibility of trace-metal accumulation in river-bottom sediments;
- the potentially harmful effects on land and river quality of accelerated erosion resulting from intensified land use (Rickert et al., 1976).

Methods such as these can provide the conceptualization needed "to develop regional programs for quantitatively defining the effects of land management on river quality (Rickert et al., 1976)".

More qualitative means would be required in addition to implement other "whole" system goals, related to the central action of knowledge and research, which might include:

- monitoring watershed changes as reported by existing agencies or warning systems;

- monitoring and reporting regional and natural resource supplies which potentially threaten the ability of the watershed to achieve its objectives;
- analyzing and reporting how past decisions impair the ability of present societies to achieve their objectives;
- making available prescriptions and design recommendations for proposed developments and land-use changes (Giles, 1977).

Such means are in a crude state of development, relying upon research in such diverse fields as individual attitude formation, environmental perception, ecosystem energetics and technology assessment. White (1966) suggests that since most factors determining individual attitude formation are related to relatively inflexible personality traits, relevant knowledge and research priorities would center around a much more controllable variable:

> "... the decision situation (or) the time of the vote, the leaders who force the decision (and) the way they phrase the question... Among the numerous aspects of environmental stimulation, probably the one most susceptible to change is the information about environmental conditions and ways of managing them. Although certain findings suggest that the information alone... may have little effects upon attitudes...other studies indicate that if the situation in which choice is exercized is modified or if the individual's sense of efficacy in dealing with the confusion of the world is changed suitably, the information takes on a different significance (White, 1966)".

In response to this opportunity, Giles (1977) states that the emphasis of a goal-seeking, public participation intervention must be positive in nature, concentrating "on human success, life enhancement, increased efficiency and

quality of life (Giles, 1977)". Of the many methods he cites for achieving this goal, the presentation of future scenarios might someday perhaps be the most useful and straightforward, yet in the current period of value transition it appears that the more high-powered marketing and mass media methods he mentions will be used to influence attitute formation. Paul (1972) has advocated the use of environmental indicators, transformed into indices, to "provide a simple format for communication (and) a format for operational goals and objectives (Paul, 1972)". In the latter case, they form criteria to judge the degree to which goals are being achieved. A graphic representation is used to compare the average indices of different regions, which, when linked to an image of a desirable future, could become a powerful tool for public participation programs in those regions of poorest environmental quality.

Giles (1977) has also emphasized the importance of considering means for understanding and communicating urban watershed energetics, a task that might be more appropriate within the guidance systems yet surely of integral significance to SPEQ. He bases his principles for energetics on the relative closedness of governmental and territorial units he foresees as a future consequence of increased resource competition. They are:

- successful systems store energy;
- some energy must be spent on new alternatives for the system so that it may evolve as external conditions change;

- man should use remaining fossil fuel reserves towards investment in a complex of support systems for man that will not require fossil fuels for their operation (Giles, 1977).

His concept of energetics is very profound, refering to the "study of the storage, flow and transformation of energy from one form to another within watersheds" as a conceptual framework for providing" insights into the outer limits of maximum yields of systems and basic system constraints (Giles, 1977)". His views parallel those of Hertz (1970), who refers to technology assessment, or an adequation of engineering change with long-term equilibrium objectives, as the new technological imperative. He maintains that "in all technological studies must be inserted the requirement that solutions to problems are acceptable only when the broadest thermodynamic equilibrium constraints are considered (Hertz, 1970). It is conceivable that the efficient use of available energy might become more important than related financial considerations, indicating that many new principles in addition to cost-benefit accounting should be included within decisions, related to the quality of life, which recognize life's fundamental dependence on energy. Holt and Talbot (1978) cite four principles for the conservation of living resources which are of evident interest to the management of energy use in particular and ecosystem use in general:

- the ecosystem should be maintained in a desirable state such that consumptive and nonconsumptive values could be maximized on a continuing basis, present and future options are ensured, and risk of irreversible change or long-term adverse effects as a result of use is minimized;

- management decisions should include a safety factor to allow for the fact that knowledge is limited and institutions are imperfect;
- measures to conserve a wild living resource should be formulated and applied so as to avoid wasteful use of other resources;
- survey of monitoring, analysis, and assessment should precede planned use and accompany actual use of wild living resources. The results should be made available promptly for critical public review (Holt and Talbot, 1978).

