Environmental information: an approach to pollution control in Brazil

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ENVIRONMENTAL INFORMATION
An Approach to Pollution Control in Brazil

By
Anna da Soledade Vieira, MLS

A doctoral thesis
Submitted in partial fulfilment of the requirements for the award of Doctor of Philosophy of the Loughborough University of Technology

May 1980

Supervisor: Professor P. Havard-Williams, M.A., F.L.A.I.
Department of Library and Information Studies

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'Be praised, my Lord, in all your creatures!'  
(From: Lauds of the Creatures, by St. Francis)

'Proibido escalar. Proibido sentir  
o ar de liberdade destes cimos,  
proibido viver a selvagem intimidade destas pedras  
que se vão desfazendo em forma de dinheiro.  
Esta serra tem dono. Não mais a natureza  
a governa. Desfaz-se, com o minério,  
uma antiga aliança, um rito da cidade.'  
(From: Triste Horizonte, by Carlos Drummond de Andrade)
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The interconnection of environmental pollution and socioeconomic development is discussed, taking information as the starting point. Information in this field has been developed, and the ensuing problems considered, in the international forum by United Nations Agencies and Conferences, and at a national level by the Brazilian Federal Government. The main problems relating to the pollution of the Brazilian environment are introduced, and Governmental policy - internal and external - is shown on the national plane to be somewhat uncoordinated, and on the international plane to be rather resistant to external pressures. This limits both the development of a national environmental information system, and the participation of Brazil in the international exchange of information and ideas.

Environmental information is focused at the international level through UNEP's systems, and the Brazilian situation is presented comprehensively through the data collected in sixty-two environmental agencies. These agencies were surveyed with the twofold objective of:

a. analysing the generation of information and the pattern of its use by the Brazilian environmental agencies in their decision-making process, and
b. investigating how the variables of region and task influence the pattern of information use by environmental managers.

The analysis has been based mainly on the interviews conducted with the managers in charge of environmental pollution control in Brazil, and involved the following steps:

a. the identification of managerial functions and tasks in the field of environmental pollution control;

b. the identification of information needs related to each task;

c. the analysis of regional characteristics related to tasks and information needs;

d. the analysis of both regional and task characteristics related to the sources of information used by the managers.

Some alternative solutions towards an environmental information policy are proposed, taking into account managerial information needs, information units already existing with greater potential for contributing to this field and the national and regional political background.
1. MAPPING THE FIELD

1.1 THE SUBJECT RANGE

It is only recently that man has shown any concern for the quality of his environment. For thousands of years he has been quite happy to use natural resources without any thought for the effect he was having upon his world.

With the establishment of the modern forms of civil government, official programmes came into being which considered the environment only vaguely as part of public health function of administration and legislation, providing for water supply, waste collection and disposal, housing, sanitation and vector control. And even these were considered and provided for in a discrete manner, as independent health services.

From the beginning of the 1960's the protection of the physical environment became an important issue in government programmes, in scientific literature and in discussions of ordinary people all around the world, often in a very emotional tone. However, it was only in the 1970's that environmental control, received serious and balanced consideration as a subject in its own right.
Today surveillance, monitoring and control are very comprehensive in the developed world and include many different aspects of both physical and human environment, such as: public health and sanitation, housing, leisure, population growth, pollution, energy, natural resources and land use. Nevertheless the scope of government actions can vary according to the economic condition and technological development of the country to cope with the complex duty of balancing consumption and conservation, industrial development and clean environment.

In this present work, the subject has been considered from the particular point of view of information for the control of pollution in Brazil. This topic brings together two of the most challenging problems for modern society: socioeconomic development and environmental pollution, once the latter is presented as a by-product of the two extremes in the scale of development and backwardness.

The way in which the notion of development has been used in this thesis makes no distinction between the advanced Western capitalist countries and the Eastern European communist States. Altogether they are indistinguishably called hereafter developed or advanced countries, in contrast with the other group hereafter denominated Third World, or developing, underdeveloped, less developed or backward countries. The focus
throughout has been on the environmental consequences of changes in level of technology and wealth.

Both socioeconomic development and environmental pollution are related to the question of quality of life, often an elusive concept, as it relates to the level of expectation of the individual and the group; and it can vary from urban to rural life, from one culture to the next.

