Philippine Journal of Public Administration, Vol. XXVI, No. 1 (January 1982)

Environmental Administration: Systems Approach and Intervention Process Model

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Environmental administration as a relatively new field of public administration still lacks a coherent body of theory, practice, and knowledge. To be responsive to the special demands and complexities of environmental programs, environmental administration needs not only skilled administrators but managers who are able to perceive, span, and integrate all relevant factors in decision-making and program implementation. The three aspects which are deemed vital to the practice of environmental administration are: (1) conceptualization of basic concepts of the environment, changes in values, perceptions, beliefs, attitudes, and behavior; (2) coordination in all directions, vertical/horizontal, and among all levels of government, local/national; and (3) community and citizen participation in environmental and other activities. The systems approach may enable environmental administration to better deal with the intricacies involved and provide a methodology that can overcome many of its conceptual weaknesses. A proposed intervention process model, where environmental administration has an impact on the basic systems and subsystems, and on the pathways linking the systems, justifies such a positive view.

Introduction

The success of environmental protection depends in large measure on the administrative effectiveness of agencies in charge of strategy formulation and implementation of intervention programs. This has been brought out by various writers, including Caldwell, Edmunds and Letey, and in reports of the World Health Organization and the 1972 United Nations Conference on Human Environment, held at Stockholm.[1] However, even to date, administrators of environmental programs can find very little in the literature of direct relevance to their understanding and skills in administering these intervention programs. Moreover, the existing theory and methodology of public administration are not firmly developed and are too poorly defined to be useful to environmental administrators. Environmental administration, which is a relatively new study area in public administration, encompasses an interdisciplinary field of social, cultural,

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[1]Lynton K. Caldwell, "Authority and Responsibility for Environmental Administration," *Annals of American Academy of Political and Social Sciences,* Vol. 398 (1970), pp. 107-115, and "Environmental Quality as an Administrative Problem," *Annals of American Academy of Political and Social Sciences,* Vol. 400 (1972), pp. 103-115.

S. Edmunds and J. Letey, *Environmental Administration* (New York: McGraw-Hill Book Co., 1973), pp. 1-2 and 19-22.

World Health Organization (WHO), "National Environmental Health Programs: Their Planning, Organization and Administration," Report of a WHO Expert Committee, TRS 439, Geneva (1970), pp. 30-37.

United Nations (U.N.) Department of Economic and Social Affairs, "Organization and Administration of Environmental Programs," Publication ST/ESA 16(1974), pp. 12-22.

political, and economic programs that are congruent with the technical, physical, chemical, and biological systems of the natural environment. These interrelated socio-technical programs are systematic in nature in that the relationships of each subsystem must be viewed within an integrated whole. Consequently, new approaches are needed to understand and to administer these complex systems.

Environmental Administration

Pollution, environment, ecology, and the quality of life are the watchwords of the current worldwide concern over the present and future state of the planet Earth. During the past decade, there has been a tremendous upsurge of interest and activities in the field of environment in both the developed and developing societies. Despite all these expressions of grave concern and the initiation of various environment activities, there exists a lag in the theoretical and empirical study of the administration of environmental programs. Although pollution control strategies and new technologies have advanced, the implementation of these programs has been hampered by deficiencies in administrative theory and practice. This is a serious shortcoming because ultimately the state of the environment will be determined to a great extent by administrative processes and the capability and skills of administrators.

The field of environmental administration is a relatively new concept which still lacks a coherent body of theory, practice, and knowledge. Both Caldwell and Henning mention that, although there is a large literature on the organization and administration of public programs, very little directly pertains to the problems of environmental administration.[2] Administrative theory itself has not advanced very far beyond the traditional principles or "rules of thumb" that still guide much of administrative practice. To date, knowledge and practice in the organization and administration of environmental programs have slowly advanced and are still largely based on existing administrative principles which are thought to have common application. Yet, these general principles have little regard for the special demands and complexities of environmental programs.

No doubt program effectiveness depends on the skills of administrators; but environmental administration particularly needs managers with a broad approach and who are able to span and integrate different disciplines. In order to achieve its objectives, environmental program administration must effectively deal with the diversity of the physical, chemical, biological, and technical factors which make up the environment, and with the complexity of the social, cultural, political, economic, and institutional dimensions of man's relations with his environment. With the limited means now at his disposal, the average administrator is simply unable to respond and to cope adequately with these complex natural and man-made forces in the environment.

The Environment and Related Problems

The environment consists of all the physical, chemical, and biological systems of the planet Earth. Ecology includes not

[2]Lynton K. Caldwell, "Organizational and Administrative Aspects of Environmental Problems at Various Levels," U.N. Conference on Human Environment, Stockholm (1972), p. 56.

Daniel H. Henning, *Environmental Policy and Administration* (New York: American Elsevier Publishing Co., Inc., 1974), p. xiii.

only man and all living things but also their relationships with one another and with their surrounding living and nonliving environment. The interrelationship of man and environment through social organizations forms the central link that the system or subsystem of environmental administration attempts to manage. The complex interrelations and interdependencies of the human and nonhuman elements of the environment themselves constitute a general system and sets of subsystems, and thus environmental administration may be viewed as a subsystem which attempts to regulate their interactions and overall impact.