These types of insights available from research into attitude formation, behavior and energy use patterns must be considered in the conception of means for restoring water quality because they reflect the systemic dynamics of the reality particular to a territorial unit. Water quality is a function of all of these factors which together determine both the extent of the deterioration problem itself and the collective capacity which can potentially be mobilized to respond to it. Carter (1974) has described a variety of means currently in use in the United States for protecting the environment, which include, besides the familiar economic incentives and effluent charges:

- citizen environmental commissions;
- environmental sections in municipal and regional master-plans;
- land use controls;
- other environmental controls;
- environmental quality standards;
- environmental impact statements;

- moratoria;
- law suits (Carter, 1974).

Such means are only as valuable as the extent to which they incorporate the more important issues (related to behavior, perception, energy and land use, etc.) inherent in the social dynamics of territorial entities. These considerations point out the endogenous and exogenous constraints inherent to various action systems and suggest criteria which these means must satisfy in order to correspond to the particular needs of the local or regional conjuncture.

The evaluation of alternative action systems retained for the achievement of water quality goals commences with a scenarization of their direct and indirect effects, both at the time of their implementation and in the distant future. Coupled with this is a specification, based on the chosen goals, of the relations these action systems should entertain with the environment into which they are to be implemented. Both include a consideration of constraints and subjective criteria reflecting local contexts and an adequation with a retained future image. The result is an understanding of both desired and foreseen repercussions within economic, social, political and environmental systems which can be used to compare the advantages and inconveniences of alternative arrangements of action systems within administrative programs.

Besides the criteria mentioned above with respect to the efficient use of energetic, financial and human resources, organizational criteria

should preside over this evaluation. These include questions as to whether or not fair and judicious decision systems have been designed, whether or not these are capable of sufficiently representing all interest groups, whether or not they possess the capability to implement their decisions, and, finally, whether or not they exhibit innovative behavior in their design of action systems (David et al. 1971). Final decisions, in addition, must reflect more profound considerations of distributive equity, including "material equity, psychological well-being, physical health, democratic participation in government processes and aesthetic factors (Krieger, 1971)". Reich (1966), commenting on the law that a democracy undertaking societal planning must adopt in order to distinguish itself from the familiar centrally-planned socialist model, suggest that the concept of privacy be used as the point beyond which planning bears no further authority, and that this be specified by law. Since respect for the individual human being remains a distinctive characteristic of North American democracy, he maintains that "planning must be halted at the line where belief, artistic expression, domestic affairs, education and creativity begin (Reich, 1966)". Such considerations have to be integrated within evaluations of action systems to determine the extent to which they would increase the aptitude within territorial units of the population to create a better equipped and informed local collectivity, thereby lending a self-entraining dynamism to action systems which are understood and valorized by the constituencies they have been designed to serve.

Those action systems and arrangements which seem the most adequate to the regional or local conjuncture are then chosen and they are specified

in sufficient operational detail to realistically schedule their implementation. The SPEQ, for example, has categorized the implementation of its purification program in three stages: development, national implantation and regional implantation (SPEQ, 1978). These phases would probably correspond as well to the institutionalization of a government coordinating agency, such as the guidance systems mentioned herein, or the adoption of a new methodology for planning and organizing quality-controlled human action. They represent the direction that efforts must take in order to begin assuring some semblance of coherence among the varied action systems taking place in reality. Once the mechanisms of quality control are developed and introduced nationally, an organized decentralization would present a greater opportunity to effectively mobilize resources and achieve coherence in action programs designed to remove the causes of the more complex problems facing contemporary civilization in this unique period of human evolution.