H. Blumenfeld puts forward a generalisation which defines a good environment as one which produces healthy, happy, wise, and good men and women (1). As a common denominator it could also be said that the essence of the quality of life concept, as far as environmental planning is concerned, lies in ensuring humane living conditions. This is the point where development meets the environment either to improve or to lower the desired living standards.

According to R. Easterlin, modern economic growth, or development, may be defined as a rapid and sustained rise in real output in the technological, economic, and demographic characteristics of a society (2). As far as the positive side of it is concerned, the basic consequences of this rise are reflected in the well-being of the individual, that is in the improvement of his condition, employment and leisure, altogether important facets of the human environment.
On the other hand, the continuous economic growth of nations, as measured by their rising gross national product - GNP - and increasing industrialisation, has been blamed as the cause of the deterioration of the environment by the critics from the developed countries. These authors state that all nations should consider new approaches either by insisting in zero growth (3); or using alternative technologies which could lead the development back to a 'beautiful smallness' (4), or by shifting from expansion to a state of economic equilibrium (5).

The deterioration of the physical environment is in itself partly caused by pollution, which is defined by the Chambers Dictionary of Science and Technology as:

any environmental state or manifestation which is harmful or unpleasant to life, resulting from man's failure to achieve or maintain control over the chemical, physical or biological consequences or side-effects of his scientific, industrial and social habits (6).

Pollution can be therefore a by-product of either a non-appropriate technology, or a wasteful pattern of consumption or bad sanitary conditions - all three a question of socioeconomic development.

The present study focuses on Brazil as a representative of developing countries because it seems that the international scientific community has an increasing interest in Brazilian ecology and in Brazilian efforts
being made towards conservation. Also there has not yet been published any comprehensive analysis of the most governmental or other environmental system from the viewpoint of the role of information.

Throughout the following chapters pollution will be focused in terms of the information needs of institutional management in Brazil. Thus the analysis will take into account some basic characteristics of Brazilian society and economy likely to explain the existing types and levels of pollution in the country. One of these characteristics is the duality pertaining to all developing countries - a complex situation where the economic backwardness of an agricultural stage of development coexists with the economic advance of industrialisation.

Because of this dual situation, two basic approaches will be taken. One of them will consider the consequences of industrialisation and technology when the protection of the environment is not a priority, meant pollution and overexploitation of the natural resources. To a lesser extent it happens in developing countries, but it is principally a problem of developed nations.

On the other hand the human aspect of the problem is presented and pollution is introduced as a by-product of poverty in the developing countries, and represented mainly by poor sanitary conditions.
Arising from the controversy amongst poor and wealthy nations about development, the preservation of the environment, the UN brought onto the scene a new concept - ecodevelopment - meaning the point of equilibrium between socioeconomic development and environmental conservation. These parallel notions taken together respect the right every nation has to accelerate its own development and at the same time assimilate the concern for a clean, healthy environment.

Because it represents an ideal balance between mankind and nature, and it is intended to diminish the inequalities among nations, ecodevelopment has been adopted as the ideology guiding the present work and influencing the solutions presented towards an environmental information policy in Brazil. In choosing such a position, the author expresses her belief in a future world where nature will be respected, nations may coexist peacefully, and individuals can live as real human beings.

1.2 RESEARCH METHODOLOGY

The research core is finding out the information needed, used, and generated by the Brazilian Environmental Agencies in their decision-making process, and investigating how certain variables of region and task influence the pattern of information use.
Two hypotheses are formulated:

1. there is a constant relationship between managerial tasks performed in the area of environmental pollution control and information needs;

2. the degree of complexity of managerial tasks is dependent on the socioeconomic level of any given region and, consequently, there are different levels of information need.

Testing the hypotheses involved the following steps:

- identification of the managerial functions and tasks in the field of environment;
- identification of the information needs related to each task;
- analysis of regional characteristics related to tasks and information needs;
- analysis of both regional and task characteristics related to the sources of information used by managers.