Environmental administration has assumed a role of crucial importance today because of the growing number of programs and projects that have been mounted in response to the concern for environmental quality. Strong pressures have been exerted on government and other institutions to respond to the urgent call to protect the environment. Unfortunately, the response to this challenge to forestall what many scientists and conservationists regard as an impending doom for the planet has been less than adequate. This deficiency itself may be seen in the administration of environmental programs which have been organized in different parts of the world.

The awareness of environmental deterioration and the pressures on government to deal with it more effectively have been generated by the evidence all around us in the form of polluted water and air, among other indicators.[3]

The environment is considered polluted when the physical, chemical, and biological properties of its different components (air, water, soil, food, and the occupational, residential, and recreational environments) are qualitatively and quantitatively changed. This is the consequence of the intentional and unintentional discharge of waste materials, the deliberate use of chemicals, or the dissipation of energy in the form of heat, noise, vibration, or radiation. Pollution, thus, occurs when environmental changes create or are likely to create nuisance or hazards to public health, safety, and welfare, or when they are harmful to domestic, industrial, agricultural, recreational and other legitimate uses of environmental components or to livestock, wild animal, fish, aquatic life, and other biological species.

The uncontrolled discharge of domestic and municipal wastes affects water, soil, and food quality, and this remains the major problem of environmental pollution. The industrialized countries face mainly problems of environmental pollution caused by chemical and physical agents. In many developing countries, there are already limited areas where rapid and uncontrolled urbanization and industrial development are creating pollution problems of a more complex kind, despite the assertion by the development-minded that economic development must be accelerated at all costs now and pollution problems attended to later.

[3]United Nations (U.N.) Conferences have been held over the last few years and have documented the growing degradation of the environment and the concern shared by all nations. These include: (1) U.N. Biosphere Conference, Paris, 1968; (2) U.N. Conference on Human Environment, Founex, Switzerland, 1971; (3) U.N. Conference on Human Environment, Stockholm, Sweden, 1972; (4) U.N. Symposium on Environment and Development Strategies, Cocoyoc, Mexico, 1974; (5) U.N. Conference on Human Settlements, Vancouver, Canada, 1976; (6) U.N. Water Conference; Mar del Plata, Argentina, 1977; (7) U.N. Conference on Desertification, Nairobi, Kenya, 1977.

Despite disastrous experiences of the developed countries, for example, Japan, the United States, and England, the unofficial policy of development at all costs still appears to prevail in many developing countries, and as a consequence, low priority is given to environmental protection programs. Budgetary support for the implementation of urgent programs is limited. In recent years notable examples of this skewed development policy in Asia can be seen in South Korea, Malaysia, and the Philippines. For example, the Director-General of the Philippine National Economic and Development Authority stated in 1972 that development had greater priority than environmental protection.[4] However, there is evidence in the more recent years that a more considered and balanced approach is gaining the attention of governments in these countries and elsewhere.

The ultimate goal of socioeconomic development in developing countries is the raising of the quality of life of the people to a tolerable level. This is more than a matter of gross national product, annual income, or other economic measures, for by its very essence the quality of life implies that environmental quality must itself be tolerable and therefore acceptable. This remains an acute problem in developing countries, which will be magnified as urbanization and industrialization are intensified, unless the necessary attention is given to environmental management.

Special Problems in Environmental Administration

The administration of environmental programs has several distinctive features compared with that of other development sectors. These have been noted briefly in a WHO Report as follows:

(1) nature of the object being managed — the environment;
(2) multidisciplinary nature of the management process — social, cultural, political, economic, and environmental;
(3) public attitudes toward the object being managed which, in conjunction with the preceding features, constitute a conceptual problem;
(4) need to coordinate many different agencies, official, private and voluntary, that are concerned with the environment;
(5) difficulty in placing a value on the objective of a good environment or a good quality of life;
(6) multiplicity of aims, objectives and criteria applied;
(7) long-term horizon between decision and outcome (quality of life) and the uncertainty surrounding decision-making; and
(8) public involvement and citizen participation.[5]

The environment can be an emotional issue; fears and prejudices about it can provoke strong reactions to the introduction of rational or objective management methods. It, therefore, calls for greater sensitivity in administration.

A survey of all the problems and constraints faced by environmental administration would require an extensive digression on organization and administration. A brief survey of problems

[4] *Manila Times* (14 March 1972), p. 16.

[5] WHO, "Evaluation of Environmental Programs," Report of a WHO Scientific Group TRS 528 (1974), pp. 48-50.

and constraints has been presented in two WHO reports.[6] However, it is pertinent to focus attention on three special problems (conceptual, coordination, and community/citizen participation) relating to the environment. These are not unique problems in the area of organization and administration but are highlighted here for their special relevance to environmental programs.

Caldwell reported to the 1972 U.N. Conference on the Human Environment that one of the basic problems in the practice of environmental administration is *conceptual.*[7] Traditional public agencies have never dealt with environmental matters in a comprehensive and holistic manner, although governments have had a long experience in specific aspects of the environment, for example, management of environmental change in programs of mining, agriculture, forestry, transportation, and other economic development activities. However, because of the relative newness of environmental issues and programs, these have not really been fully understood by administrators or by their representatives in government. Thus, the inability to achieve a comprehensive understanding and appreciation of the basic concepts of the environment remains a major obstacle to a successful program. Moreover, the traditional functional and hierarchical structure of public administration is not best suited to deal with the complexities of a holistic approach to the environment. Traditional public administration is not designed for the comprehensive task of environmental protection and seldom possesses the flexibility required to respond to rapidly evolving problems.