4.4 A summary of the application

It may be concluded from the above application that SPEQ, through its choice of principles underlying a new purification program, has developed a certain systemic perception of the reality situations associated with water quality deterioration systems. This was previously lacking due to sectorialized preoccupations with a few narrowly-conceived aspects of the overall deterioration system (Peterson, 1979). It has yet to relate its mandate to a generalized image of a desirable future, based explicity on citizen's goals, because the institutionalization of a capacity for future perception and goal articulation has not yet been attempted. These planning

activities of ever-increasing significance cannot be undertaken in a coherent manner within present sectorialized institutional arrangements. They are beyond the mandates of each intervenant, hence beyond their immediate responsibility. Concensus appears to be crystallizing around the concept of government decentralization as a viable alternative for the accomodation of necessary planning activities.

The guidance system concept elaborated upon by Giles (1977) is one alternative for coordinating sectorialized, yet decentralized, central administrations, providing each intervenant with a coherent set of policy research data and conclusions to which it may normatively adequate its mandate. The objective he conceives for these institutions is "to create a decision-aiding system that will perfectly match a future watershed with the needs and expectations of the citizens living there and in adjacent watersheds (Giles, 1977)". This arrangement recognizes that planning at the territorial level should be done so as to inspire the interest and confidence of an informed and expressive citizenry. The higher profile of relevant issues achieved through decentralization would facilitate an integrated approach to structured regional problem situations, illuminating their interdependencies and provoking the emergence of more realistic priorities for administrative action. As a result, an agency such as SPEQ could arrive at a more judicious choice of action systems to implement based on a geographically adequated conceptualization of the means to which it has general access.

Descôteaux and Ouellet (1978) cite many other advantages to decentralization, from the point of view of SPEQ, including:

- a greater rapidity of administrative intervention;
- a potential for increased administrative realism relative to the environment;
- a tendency for administrative personnel, because of their territorial situation, to consider the impacts of their actions in addition to the means generally available to perform them;
- a political leadership of higher quality based on persuasion and negotiation rather than polarization and confrontation;
- a sensitization and animation of the population, and other actors taking decisions affecting the environment, to facilitate operations;
- a liberation of the central activities of research and planning, facilitating organization (Descôteaux and Ouellet, 1978).

Furthermore, EPA has described its experience with decentralization as:

> "... a series of created tensions and the balancing of those tensions. The Regional Administrator is required to balance his enforcement and assistance roles. Headquarters and the regional offices must achieve some balance (a) between national and regional objectives and priorities; (b) between Headquarters' desires for uniformity and consistency and the regional office desire for operational latitude; and (c) between categorically seperate national program aims and the aims of EPA program integration in the regions. In addition, by bringing the Federal government into such proximity to State governments, decentralization also emphasizes the tension that occasionally arises when Federal and State environmental protection objectives and priorities are not in harmony. Tensions such as these can prove exceedingly beneficial to the Nation's anti-pollution efforts by forcing intelligent and creative

forces to cooperate with one another and balance the various perspectives which they bring to bear on environmental problems (USEPA, 1972)".

Carried to the territorial level, the reality perception forced by such tensions and balances could revitalize local government, increasing their power to implement the many means generally available at the local level for protecting the environment and the quality of life. The central level of government could then maintain an advisory position, preventing diseconomies of scale and providing the guidance required for a common approach to land-use planning which does not exacerbate regional disparities. These two institutional levels have been referred to by Maquart (1977) as **micro-aménagement** and **macro-aménagement** respectively. The first, dependent upon local responsiblity and a decentralized administrative presence, is pre-occupied with the quality of life, or the means by which a living is earned and the habitat in which life is experienced. The second would operate in large economic spaces and aspires to increase the concurrential capacity of regional and national economies by improving their competitive stance in national and international markets. The methodology presented herein is one suggested means for conceptually linking these two vital planning levels together. Being a hierarchically structured whole system, no component part of the methodology can be truly understood in isolation from the others, however "starting from any given system stratum, understanding of a system increases by crossing boundaries: moving down the hierarchy one obtains a deeper understanding of its significance (Ozbekhan, 1971)". This is preci-

sely the type of understanding that the methodology aspires to achieve for a decentralized administration, operating in coordination at the national, regional and local levels with other actors through the mediation of an institution such as the guidance systems.