From over a hundred institutions initially contacted, sixty-two have been selected as those government agencies acting to prevent and eliminate pollution in Brazil. They include three types of organisations:

a. environmental agencies, which have the power to make environmental policy and implement the law and its
sanctions against the individual or enterprise polluting the atmosphere, the water or the soil. Typical examples of this kind of organisation are the Fundação Estadual de Engenharia e Meio Ambiente (Foundation of Environmental Engineering) - FEEMA - in Rio de Janeiro, and Companhia de Tecnologia e Saneamento Ambiental (Company of Environmental Technology and Sanitation) - CETESB - in São Paulo. Some states - Acre, Amazonas, Ceará, Espírito Santo, Mato Grosso, Maranhão, Paraíba and Piauí - did not have an environmental agency at the time the data were collected, and so its duties were fulfilled by the existing sewage and water control institution. Two bodies of the Ministério da Marinha (Ministry of Navy) have also been included because marine pollution is under the responsibility of that authority. Air and noise pollution caused by air traffic is controlled by the Ministério da Aviação (Air Ministry); this is why one of its bodies has been included. The Comissão Nacional de Energia Nuclear (National Committee of Nuclear Energy) - CNEN - has also been added because it is responsible for controlling the use of radioactivity in the country;

b. sewage and water authorities, which are in charge of water supply and sewage disposal in urban areas. The Companhia Estadual de Águas e Esgotos (Company
of Water and Sewage Works) - CEDAE - in São Paulo, and the Companhia de Saneamento Básico do Estado de São Paulo (Company of Basic Sanitation of the State of São Paulo) - SABESP - in São Paulo are two examples of the sewage and water authorities that exist in all states of Brazil. It has been decided to include all these twenty-three authorities and not limit the research to the eight authorities that have a remit to look after both sanitation works and pollution control. This is justified because in a developing country sanitation is an important aspect of the environmental pollution control;

c. some organisations related to fringe aspects of the environmental activity, such as:

- regional development, as for instance the Superintendência do Desenvolvimento do Nordeste (Superintendency of the Development of the Northeast) - SUDENE - for the Northeast region;

- policies related to urban development, that is the case of the Comissão Nacional de Regiões Metropolitanas e Política Urbana (National Committee of Metropolitan Regions and Urban Policy) - CNPU;

- foreign policy of the country in environmental matters, represented by the specific sector of
the Ministério das Relações Exteriores (Ministry of Foreign Affairs), the Divisão das Nações Unidas (Division of the United Nations Affairs) - DNU.

In the present work, when these three types of organisation happen to be referred to globally, they will be called Brazilian environmental agencies, or environmental agencies.

Brazilian environmental agencies were contacted personally: this led to interviews with at least one manager working in either the policy making or the technological side of environmental control. The only exception was the agency of the State of Acre. For a number of reasons this State was not contacted in the same way; so the generic data were provided by the Secretaria Especial do Meio Ambiente (Secretariat of the Environment) - SEMA - the central body in charge of the national coordination of environmental policies and actions of the government.

The following methods were used:

. direct interviewing took place with managers working at Brazilian environmental agencies. Then data were collected in order to describe the institutions, point out the environmental problems of each region, and indicate government actions to remedy them.
The decision-making process was also focused upon during interviews and related to the need and availability of information for managers;

- the analysis of institutional files and documents was undertaken where allowed, in order to trace the interrelations among the institutions and to find out about environmental policies;

- participative observation was used to check some points made in the interviews, where it was considered necessary;

- Brazilian environmental legislation, both federal and state, was analysed;

- newspaper-cuttings on environmental events in Brazil have been collected. For this purpose, Lux Jornal, a kind of SDI news-cutting service existing in Brazil, has been subscribed to from July 1977 to June 1978, and from the huge amount of material received a random sample was taken, represented by one week per month, totalising 1668 news cuttings. The items have been analysed and indexed, to allow for checking against the interviews.

Two basic approaches have been investigated for the review of the subject background of this work: either bibliographic or descriptive. The first approach would focus the sources and result into a literature review, a quite traditional feature of academic thesis.
The second one would focus on the subject itself and present the historical view and socioeconomic interrelations of environmental pollution and development-underdevelopment. The second option has been adopted because of the following reasons:

- the work is directed to the information community rather than to environmental scientists, and librarians are not necessarily experts in the subject;

- the knowledge of the subject structure of the literature, as viewed in the present context, is essential for an understanding of the research core and conclusions, as applied to Brazilian conditions.