Most societies are rapidly developing with new problems and new technology which strain the capabilities of organization and administration designed for less turbulent environments. New techno-economic developments have caused many environmental problems. Operational flexibility, which is the ability of government to reassess priorities, to restructure agencies, and to alter budget allocations, is needed to cope with new environmental problems as fast as they emerge. In this respect, "adhocracy" as an organizational and administrative approach may be needed in many instances to cope with new challenges to the environment. The use of temporary agencies can be effective in dealing with rapidly emerging problems that cannot be handled by bodies structured along bureaucratic lines.

Conceptual difficulties of administrators need to be overcome by a reorientation of their views of the environment, and changes in values, perceptions, beliefs, attitudes, and behaviors.

Within this context, a concept of environmental development is now emerging which deserves elaboration. Such concepts have been advocated by the United Nations Environmental Program and other international agencies, such as the Canadian International Development Agency.[8]

[6]WHO, "Health Aspects of Environmental Pollution Control: Planning and Implementation of Natural Programs," Report of a WHO Expert Committee, TRS 559 (1974), pp. 48-50; "Environmental Quality Planning and Policy in Developing Countries," A Report on an Inter-regional Seminar, Geneva (26 July - 1 August 1977), pp. 6-9.

[7]Lynton K. Caldwell, "Organization and Administrative Aspects of Environmental Problems at Various Levels," A paper of the U.N. Conference on Human Environment, Stockholm (1972), pp. 16-19.

[8]U.N. Environment Program, "Environment and Development," Report of the Executive Director at Meeting of Governing Council, 30 March - 14 April 1976, Nairobi.

Canadian International Development Agency, "Eco-Development, National Development and International Co-operative Policies," Report on Workshop, 13-15 October 1976, Ottawa.

Environmental development encompasses the goal of protecting the environmental resources of the nation and, at the highest level, the resources of the planet Earth. It is consistent with the rational use of resources and the application of technological styles and organizational forms that respect the natural ecological systems and the local socio-cultural patterns. Environmental development is sometimes called eco-development and is also closely akin to the "another development" approach of the Dag Hammarskjöld School.

Concepts of environmental development can help administrators and citizens of a given region to realize the full development potential of the resources endowment and environmental conditions of the region, maximizing the use of indigenous human resources and skills to produce the kind and quality of life to which they aspire without destroying the resource on which sustained development depends. Environmental development thus seeks concrete development strategies capable of making sound ecological use of the resources of a given ecosystem in order to satisfy the basic needs of its inhabitants.

Environmental administration must take into account the new ethics of environmental development, if it is to be effective. In practice, this means the integration of all pertinent factors in decision-making and program implementation. In design, environmental development is possible only through the holistic viewpoints that can be made by the systems approach. On a philosophical level, environmental development makes strong demands on administrators, politicians, and citizens in that ethics and values based on long-term ecological premises are necessary. These ethics and values permeate the concept of long-term preservation of the environment, and the control of technology and man's excesses in his individualistic search for short-term economic gains and the pursuit of a self-indulgent life style. A true community of mankind is needed for the long-term protection and preservation of the planet Earth, as exemplified by the new ethics, values, and attitudes of environmental development.

A second problem of environmental administration concerns program *coordination* which is a special concern because of the nature of the program. A 1970 WHO report expressed this concern.[9] Reorganizing to ensure a comprehensive approach to environmental problems does not necessarily guarantee coordination of programs. The restructuring of environmentally related agencies in a common or interlinked organization is only an initial step in the administration of a complex and comprehensive program. The supra-agency must still be able to effectively coordinate with other agencies that may have programs with an environmental impact. Thus, effective coordination in all directions (vertical/horizontal) and among all levels of government (national and local) remains a major obstacle to successful environmental program administration.

Coordination as a factor in administrative performance will consequently be influenced by the political forces that support and control the program, according to Marlay in his 1974 study of environmental protection in the Philippines.[10] Where political power is

[9]WHO, "National Environmental Health Programs...," pp. 33-34

[10]Ross Marlay, "The Politics of Environmental Protection in the Philippines," Ph.D. thesis, Southern Illinois State University, U.S.A. (1975), p. 626.

concentrated in a single group, responsibility lies more heavily with its official representatives than in countries where political responsibility is dispersed among political parties and national and local institutions. Where centralized planning is practiced, the main responsibility for environmental policies and programs lies with the central planners. When central planning is oriented towards economic development, as in many developing countries, there is always the likelihood that environmental consideration will be given less attention, thereby complicating environmental administration.

Given a high priority to ecological and environmental values, it may be easier and quicker to develop desirable policies in closed societies than in countries where pluralistic consultations must be first effected before actions can be implemented. Although centralized planning may tend to augment errors that are built into development plans, environmental impacts have resulted more often from lack of planning or the absence of coordination between agencies and their planners. Planning, therefore, is an important element of environmental administration, and must be comprehensive, in scope and detail, and coordinated to meet the multifaceted challenges of the environment.