Finally, given the acceptance of new, adaptive institutional arrangements, such as this planning methodology, the guidance systems and a decentralized environmental protection administration, the legal environment in which they are to operate would have to be defined. Paul (1972) provides one discussion of the value basis which subsequent planned legislation and judicial activities related to environmental quality should incorporate:

> "The term "environmental quality" must encompass the values which motivate and inspire people to public action. It must include considerations of health... It must encompass an aspiration for outdoor recreation... It must involve the retention and replenishment of natural resources, for our greed in devouring resources and consuming products can only lead to limitations on the choices and alternatives available to our children and grandchildren. It must cultivate a yearning for the aesthetic enjoyment of life, for a life without beauty may not be worth living. These four basic values are inherent in the purpose of planning for environmental quality (Paul, 1972)".

It is the legal institutions, more than any others, which possess the authority to affect the many actors undertaking actions in reality, and any administration, such as SPEQ, which wishes to bring about a consonance between its goals and the goals of other territorial actors, will increasingly expect the law to embody principles of social, ecological and energetic equilibrium which encourage social systems to retain their resilience, and that of the ecosystems on which they depend, by maintaining their activities

within defined domains of stability (Holling, 1969). This application of the methodology has emphasized the fact that SPEQ cannot hope to fulfill its mandate in isolation from other government and private activities, but must rather catalyze the type of institutional and legal change required to render environmental quality planning possible through the research of a basis for coherence in the reality and future perceptions of the action generation systems of all intervenants undertaking action systems in the environment.

CHAPTER V

Discussion

This presentation of a long-range planning methodology, the problems to which it would be addressed and an exemplary application to the problem of water quality deterioration has been oriented towards the end of explaining a conceptual framework, based on the theory of human action, through which the variety of disciplinary endeavors necessary for future-responsive social planning in response to complex problems could be synthesized and effectively employed. A rudimentary concept of a decentralized coordinating agency, consisting of guidance systems, was also suggested as one alternative fashion for designing the organizational capacity of a government entity specializing in such "whole system" planning. Most of the tasks inherent to this planning methodology are currently subjects of continuing research and would take years to become usefully developed and appropriately applied. A realistic conceptual framework and alternative institutional arrangements for the planning of quality-controlled societal action are prerequisite to the vital task of effectively harnessing these diverse research interests in such a way as to render them relevant to continuing human evolutionary development.

While the methodology may appear at first glance to be unnecessarily redundant in its requirements, it in fact represents a requisite, comprehensive structure permitting the accumulation, synthesis and appreciation of sufficient information to understand the very processes by which action

programs are conceived and realized. This knowledge is indispensible to an increasingly urgent quality control of actions taken in the resolution of complex societal problems. Two main categories of information are derived from the use of this methodology. First, information concerning the environment into which the actions will be implanted, and the endogenous and exogenous constraints to such implantation, is refined and applied through each successive evaluation step of the methodology. Second, a wealth of different information is required for the crystallization of the objectives, central actions and goals into the final arrangements of means which constitute the genetic code of the action program. Information concerning endogenous constraints and goal-responsive operational modes is the most pertinent during the more creative steps of the methodology where the important elements of the action gestation process (Fig. 1) are determined. The need for more of these two types of information is already reflected in the amount of research currently devoted to impact evaluation and institutional analysis. In theory, these two types of information are necessary and sufficient for an improved quality control of action programs.