- the description is basically an interpretation of the literature, and therefore it satisfies to some extent the expectations of the academic community by exhibiting a basic bibliography on the subject. It is expected that the sources presented all through the present work might be a valuable introduction for librarians interested in this subject.
REFERENCES


2.1 HISTORICAL BACKGROUND

R. Dubos (1) and J. Dorst (2) have traced the evolution of environmental disturbance from early time. According to those authors, man's impact on nature began with his appearance on Earth, as he had to hunt and fish for his survival. But the historical roots of environmental pollution may be drawn from 8,000 years ago, when man became a shepherd and started using fire to make open space for grazing. The use of such a powerful implement intensified 5,000 years ago, when he adopted an agricultural economy and fire was the main device to clear the ground and transform forests into arable land.

Some of the practices introduced by the transformation of man as a farmer are still present today, such as the use of fire, shifting cultivation, monoculture and misuse of fertilisers and pesticides. Many negative results are connected with this traditional agriculture. Thus, soil erosion and impoverishment, deterioration of the atmospheric air, and climatological changes have been the consequences of burning forests and fields. Inadequate or excessive use of fertilizers has caused both the exhaustion of soil and the eutrophication of
fresh waters. The massive use of pesticides has been characterised by serious ecologic hazards with additional consequences for the future as it interferes with the life cycle.

Monoculture has invariably resulted in the exhaustion of soil and the multiplication of pests, as it creates favourable conditions for them.

Nevertheless, it is only after the Industrial Revolution, which began in Europe by the end of the eighteenth century, that pollution became an actual problem, demanding the intervention of the State in the form of governmental agencies deriving authority from legislation. Technological and social changes, consequential on this economic movement resulted in new roles to be played by man in society, and in demands for a social structure suitable for urban nuclei, besides uncovering the appalling condition of the population's general health. Pollution generated by the new technology combined with malnutrition, poor sanitation and lack of urban infrastructure. Such a negative combination led to a savage deterioration in the development.
2.2 PHYSICAL SOURCES OF POLLUTION

Time has passed, science and technology matured, but it seems that the basic environmental pollution problems are still the same; only their seriousness varies geographically according to the level of development of each region.

The problems can be assembled into four groups:

1. Fresh water pollution is still the most worldwide problem, caused by domestic sewage, industrial disposal and agricultural wastes;

2. Marine pollution resulting from ship wastes, industrial disposal and domestic sewage;

3. Air pollution caused by industrial effluents, and burning of fuels (cars, domestic use and agriculture);

4. Land pollution by industrial, agricultural and domestic disposal.

During the last three decades man has been threatened by a new type of pollution risk - radioactivity - which can affect air, water (fresh and marine) and soil, and contaminate all kinds of life on earth. The contamination may be caused by atomic explosion, reactor cooling processes and waste disposal, as discussed by A. Weinberg (3) and P. Lebreton (4).
A parallel aspect is socio-political and relates to:

- the autocratic position which governments usually take about the development of nuclear technology within their own territory, denying to public the right to information and participation in the main decisions, even when the matter is concerned to peaceful uses of nuclear energy;

- at the international level, political disputes lead governments to divert funds from socio-economic programmes to defence, in order to win the armament race.

These points make layman suspicious of nuclear progress, and motivate him to manifest his concern and annoyance about the increasing devotion of both science and governments to the use of radioactivity sources.

On the other side of the argument, there are those who believe that nuclear technology carries only a potential risk and should be exploited now, in order to provide benefits for mankind in engineering, power generation and medicine, for example.

The energy crisis affecting the world since the beginning of this decade has motivated research on safe ways of exploring nuclear energy for consumption. J. Saglio, for instance, defends the use of radioactivity sources for this purpose, and compares the environmental impact of implementation of nuclear power plants to
the conventional ways of energy generation, and concludes that the nature of risks is the same, only the degree varies (5).