Although the principle of coordination is well-known to all Philippine public administrators, in practice, it has been less successful. The current strategy has been the reorganization of environmental programs, as evidenced by the recent establishment of the Ministry of Human Settlements. To ensure that program coordination is carried out, the organizational arrangements include the establishment of several advisory councils and committees at ministerial levels. In addition, the institutionalizing of the environmental impact assessment procedure in development programs and projects is aimed at bringing about a measue of interagency coordination.

The third special feature of environmental administration is the need to ensure the *participation* of the public and interest groups. Traditional public administration views the public as a clientele service area, complacent, and uncreative. In recent years, the surge of community/citizen participation in environmental and other public activities has swept away this traditional stance and replaced it with the new public administration view that encourages popular participation.[11] But even though it is recognized that community/citizen participation may improve public decision-making, and facilitate the attainment of goals, administrators have not always encouraged or implemented the concept for fear that it would create political conflicts and delay important and urgent development projects. Today's citizens, however, are more articulate, more aware of their rights and, more sensitive to environmental issues; they believe that they can contribute to the attainment of societal goals. In open societies, community/ citizens involvement is no longer simply a luxury or a "good thing." It is recognized as a necessity that administrators cannot disregard without risks. Even in closed societies, citizen participation in the affairs of government is encouraged by group discussion meetings down to the lowest levels.

Mechanisms for popular participation must allow for the education of citizens and the response of administrators. In order to ensure intelligent objective par-

[11] Henning, *op. cit.*, pp. 22-28.

ticipation, the public must understand the nature of the problem, all the possible solutions, and the costs of those solutions. Administrators, on the other hand, must respond to the people and ensure that their participation has an impact. Environmental administration must accordingly be able to deal with the citizenry through public hearings, advisory boards, and workshops. These are challenging approaches, which have reached new dimensions in environmental administration. Alternatively, problems can be expected where these approaches to community/citizen participation have been ignored.

In the Philippines, there has been only slow recognition of the role of public participation in environmental issues. In the early years of Martial Law, this proved to be a difficult area. However, the emphasis on barangay organizations and their role in environmental protection have gained the support of the leadership. In addition, the role of consumer organizations can be expected to lead to greater emphasis on matters of public concern and interest.

Limits of Existing Environmental Administration

Traditional program administration has shown an inability to cope with existing environmental problems, as is evidenced by the environmental deterioration found in most developed and developing societies. Improvements in environmental protection are linked with the general improvement in environmental administration. Even where programs have been well-developed, implementation activities have not adequately responded to the issues. The reasons are threefold: the administrators, the complexity of the contemporary social system, and the present state of administrative theory and practices.

Environmental programs are frequently administered by highly trained technologists who rose from the ranks with minimal training in the administration of simple systems, let alone the complex systems of environmental affairs. The complexity of environmental intervention programs interacts with political, economic, social, and cultural values. Administrators are required to solve problems not only in engineering and technology but in social and political areas as well.

The weakness of environmental administration was reported by Caldwell in his book, *In Defense of Earth,* where he noted:

> National governments and especially their administrative services play definitive roles in managing problems of the human environment. . . . Among many limitations on the ability of a nation to fulfill its commitments . . . administrative inadequacy is one of the most common. . . . Administration of environmental affairs is one of the most difficult areas, demanding inputs of scientific and technical knowledge and skill in planning, organization and administration of complex program that are nowhere common attributes of public administration. The commitment of national governments . . . to the protection and improvement of the human environment has raised the necessity for upgrading public administration standards everywhere.[12]

The Systems Approach

The systems approach is derived from the development of General Systems Theory (GST) that began in the field of biology. A major thrust of GST is the view that living systems are essentially "open systems" as opposed to "closed systems." This was first articulated in a

[12]Lynton K. Caldwell, *In Defense of Earth* (Bloomington: Indiana University Press, 1972), pp. 195-197.

1950 article in *Science* published by the theoretical biologist Ludwig von Bertalanffy.[13] A pioneer in the promotion of an organismic view in biology, he first developed his General Systems Theory in the 1930s. Bertalanffy is credited both with introducing the term "General Systems Theory" and with initiating the intellectual movement for a unified science. The essence of this theory and movement is that systems can more fully explain an interdisciplinary approach to science than the classical approach.

The systems approach embodies the tenets of General Systems Theory and is the application of theory to practice in dealing with dynamic processes, such as evolution, change, adaptation, learning, motivation, and interaction in physical, biological, or social systems. It includes new ways of approaching the so-called "soft" variables, such as values, judgements, beliefs, and sentiments. It is also an approach to a theory of organizations and management; for example, the systems approach permits a new way of thinking about organizations, and considers the basic tendencies and behavior of organizations in terms of such concepts as feedback, open and closed loops, self-control, equilibrium, growth and stability, reproduction, and decay. The systems approach can provide a new method, enabling environmental administration to better deal with the complex interactions of human, social affairs, technology, and ecology.

Applicability of the Systems Approach to Environmental Administration

As a form of social intervention, environmental programs today are in a state of flux throughout most of the world. Traditional approaches are being challenged and new approaches sought in response to fast-emerging problems in the developed and developing societies. The social, cultural, economic, and political trends converging on environmental problems call for a comprehensive approach to the conceptualization, planning, and implementation of intervention programming that differs from the traditional segmented and sectoral approaches. Environmental administration involves not only socio-technical methodologies but is also conducted in a charged atmosphere of politics and economics with undercurrents of social and ethical values. In these mixed and ever changing situations, tendencies can be identified which deter the attainment of environmental goals.