In the development of the methodology and its application a special emphasis was placed on the structural coherence and functional interactions of each of the three planning phases within a hypothesized institutional arrangement which might employ them. The content of the gestation and elaboration phases, comprising a broad field of policy and action administration, was neglected however in order to permit a more involved discussion of the type of content relevant to the increasingly important normative orientation phase. This is because a "whole system" perspective integrating

a reality and future perception based on present and emergent values is a primordial necessity for the formulation, evaluation and choice of policy intentions (central actions) and implementation measures (action systems). Hence, discussion of techniques for inventorying alternative action modes, performing informed evaluations and effectuating political choices were sacrified in favor of a treatment of concepts related to the reality and future perceptions which provide the normative criteria indispensible for the above undertakings. Stress has been placed on the appreciation of a variety of individual and societal values, as well as upon the articulation of a desirable future, since these are necessary for the conception of normatively adequated objectives, central actions, goals and action systems. Endogenous constraints to action were discussed as they relate to the organizational capacity potentially available for catalyzing meaningful government intervention, yet exogenous constraints arising from social and institutional inertia, and their ramifications for a societal learning endeavor, are of equal importance. Finally, an explicit discussion of the implementation of action systems and the monitoring of their outcomes was foregone, while the kinds of feedback needed for the normative orientation phase from these activities were discussed.

While many considerations arising in this methodology are fairly well articulated in current planning processes, others are neglected in view of their apparent complexity. Thus, it is certain that the current inventory of operational action systems and other means is not entirely sufficient for the requirements of quality-controlled planning. The use of the methodology can point out weak information points where further research is re-

quired because of its basis in the theory of action, embodying the very essence of the thought process used in planning human action. This theory is inherent to every part of the methodology, rendering the logic of each activity consistent to the others. Integrated with a systemic perception of reality, and its implications for increased future-responsive organizational management and planning, the theory presupposes decentralized government interventions based on transparent decisionmaking conducted in correlation with explicitly documented human values. As the content of the various components of this theory become more fully articulated through the use of the methodology, its continued employment would lead to improved quality controls of rationalization and planning that are required for assuring the coherence of human action systems which, as a "whole", determine the unfolding trajectory of civilizational evolution.

CONCLUSION

Normative reality and future perceptions are necessary to identify and judge values which can make decision-making trade-offs explicit, based on a future-responsive learning rationality rather than short-sighted sidestepping of the long-term issues. Decisions need no longer be based on the imperatives of well-developed technologies, centralized expertise and vested power interests. These, rather, would be subject to rigorous technology assessment, harnessed by the values of the men in whose interest technology and government were conceived. Technology and societal planning would be united in an effort to rationally design inevitable societal changes through a decentralized comprehension of societal processes by an educated electorate. The values upon which this endeavor would be based, however they are decided, would serve to assure that these actions are coherently undertaken with the view of achieving explicitly defined socially acceptable and politically viable futures.

BIBLIOGRAPHY

ACKOFF, R.L. (1970). A Concept of Corporate Planning. Wiley-Interscience: Toronto.

ACKOFF, R.L. (1974). Redesigning the Future. A Systems Approach to Societal Problems. Wiley-Interscience: Toronto.

BELLA, D.A. (1975). "Strategic Approach to Estuarine Environmental Management". ASCE, Journal of the Waterways, Harbors and Coastal Engineering Division, February: 73-92.

BELLA, D.A. and OVERTON, W.S. (1972). "Environmental Planning and Ecological Possibilities". ASCE, Journal of the Sanitary Engineering Division, June: 579-592.

CALDWELL, L.K. (1970). "Authority and Responsibility for Environmental Administration". Annals of the American Academy of Political Science, 389: 107-115.

CALDWELL, L.K. (1971). "Environmental Policy in a Hypertrophic Society". Natural Resources Journal, 11: 418-435.

CALDWELL, L.K. (1974). "Environmental Policy". in Human Ecology. F. Sargent (editor), North Holland Publishing Co.: Amsterdam.

CARTER et al. (1974). Environmental Management and Local Government. International City Management Association: Washington, D.C. NTIS # PB 232 955.

CHADWICK, G. (1971). A Systems View of Planning--Towards a Theory of the Urban and Regional Planning Process. Pergamon Press: Toronto.