An extremely important aspect related to all environmental pollutants - some of these by-products of development - is that society should have the right to choose its own destiny. And, in order to be in condition to exercise this right, everybody must have at least health, education and freedom, some basic components of the quality of life, which quite often developing countries fail to offer their population. It suggests that some conflicts in society could be at the root of environmental pollution.

2.3 NON-PHYSICAL FACTORS CONTRIBUTING TO POLLUTION

Notwithstanding the importance of controlling the agents of all previously mentioned nuisances, the genesis of environmental pollution lies deeper, beyond the physical sources, and can be attributed to political, technological and social factors within a specific country.
2.3.1 Political Factors

The main determinant of environmental affairs is political. It reflects the ideology of the government of a specific country and the values (moral, religious and philosophical) of a particular culture. To start with, the duality 'Capitalism-Socialism' may have differential content as related to the environment. Whilst in a capitalist society based on market economy, emphasis is on mass consumption, private property and the pursuit of individual profit, in a socialist economy, based in central planning, the aim is the building up of a common wealth shared equally by all citizens. Depending on which of these ideologies is adopted by the government, the consequences upon the environment may vary. These may be found on the overexploitation of both man and nature in a capitalist country, once they are seen as resource to be used in order to produce money for the highest layer in the society. On the other hand it may be found a tendency to conserve natural resources in a socialist country, as part of the concept of common property owned and centrally administered by the State with public participation in both the work and the benefits. This kind of orientation may lead citizens to care for the environment in order to share its benefits and may lead the government to be more responsible, as it is
the legal possessor and only administrator of the estate. The concern for nature as a socialist feature has been expressed by F. Engels in his Introduction to Dialectics of Nature and Part Played by Labour in Transition from Ape to Man, where he allerts mankind to the dangers of interfering with the traditional course of nature in order to increase production in the short term (6).

It could be argued that this interrelation exists only in theory, but that in the practical plane the results are not as well defined or predetermined solely by the political ideology. They would also depend on the administrative and political structure of the nation, the strategic goals at that given moment, and on the availability of local information within the central government. Any of those conditions could lead either to a capitalist government protecting the environment, or to the socialist government despoiling it.

However, as far as natural resources management is concerned, T. dos Santos understands the idea of rationality as contingent to the social system and sees waste as an integral part of the capitalist world (7).
A critical analysis of Capitalism and Socialism as they affect the environment has been written by H. Stretton. He states that the Left loses prestige in the eyes of the people because most governmental actions, both in safeguarding natural resources and in cleaning the polluted environment, are detrimental to the lower class because it is associated to cost increase and scarcity of some natural commodities. He then suggests that the conservationist movement is Right-wing and benefits basically the upper-class (8).

Going beyond the politico-economic ideology professed by any government, two other determinants could also be considered among the political factors which provide the framework for the value ascribed to nature by man. They are the religious and philosophical doctrines characteristic of a specific culture. J. Dorst (2) and White Jr. (9) point out the contrast between Eastern and Western thought in what it is of concern to man-nature relationship. The same ideas are shared by J. Le Groff, who shows the contrast between Christian Europe and Moslem Eastern cultures (10). Christianity preaches that God created everything and, at the last, he created man in his own image. He allowed man to name all other creatures, thus revealing his desire to settle man at the top of creation, as the master and consumer of nature, which
has been created only for mankind's pleasure and benefit, as stated in *Genesis*:

have dominion over the fish of the sea, and over the birds of the air, and over every living thing, that moves upon the earth (11).

Animism was a common belief in Antiquity and it is still today among primitive tribes. However, history has shown for centuries that whenever Christian missionaries meet native groups, with their own pagan religion centred in nature, they struggle to shift this belief into the traditional anthropocentric Christian doctrine. It is possible that, once man has abandoned this special feeling for nature, he feels himself freed to deploy the environment if he wishes it, because he sees it merely as something destituted of spirit:

Christianity had God, man and nature reconciled only briefly, from 1150 to 1300, under the mediaeval scholastic doctrine. Saint Francis may be mentioned as a representative of this period. He tried to eliminate the dualism of man and nature, to restore the concept of soul to non-human living beings and to reestablish equality among all creatures. In the Franciscan doctrine man and the animals are brothers, rather than master and servants (9). Recently, Pope John Paul II included the environment as a topic in his first
encyclical letter *Redemptor Hominis*, warning man not to destroy nature through pollution and military weapons (12).