First, administrators, politicians, and people tend to overlook the interactions of the varied environmental forces and hence neglect the intervention programs designed for their control; for example, in the field of environmental pollution control, there are more than 20 distinct categories of topics: water/air pollution, water supply, radiological health, food safety, and others. In some countries, agencies have responsibilities over one or more of these categorical programs and frequently operate in virtual independence and isolation or at cross-purposes with other agencies. Under these conditions, a consolidated intervention program is difficult, ineffective, and costly as well. Alternatives to promote cooperation include coordinating councils or committees composed of interested agency heads.

Many environmental programs do not have the expertise or the desired thrust to coordinate the social and other factors that determine program impact and effectiveness. These social, cultural, economic, and political factors are frequently

[13] Ludwig von Bertalanffy, "The Theory of Open Systems in Physics and Biology," *Science*, Vol. 111 (1950), pp. 23-29.

neglected. As pointed out previously, this is due most probably to the administrators themselves in their education, perceptions, and experience, which tend to concentrate on the scientific and technological aspects with the result that minimal attention is given to the social factors and to the theory and practice of administration itself. Organized efforts are needed to set up environmental programs, and arrangements must be made for communication and coordination among the separate parts. For this reason the systems approach is seen as a logical means to link the diverse sectors. The systems concept is not only concerned with the mechanics of program planning and implementing but it also encompasses the wider context of a way of thinking about socio-technical problems. A comprehensive view must include human values and attitudes toward new environmental ethics.

Development administration, in fact, is seen in this context as encompassing the development of the national economic, social, and political sectors. However, development administration has not been proposed as the integration of these separate sectors in a holistic viewpoint, which would be possible with the systems approach. In actual practice, development administration is confined to the superficial treatment of program integration for short-term planning purposes. When serious decisions are urgently needed through the political and administrative processes, the old values and vested interests of agencies and client groups usually assume paramount importance and reversion to the fragmented approach is a natural outcome, despite all the rhetoric for collaboration, cooperation, and coordination. It is one of the concerns of this paper to emphasize the holistic viewpoint of the systems approach as a means of overcoming the fragmented administration of the varied sectors of national development. The existing linkages within the practice of environmental administration serve as the strong forces capable of achieving a true unity of administration.