COMTOIS, Y. (1979). Réflexions sur la nécessité et les contraintes de la participation populaire à la gestion de l'environnement et examen des structures de l'O.P.D.Q. afin de déterminer son rôle potentiel dans la mise en place du processus de participation. INRS-Eau: Québec.

DARBY, W.P., McMICHAEL, F.C. and DUNLAP, R.W. (1976). "Urban Watershed Management Using Activity Indicators to Predict Water Quality". Water Resources Research, 12(2): 245-252.

DAVID et al. (1971). Institutional Design for Water Quality Management: A Case Study of the Wisconsin River Basin. Volume I. Section A -- Summary. Water Resources Center, Wisconsin University: Madison, NTIS # PB 199 268.

DEGREENE, K.B. (1973). Sociotechnical Systems -- Factors in Analysis, Design and Management. Prentice-Hall, Inc.: Englewood Cliffs, New Jersey.

DEMARD, H. (1978). La rationalisation des activités reliées à l'eau en milieu urbain au Québec. International Seminar on the Rational Use of Water, Cannes, France, December 6-8, 1978.

DESCOTEAUX, Y. (1977). Les moyens d'intervention face à la présence de substances toxiques dans l'environnement. AGIR Ltée: Ste-Anne-de-Beaupré, Québec.

DESCOTEAUX, Y. and DELISLE, A. (1978). Les citoyens et l'évaluation de la qualité des actions humaines. AGIR Ltée: Ste-Anne-de-Beaupré, Québec.

DESCOTEAUX, Y. and OUELLET, L. (1978). Concepts et méthodes de la régionalisation d'une administration centrale. AGIR Ltée: Ste-Anne-de-Beaupré, Québec.

DEWEES, D.N., GRIMA, A.P. and PICKETT, E.E. (1973). Comprehensive Water Resources Policy Planning: Review and Recommendations. Institute of Envi-

ronmental Science and Engineering, University of Toronto: Toronto, Report # EF-20.

ELGIN, D.S., MacMICHAEL, D.C. and SCHWARTZ, P. (1975). Alternative Futures for Environmental Policy Planning: 1975 - 2000. U.S. Environmental Protection Agency, Office of Pesticide Programs: Washington, D.C. EPA-540/9-75-027.

ENVIRONMENT CANADA. (1975). Monograph on Comprehensive River Basin Planning. Information Canada: Ottawa.

FOLEY, D.L. (1973). "British Town Planning: One Ideology or Three?" in A Reader in Planning Theory. A. Faludy (editor), Pergamon Press: Toronto.

FORRESTER, J.W. (1969). "La planification sous le règne des influences dynamiques des systèmes sociaux complexes". in Prospective et politique. E. Jantsch (editor), O.E.C.D.: Paris.

FRECHETTE, F. and MARCEAU, R. (1977). Pour une politique des eaux usées. INRS-Eau: Québec.

FRIEDMANN, J. and HUDSON, B. (1974). "Knowledge and Action: A Guide to Planning Theory. Journal of the American Institute of Planners, January: 2-16.

GARRIGAN, T.E. (1973). Inter-Plan Communication and Motivation Study: Florida Background Study. Sperry Urban Science Center: Washington, D.C., NTIS # PB 242 181.

GAUVIN, M. (1978). L'industrie du textile et l'environnement. SPEQ: Québec, Internal Report.

GAUVIN, M. (1979). Personal Communication.

GILES, R.H. (1977). A Watershed Planning and Management System: Design and Synthesis. Virginia Water Resource Research Center, V.P.I.S.U.: Blacksburg, Virginia, Bulletin 102.

GOLDSTEIN, W. (1973). The Political Metaphors of Environmental Control. Alternatives, 2(4): 11-17.

GRAD et al. (1971). Environmental Control: Priorities, Policies and the Law. Columbia University Press: New York.

GROSS, B. (1971). "Planning in an Era of Social Revolution". Public Administration Review, 31(3): 12-19.

HARMAN, W.W. (1975). "On Normative Futures Research". Policy Sciences, 6: 121-135.

HARRIS, D.J. (1978). "Corporate Planning and Operational Research". Journal of the Operational Research Society, 29(1): 9-17.