Saint Francis' ideas share a common basis with the oriental doctrines of Buddhism, Hinduism and Taoism, which consider nature and all living beings proceeding from God whose spirit they share.

Eastern religions and philosophies are a unified body of doctrines, which lead people to think, contemplate and achieve integration with the spirit of nature. On the other hand, Western religions remain apart from the schools of philosophy, are based on the concept of morality and tend to encourage people to detach themselves from the physical world, as an ideal of Christian perfection.

However, political ideology, philosophy and religion should be understood only as indicators of tendencies towards a certain pattern of behaviour of both government and people within a certain culture in relation to the environment. Although these considerations cannot be taken dogmatically, however environmental concern is more likely to exist either under a policy which leads both government and people to share the responsibility for the environment, or within a culture whose values make man and nature allies in the issue of high quality of life.
2.3.2 Technological Factors

Science and technology, as conceived today, are a Western achievement. According to L. White Jr., science began as a development of natural theology when, in the 13th century, man started observing and analysing nature in an effort to understand God's mind by discovering how his creation operated (9).

From the 18th century, scientific knowledge became progressively more independent from theology. On the other hand, technology as an empirical method preceded science and still represents man's dominance over nature. Except for the chemical industry which used scientific principles in the 18th century, it was only by the end of last century that science and technology got together. From the World War I this link got stronger and permanent for better or worse, depending on man's decision, so that the same discovery can be used either for the benefit of mankind or for its perpetual harassment and final extinction.

As far as the environment is concerned, technology has been blamed both for inadequacy and for generating an over-dependence on natural resources. Under technological inadequacy has been included the use of old-fashioned equipment and processes, the adoption of unsuitable processes to a specific environment and the super-efficiency of science and technology.
The use of old-fashioned processes and equipment is a frequent threat to the environment in the countries of the Third World. It happens either because they do not have knowledge and means enough to develop their own technology, or because they are politically and economically subjugated by the developed countries. The sale by rich to poor countries of old fashioned technology, leading to pollution, is an everyday event. It is carried out under the label of 'aid', and with the excuse that the environment of the developing countries has a greater capacity to absorb pollution. An example of such transfer of technology is proposed by the Commission of the European Communities in its programme for 1977-81 (13).

For I. Illich any technology transferred from developed nations to the Third World is inadequate and could produce irreversible despair, because the plows of the rich can do as much harm as their swords (14), as they violate the physical environment, affect the social structure and change the cultural values.

Technology has been described as unsuitable for both man and his environment, as it generates an inhuman
atmosphere and violates nature. E. Schumacher says:

Technology recognises no self-limiting principle - in terms, for instance, of size, speed, or violence. It therefore does not possess the virtues of being self-balancing, self-adjusting, and self-cleansing. In the subtle system of nature, technology, and in particular the super-technology of the modern world, acts like a foreign body, and there are now numerous signs of rejection (15).

Then, he presents a proposal for a technology with a human face, softer to both man and nature. His basic concern is related to the developing countries which have been using imported technology unsuitable to their own social and physical environment.

However, developing countries are very suspicious of this movement for alternative technologies, fearing it is a new device to keep them backward. The answer presented by them to E. Schumacher is 'small is beautiful but large is powerful'. This is the problem facing the developing countries: how to become powerful and keep beautiful.

Blaming the superefficiency of technology is to a certain extent a bizarre position, but it has been actually proclaimed as a cause of pollution. Its main negative effects on the environment have been criticised by individuals and groups, as for instance the defenders of alternative technologies and some conservationists.
According to the critics, these effects are:

- technology sustains economic growth which is in itself undesirable, because it creates conditions likely to cause stress in the environment through production and consumption and because it is insane to try for continuous growth in a finite world (16);

- science and technology favour unwanted population increase, as they improve health and sanitary condition;

- the side-effects are inseparable from new technology, and many of them are unpredicted and sometimes even unpredictable, especially their social side-effects (17);

- technology destroys human values and creates weapons for men to kill each other and ruin the environment;

- technology is a single minded phenomenon whose aim is development at any price.