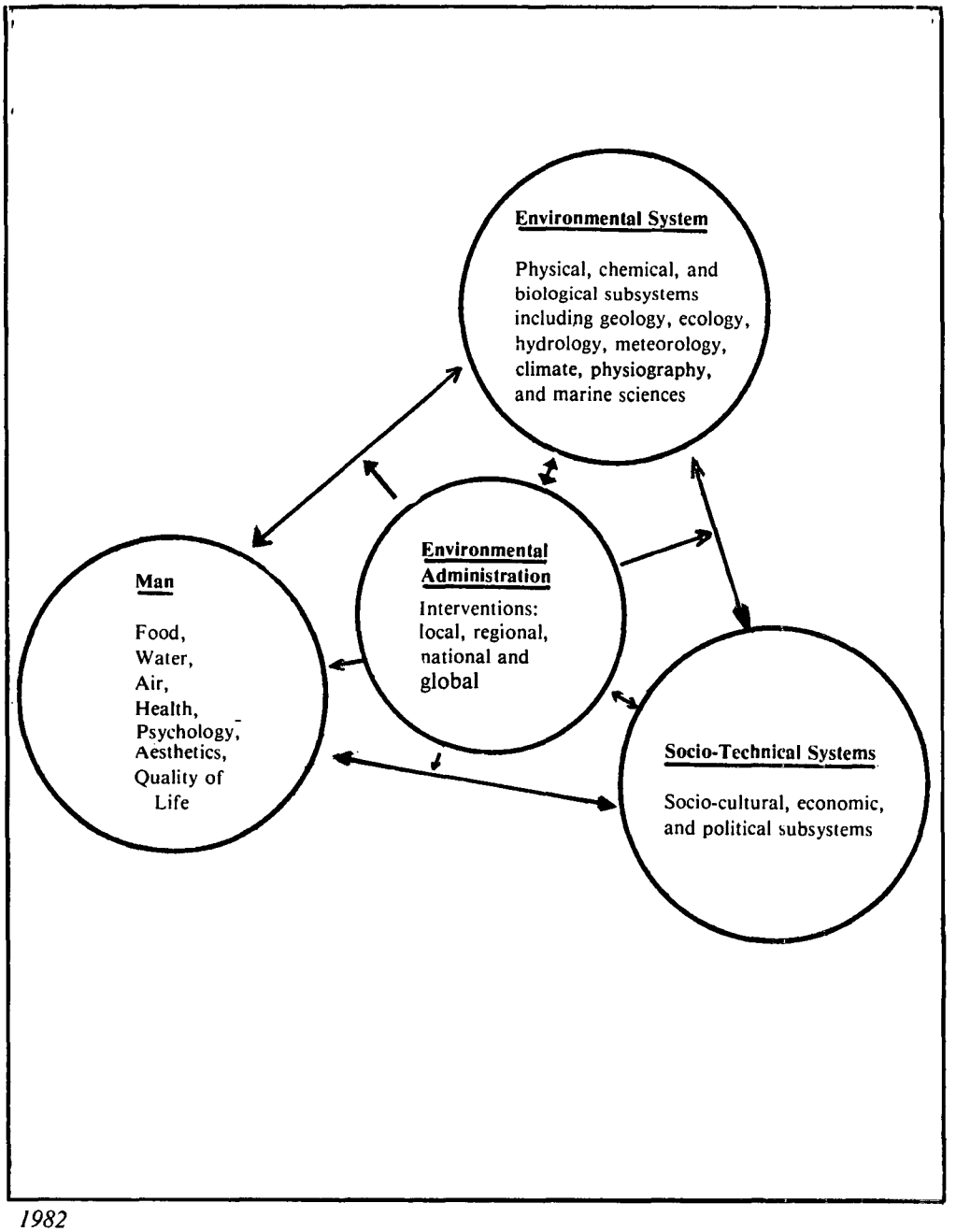
An Environmental Model

The development of a systems model, which would be useful for administrators of environmental programs, will depend on the integration of the various approaches described above. An environmental model is proposed which would elaborate on the basic interactions of man, society, and ecology. The model of subsystems is proposed initially with its broad and general content and, then elaborated in greater detail. Thus, for this initial stage, the general relationships between three basic subsystems are presented in Figure 1, excluding at this stage the environmental administration subsystem at the center.

Some general assertions can be made on the model at this stage in order to expand on the basic triad of man, society, and ecology, and their corresponding interactions and impacts.

The environmental subsystem shown in Figure 1 and the interactions with other subsystem should be elaborated. In the environmental system, the physical, chemical, and biological interactions form the basic dynamics of the ecosystem. These subsystems include the air and water resources, the soil media, and the food sources of the natural ecosystems. They impact upon man and his socio-technical systems and are in turn affected by them through a multitude of pathways. Man is therefore exposed to the stresses of the environment through the air, water, and land media, including the impact of

Figure 1. Environmental Administration Intervention Model



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weather and climate; man and his socio-technical system have an impact on the environment in turn. In general terms, these are the environmental interactions that gave rise to the concern for the ecological state of Earth. The environmental system and the subsystems thereto are the focal points of the primary impact of man and his activities. Models and the systems approach have been employed by scientists to describe the subsystems in mathematical or quantitative terms.

The *socio-technical subsystem* is more difficult to describe since it involves not only the hard technology that is used by man in development but also the social sciences systems. The natural sciences have been comparatively well-developed by modern man through recent times. However, their impact on the environment has only recently been identified as a concern of man and his surroundings.

Many of the social sciences are still in the early stages of development. Economic development, which is associated with national development, has made impressive gains through many concepts and models, although some are conflicting and controversial. Nevertheless, the present theories and practice of economics have provided a basis for refinements in global and national studies and programs. The world of political development similarly has made impressive gains in knowledge and practice, albeit there are conflicting views in theory and experience.

A set of methodological approaches and worldwide practices has been articulated in the social sciences, despite many theoretical and operational deficiencies. The list of the soft sciences (public administration, sociology, psychology, and others) is impressive. However, it is in the social sciences that the systems approach is on less firm ground at this stage of development. There are several good landmarks but the bases for the many theories, methods, and practices in the soft sciences need refinement and development. Nevertheless, even with these recognized weaknesses, it is possible to establish general ideas about the socio-technological subsystem.

The socio-technical subsystem, conceptually analyzed as being composed of the economic, political, and socio-cultural elements, is made up of social organizations, including public and private groups. Within these elements, factors in the socio-technical subsystems have a direct impact on man and have produced stress. Modulation of this stress is sought through social programs, such as welfare aid, attitude changes, and pollution control. This is the area wherein social organizations perform their primary service to man. Noticeably, the socio-technical factors can enhance or endanger man and the environment. These bear directly on man by having an impact on the environment, economy, and even aesthetic. They can have immediate impact (air pollution) or long-range impact (control of water pollution, but all have an impact on man and the environment in various ways.

Man constitutes the third of the basic triangle of subsystems shown in Figure 1 and is indeed the most important, since he is the central theme of the total environmental system. Here the focus is on the immediate health and well-being of man and ultimately his quality of life. Man is a complex system with numerous elements in his immediate environment. However, this can be simplified to the basic interactions of the environment on individuals. There is no need to restate the impact and pathways relating to man as

shown by the linkages with the physical and the socio-technical systems and the environmental system, but some generalized statements can be made on the human system.

The individual is affected not only by nutritional status, education, immunity, whether natural or induced, but also by his continuing exposure to the environment. His psychological and somatic reactions may be stimulated or strengthened, dulled,or atrophied by these environmental experiences. These environmental experiences may give rise to protective behaviors to avoid or reduce the exposure; and the degree of their impact will depend on the individual's tolerance and adaptability.

Environmental impacts may produce feedback in the individual to modify psychological and somatic effects;the environmental exposure may have an impact going beyond psychological and somatic effects and produce genetic effects.The impact on the individual stimulates feedback to the other two basic systems and to the total environment surrounding all three (man, environmental system, and socio-technical system).