HELLER, A. (editor) (1972). The California Tomorrow Plan. William Kaufmann, Inc.: Los Altos, California.

HERTZ, D.B. (1970). "The Technological Imperative -- Social Implications of Professional Technology". Annals of the American Academy of Political and Social Sciences, May: 95-106.

HINES, N.W. (1971). Public Regulation of Water Quality in the United States. National Water Commission: Arlington, Virginia, Legal Study 18, NTIS # PB 208 309.

HOLLING, C.S. (1969). "Stability in Ecological and Social Systems". Brookhaven Symposia in Biology, 22: 128-141.

HOLLING, C.S. and GOLDBERG, M.A. (1971). "Ecology and Planning". Journal of the American Institute of Planners, 37(4): 221-230.

HOLT, S.J. and TALBOT, L.M. (1978). "New Principles for the Conservation of Wild Living Resources". The Journal of Wildlife Management 43(2): Supplement # 59.

LANG, R. and ARMOUR, A. (1977). "The Process of Environmental Assessment: Making it Work for Canada". in Proceedings of a Conference on Environmental Impact Assessment. M. Plewes and J.B.R. Whitney (editors), Institute for Environmental Studies, University of Toronto: Toronto, Report # EE-5.

LOFTUS, K.H., JOHNSON, M.G. and REGIER, H.A. (1978). "Federal-Provincial Strategic Planning for Ontario Fisheries: Management Strategy for the 1980s". Journal of the Fisheries Research Board of Canada, 35: 916-927.

MAQUART, D. (1977). in La revue 2000, 45: 11.

MASON, R.O. (1969). "A Dialectical Approach to Strategic Planning". Management Science, 15(8): 403-415.

MICHAEL, D.N. (1973). On Learning to Plan and Planning to Learn -- The Social Psychology of Changing Toward Future-Responsive Societal Learning. Jossey-Bass, Inc.: San Francisco.

NEW ENGLAND RIVER BASINS COMMISSION. (1975). Report of the Southeastern New England Study -- A Strategy for Balanced Development and Protection of Water and Related Land Resources in Eastern Massachussetts and Rhode Island. Boston, NTIS # PB 252 162.

JOUVENEL, H. de (1977). "Prospective, décision et action". La revue 2000, 40: 42-44.

JULIEN, P.A., LAMONDE, P. and LATOUCHE, D. (1974). La méthode des scénarios -- Une réflexion sur la méthodologie et la théorie de la prospective. Research Group on the Future, University of Quebec: Trois-Rivières.

KAMPSCHROER, B.J. (1976). "Pennsylvania Tries New Water Quality Management Plan". Water and Sewage Works, January: 47-49.

KELLY, B. (1973). "Energy Conservation". Alternatives, 2(4): 20-21.

KRIEGER, M.H. (1971). Social Well-Being and Waste Water Management. Institute of Urban and Regional Development, University of California: Berkeley. Working Paper # 151.

NICKEL, P. and WALLACE, M. (1974). Philosophical Objectives of Resource Policy: The Role of Human Values. Natural Resources Institute, University of Manitoba: Winnipeg.

O.E.C.D. (1976). Science, technologie et maitrise des problèmes complexes. Paris.

O.P.D.Q. (1977). Evolution et orientation du développement et de l'aménagement. L'éditeur officiel du Québec: Québec.

ORTOLANO, L. (1974). "A Process for Federal Water Planning at the Field Level". Water Resources Bulletin, 10(4): 766-778.

ORTOLANO, L. (1978). "Environmental Assessments in Water Resources Planning". Water Supply and Management, 2: 159-176.

OZBEKHAN, H. (1971). "Planning and Human Action". in Hierarchically Organized Systems in Theory and Practice, P.A. Weiss (editor), Hafner Publishing Co.: New York.

PAEHLKE, R.C. (1973). "Decentralization, Environment and Community". Alternatives 3(1): i.