All these concerns suggest that the post-war society has shifted from the technological myth to a mistrust and fear of science and technology. It is now a common belief that governments all over the world have been using science and technology as a political power to dominate one anothers, either peacefully or through wars.
Within the country that has taken this technocratic approach, the situation could tend to an unbalanced distribution of resources between the technological and the social needs of the nation.

On the international scene, such an approach has led wealthy countries to the development of new powerful weapons - industrial and genetic - likely to exterminate life. In parallel these wealthy countries have also run some 'development programmes', which include social, medical and technological assistance, like the Point Four created by the United States. But these programmes have been attacked for using both the population and the environment of poor countries as guinea pigs to experiment new drugs and processes, besides exploiting their natural resources. Military 'aid' is another feature of the politico-economic domination of backward countries, involving bad ecological consequences, waste of resources and loss of the freedom for citizens in their own countries.

A defence of technology from the point of view of a developed country has been made by M. Kranzberg, who points out the positive influence of it in all areas of human activity (18).

All these arguments show that development in all its facets is at the root of the environmental problem, linking together the political, technological and social factors of its disturbance.
This conclusion is related to C. Quingley's idea of conceiving the environmental crisis as a socio-political problem rather than technological. According to him, technology itself cannot be blamed for the environmental crisis; the ecologically disruptive directions it sometimes takes is rather a symptom that society's pattern of belief, values and assumptions need to be reformed than a cause of the disorganisation (19).

2.3.3 Social Factors

The core of this matter is deeply related to the distribution of wealth and world growth, the latter being considered in terms of both population and GNP increase.

The explosion of world population has been a constant theme in environmental literature and a concern for the international organisations dealing with social issues.

Some publications have a very pessimistic tone, as in Population Bomb, by P. Ehrlich (20), Too Many, by G. Borgstrom (21), Malthus's classical Essay on the Principle of Population (22), and Famine - 1973!, by W. Paddock and P. Paddock (23). They all express their worries about the available resources in relation to the growing population.
According to Ehrlich's estimates, reaching the four billions in the late seventies, the world population is expected to double in thirty-five years, if the rate of increase of 2% shown in the last years remains constant (24).

Some other authors take a more optimistic view, and believe in science, technology and economic development as the solution for world's problems. It is worth mentioning R. Taagepera's model, which contrasts with the bulk of the literature by relating population with technological advancement (25). Yet on population, the Proceedings of the 8th Annual Symposium of the Eugenics Society present a reasoned and balanced discussion of the subject (26).

The general concern about population, as related to the environment, is that it will increase the consumption, and exploitation of natural resources, the production of waste and will result in greater demand upon a limited physical space. On top of this, it has been observed that the rate of population increase is higher in the developing countries for a number of possible reasons. Either they do not have any family planning programmes, or because the health service is inefficient, or because individuals themselves are not able to plan their family's size as a consequence of lack of both knowledge and resource. It is also true that in
many agricultural societies parents still regard their children as a labour force. However a modern view of the problem presents demographic growth as an inverse function of the socioeconomic level of the population.

Having in mind the demographic situation of developing countries, T. Vittachi, chief of the Public Information Division at the United Nations Fund for Population Activities, sees population growth, within a broad socioeconomic context, as a multiplier and intensifier of problems rather than the cause of them, and recommends development as the key to population problems (27).

Yet, in the case of developing countries, the population explosion - that might not be a problem in itself - combines with the lack of technology for proper use of the environment, and results into malnutrition, insalubrity, and deficiency and infectious diseases. In a cyclic natural process, it ends up by despoiling and contaminating the environment.

A parallel issue, characteristic of this century, is the movement of population into large urban concentrations, as discussed by G. Bell and J. Tyrwhitt (28), and by D. Popenoe (28) about its implications to both urban and rural areas, affecting both physical and social environment.
In the developed countries, cities represent power and affluence through technology. For the poorer people in the developing countries, cities symbolise survival and social mobility, through better health, job opportunities and education.