Environmental Intervention Program and Model

Effective intervention programs call for detailed knowledge of the complex interactions of the subcomponents in order to deal with them. The strategies of environmental programs should recognize the many complex and interlinked forces which have an impact on the environmental systems so that decisions can be made with the best assurance of success. Furthermore, rational choices are needed to identify the intervention points themselves, so that problems can be controlled or dealt with efficiently and effectively.

The systems approach of environmental relationships can be employed as a basis for cataloguing intervention activities. By reviewing each of the systems and elements thereof, it is possible to systematically explore intervention methods and strategies and to locate effective intervention points for environmental control. The execution of the intervention program then becomes basically an administrative approach.

The comprehensive cataloguing of alternatives and entry points would be exhaustive and would not be meaningful here. However, typical means by which a society and public administrators may be able to control man-environment interactions can be identified. Typical intervention actions may include controlling hazards at their source, foreclosing or altering pathways, creating barriers to exposure, changing human attitudes and behaviors, and modifying tolerances, and treating man himself by medical means for adverse effects.

The Intervention Process Model

The primary objective of environmental administration is to protect man and to preserve the total environment on a long-term basis. This requires intervention programs to modify adverse impacts on the environment, to control the interactions of man and environment, and to produce a dynamic equilibrium of harmony. Taken together, the administration of these intervention programs is the administrative process itself. The basic model is expanded now to show environmental administration in the intervention mode. In this operational mode, environmental administration not

only has an impact on the basic systems and subsystems, but also on the pathways linking the systems. This role of environmental administration is a novel proposal.

In this proposed model, each of the systems is shown in equal size and in a triangle to indicate that there is neither a hierarchy of level nor a priority of interest. Ideally, the system should be in equilibrium and carefully balanced, as a task of environmental administration. This equilibrium is the ideal situation and the ultimate goal. In reality, the system is constantly changing, reflecting the reality of a national system, which in aggregate forms the global system; for example, a developing country at a certain stage of development may chose to emphasize economic growth at the expense of the environment. This may be viewed as a prevailing policy in the Philippines today.

This reality is influenced by the stage of economic and technical development reached by a region or a country, its political life, the socio-cultural milieu, and the ethics and values of its inhabitants. This is the focus of development administration and its course of actions influencing the environmental system and man. The focus of environmental administration is feedback and counteraction between these two systems which in turn have an impact on the socio-technical system. At various stages, the magnitude and importance of each system assumes importance and therefore priority for action.

Environmental administration is basically a process for solving social problems, through the organization of resources and their application to environmental problems. The process could be short with a defined goal, such as the construction of a wastewater treatment plant. It could be an extended program lasting 10-20 years, such as the implementation of a comprehensive basin-wide water quality management plan. In this case, the construction of a wastewater treatment plan is only one point in the total extended process.

From a process point of view, the main phases of environmental administration have been identified in a WHO report as follows:

(1) Defining the substantive environmental issues, including problem and solution analyses, clarifying the problem and evaluating alternatives.

(2) Assessing the impact in societal and technical terms, including assessment of physical, chemical, and biological factors, and the social detriments thereof, such as societal costs, environmental degradation and long-term consumption of non-renewable resources.

(3) Developing public policies, including setting objectives, environmental quality standards, and establishing priorities.

(4) Identifying the criteria by which the environmental impact may be assessed, including social indicators, environmental indices, and diseconomies and resource consumption.

(5) Selection of strategies and developing programs, including technical approaches, planning, programming, and budgeting.

(6) Implementing the intervention program, determining how the program is to be executed, including designing and administering organization, and executing operations by assembling and

organizing program operations.

(7) Developing information processing systems, including environmental monitoring data and information, mathematical models of the physical and ecological environment and feedback mechanism to administrators.

(8) Evaluating the program, including developing methodologies and identifying criteria for evaluation and implementation.[14]

If an environmental intervention program is to be sound and effective, it must be well administered and follow in general the above administrative process. There are several critical points in the above administrative process that were elaborated upon in another WHO report, namely:

(1) *Identifying a problem* is important and setting the point of view from which it is perceived is equally important. Individuals and interest groups may perceive a problem differently and seek different objectives in the same environment.

(2) *Establishing objectives* is an important planning activity. In the case of environmental protection, the ultimate objective can be simply stated as the promotion of complete physical, mental, and social well-being insofar as this can be achieved by environmental control. Intermediate steps toward the ultimate objective based on a time schedule can be decided upon, since an ultimate objective in absolute terms may not be directly translatable into policy formulation or immediate planning.

(3) *Assigning priorities* is an important process since the resources for solving environmental problems are limited in all parts of the world, particularly in the developing countries. Environmental programs have to compete with other national programs, such as those for agricultural expansion, industrial development, education, the military, and social services. Usually, a limited number of programs is selected on a priority basis. In general, the setting of priorities may be based on a series of assessments common to any priority-deciding process.

Priority decisions in environmental programs are not entirely in the hands of public administrators since related groups including politicians, members of advisory committees, professional organizations, the press, and the general public should be kept informed. Their participation should be encouraged to indicate priority needs.