PAUL, R.A. (1972). Planning for Environmental Quality, Phase 1. Department of Administration: Raleigh, North Carolina, NTIS # PB 213 147.

PETERSON, M.A. (1978). Principles and Methodologies of Social Impact Evaluation. Ministère des Richesses naturelles, Direction générale des eaux, Québec.

PETERSON, M.A. (1979). L'efficacité relative des directives émises aux industries en matière d'environnement aquatique québécois. INRS-Eau, Québec.

POTTER, V.R. (1971). Bioethics -- Bridge to the Future. Prentice-Hall, Inc.: Englewood Cliffs, New Jersey.

REGIER, H. (1978). Personal Communication.

REICH, C.A. (1966). "The Law of the Planned Society". Yale Law Journal, 75(8): 1227-1270.

RICKERT, D.A., HINES, W.G. and McKENZIE, S.W. (1976). Methodology for River-Quality Assessment with Application to the Willamette River-Basin, Oregon. Geological Survey Circular 715-M, U.S. Department of the Intervior: Washington, D.C.

RITTEL, H.W.J. and WEBBER, M.M. (1973). "Dilemmas in a General Theory of Planning". Policy Sciences, 4: 155-169.

RUSSELL, C.S. and SPOFFORD, W.O. (1977). "Regional Environmental Quality Management Model". Journal of Environmental Economics and Management, 4: 89-110.

SAARINEN, T.F. (1976). Environmental Planning: Perception and Behavior. Houghton-Mifflin: Boston.

SASSEVILLE, J.L. (1977). L'agression toxique. INRS-Eau: Québec, Scientific Report No 82, 46 p.

SASSEVILLE, J.L., DELISLE, A., DESCOTEAUX, Y., POTVIN, L. and LECLERC, M. (1977). Vers une nouvelle génération de méthodologies d'évaluation des

répercussions environnementales. INRS-Eau: Québec, Scientific Report No 74, 184 p.

SASSEVILLE, J.L. (1978). Strategie pour un contrôle de la qualité des actions humaines. INRS-Eau: Québec, Scientific Report No 106, 99 p.

SASSEVILLE, J.L., MARCEAU, R. and FRECHETTE, F. (1978). "Le processus de gestation des actions humaines". in Au delà d'une simple étude d'impact". J.L. Sasseville, Environmental Evaluation Commission, Quebec Port Extension Project, Quebec.

SHCHEDROVITSKY, G.P. (1977). "Problems in the Development of Planning Activity". General Systems, 22: 3-16.

SIBLEY, M.Q. (1973). "The Relevance of Classical Theory for Economy, Technology and Ecology". Alternatives, 2(2): 14-35.

S.P.E.Q. (1978). L'assainissement des eaux au Québec -- Politique et programme. Comité des politiques d'assainissement, S.P.E.Q.: Québec, Summary Report.

THOMSEN, A.L. (1973). Public Participation in Water and Land Management. New York State Sea Grant Program: Albany, New York, Technical Report # 57.

U.S. ENVIRONMENTAL PROTECTION AGENCY. (1972). An Assessment of Decentralization in EPA. Office of Planning and Management, E.P.A.: Washington, D.C., NTIS # PB 257 639.

VALASKAKIS et al. (1977). La société de conservation: option d'avenir? GAMMA Group, Université de Montréal - McGill University: Montréal.

VAN GIGCH, J.P. (1978). Applied General Systems Theory. Harper & Row, Publishers: New York.

WALKER, W.R. (1974). "Integrated State Land and Water Policy: Complements and Conflicts". in Land-Use Issues -- Proceedings of a Conference. J.P.

Marshall and P.M. Ashton (editors), Cooperative Extension Service, V.P.I.S.U.: Blacksburg, Virginia, Report No G 29.

WEBBER, M.M. (1963). "Comprehensive Planning and Social Responsibility". Journal of the American Institute of Planners, 29: 232-241.

WHITE, G.F. (1966). "Formation and Role of Public Attitudes". in Environmental Quality in a Growing Economy. K.E. Boulding (editor). p. 105-127.