(4) *Policy formulation* in environmental protection must be made in coordination with other social objectives. Further, it must be compatible with the political and administrative framework within which it will be implemented. The formulation of policies should be the result of planning and constant reappraisal as a consequence of changing circumstances. It may be added that public awareness of environmental problem is becoming more evident, and this should be encouraged as it can make a significant contribution to the development of meaningful policies.

(5) *Carefully coordinated planning* in environmental protection is essential for many reasons. There is a lack of space in most human settlements for disposing waste product, whether under the ground, in water,or in the air, without

[14] WHO, "Health Aspects of Environmental Pollution Control: Planning and Implementation of National Program," Report of a WHO Expert Committee, TRS 554, Geneva (1974), pp. 23-32.

infringing upon the health rights or properties of others. Man's ability to disturb or alter the great forces of nature has increased to the point where mistakes or unknown effects may have disastrous and perhaps irreversible consequences. The natural resources of the earth are not inexhaustible. Thus, environmental programs should be planned on a broad scale, aiming at the wholesomeness of the whole environment. To achieve this aim, workers involved in environmental protection need to develop a multidisciplinary approach that goes beyond reliance on the physical-biological sciences, and to provide for collaboration with politicians, public administrators, political scientists, sociologists, economists, educational psychologists, physical planners, lawyers, and others.[15]

Administrative Implications of the Systems Approach

The systems view of the total environment and the administrative process of intervention programs have been presented. The next phase is to examine the implications of the systems approach to administrators in these contexts.

Man-environmental relationship encompasses all of man's socio-technical activities and interventions to protect the environment and involves a vast multitude of different actions to be undertaken by government and administered by public agencies. Intervention possibilities extend far beyond the traditional view of a sectoral program and are coterminous with a wide scope of social organizations and activities. The interlinkages of the vast political, socio-cultural, and economic sectors are made possible by the systems approach. Administrators should be aware of this new administrative accessory for improving decision-making amidst the complexities of societal activities.

In varying degrees, the successful implementation of environmental intervention programs calls for not only conventional intra-agency cooperation, but also horizontal inter-agency collaboration, coordination, and cooperation across all sectors of the national development program. In the vertical dimension, national, provincial, intercommunity, and block-level coordination and cooperation are needed. The points of intervention to ensure success can be identified by the systems approach in any particular environmental problem or in the comprehensive overview of the environment. In this approach, environmental administrators are responsible for influencing the policy decisions, selecting strategies and programs of other agencies so as to minimize the impact on the environment.

Administrators should be made aware by the systems approach of the interest of special groups as well as public advocates of citizen participation. The right of a citizen to an environment conducive to his welfare and well-being is a just and legitimate demand. The points of violation of the environment can be identified by the systems approach, which encompasses a feedback mechanism for information, communication, and correction.

The ability of environmental administrators to effectively implement intervention programs would be improved by using the systems approach to:

(1) conduct a comprehensive analysis of environmental problems and to

[15] WHO, "National Environmental Health Programs. . .," pp. 11-28.

evaluate alternative solutions;

(2) collect adequate data and information on environmental problems and intervention programs to improve decision-making;

(3) link fragmented environmental activities in comprehensive programs within agencies as well as with other agencies;

(4) evaluate and influence other sectors of government regarding the environmental impact of existing and proposed programs;

(5) develop a network of cooperation among all levels of government and communities for effective program coordination;

(6) communicate with and influence political and economic decision-makers; and

(7) change social values, attitudes, and behaviors of significance to environmental protection.

The above are ideal objectives for environmental administrators, which can be attained through the more effective use of existing administrative methodologies, augmented by the capabilities that can be provided by the systems approach. It is the exclusiveness and peculiarity of environmental administration that sets it apart from "other" forms of administration, leading to the application of the systems approach as a methodology for management.

Conclusion

The special needs of environmental administration in relation to the shortcomings of contemporary public administration theory and practice were presented. Environmental administration has been discussed as a relatively new and developing field of public administration, involving many complex and interrelated factors, on which current theory and practice have provided only limited guidance to program administrators.

It is stated that environmental administration has special characteristics which set it apart from contemporary public administration. The systems approach may provide a methodology that can overcome many of the conceptual weaknesses in environmental administration.

The presentation proposed a theoretical framework for environmental administration in the context of decision-making in an environmental model, composed of the subsystems of human, environmental, and socio-technical elements. In this model, environmental administration is proposed as central and crucial to the management of intervention programs and projects.

The environmental administration processes in this intervention model are described to provide a basis for an operational framework to guide environmental administrators. This framework can form the basis for administrators to become acquainted with the many complex environmental issues and can also facilitate an understanding of the interlinkages of subsystems, thereby enhancing decision-making in environmental administration.

The application of the systems approach in decision-making in environmental administration is proposed as an innovative methodology which by interlinking important subsystems provides the holistic view necessary for solving complex environmental problems. Since evaluation takes an integrated view, in this approach the decision process can rest with greater assurance of successful outcomes. In this respect, the systems ap-

proach may be seen as a new paradigm relevant to environmental administration.

Environmental administration as a relatively new field of public administration has yet to be fully developed in practice. The future is promising but will be demanding because of the complex issues involved. This will be particularly true in developing countries as their economic development programs are accelerated to the point where the environment would be subjected to heavy stresses. The attainment of a quality of life to satisfy the needs of the citizenry will ultimately constitute a challenge to environmental administration.