This accelerated movement to towns and cities overloads the capability of existing local government infrastructure to provide public services for the community. As a consequence, many deformations arise in the whole system. Some of them result in deterioration of the environment, as insufficient water and waste treatment, improper housing conditions, heavy traffic with increasing production of fumes and noise. The situation can get even worse where there happens to be a concentration of both population and industries in the same area. This problem has been approached in two directions: by government through land zoning policy in the new urban plans; and by wealthy inhabitants by moving to suburbia. Aspects of both urban and suburban human environment are discussed by H. J. Schmandt and W. Bloomberg Jr (30), Campbell et al. (31), and W. Michelson (32), analysing American cases, as a starting point. Socially speaking neither of these two approaches have resolved the situation, since it creates an unfair division of the environment, reinforcing the inequalities in the distribution of wealth: a large number of poor people share a decaying environment.
while a few rich people get a big share of the best that nature can offer, as discussed by D. Popenoe (29) (33). Different solutions have been tried for both the physical and social environment problems in urban areas, but this is still an open question within the trends of modernisation and development.

Unequal distribution of incomes and wealth is another social factor of environmental pollution. From the point of view of individuals, low income also leads people to degrade the environment unintentionally, either by dwelling in slums where they are surrounded by either own waste, or by causing soil erosion and deforestation through the intensive use of a small arable land, or by contaminating soil and water with diseases where they are not served by sewerage system. Speaking about countries, poverty and technological underdevelopment have similar effect, leading to uneconomic use of the natural resources, domination of the backward countries by the developed nations and all sorts of inequalities and discomfort for human beings.

An understanding of the evil consequences of underdevelopment motivates nations to compete for higher economic growth rates - one of the features of development - likely to give international political power to the country and generate social well-being for citizens. Economic growth measured by increments
in the GNP was very fashionable during the Fifties and early Sixties. It corresponded also to the period when nations were running after technological advancement blindly. From the late Sixties on people’s values have been changing in the developed countries. Thus, as J. Robertson underlines, they started questioning the GNP as a fair measure of development, since it takes into account only the exchange value of goods and services produced in the money economy, but it does not consider the quality of life and human values (34). The desirability and feasibility of a continuous economic growth in a world with limited space and resources have also been mistrusted. Then, growth began to be considered a danger to environment because it put pressure on exploitation of natural resources in order to support mass production, and generates more waste as a consequence of consumption and obsolescence.

This change reflected the new thought predominant in the post-industrial societies, and has been associated mainly with entry into the space age. Landing on the moon in 1969 gave man an increased consciousness that there is just one Earth, with limited resources. The expression 'spaceship Earth' was in fashion, and plans to save it, and to survive in it have been designed, as in P. Ehrlich and R. Harriman’s How to be a Survivor (35).
The United States launched in 1970 the idea of 'zero' growth and some theorists like P. Ehrlich discussed the level of semi-development that poor nations could still aim for, and how to de-develop the overdeveloped nations (24).

A pessimistic forecast has been made by D. Meadows (16) in the report to the Club of Rome, about famine and ecological disasters in the next hundred years, as a consequence of a continuous growth in wealth, technology, population and pollution. After this publication many other global models and forecasts were put forward, as analysed by G. Poquet (36) and W. Hecox (37).

It is worth mentioning from these models the study prepared by the Bariloche Foundation as the Third World's answer to the Club of Rome. It does not foresee serious limits to the world growth, and understands that the threats to the environment would finish if we could build an egalitarian society at both national and international levels.

A sound defence of growth within the environmental context, and even of the validity of GNP as a fair index is made by W. Beckerman at Two Cheers for the Affluent Society (38) and at In Defence of Economic Growth (39).
Today a new index has been sought to represent both development and quality of life. N. Jacoby mentions the construction of indices of change in social well-being, by the Russell Sage Foundation, and by the Organization for Economic Cooperation and Development, besides the construction of an index of Net National Welfare by the Japanese Government. All three indices try to balance people's needs with both quality of physical environment and national economic growth (40).

Irrespective of its sources and factors, environmental pollution problems require to be analysed under wide perspective, because this subject presents many facets which interrelate with other aspects of the human environment. A typical example of this interrelation is brought forward by the use of pesticides. Their intensive utilisation in agriculture has been discussed by the environmentalists, in connection with their harmful effects on both human and animal life. R. Carson's *Silent Spring* is a classic in ecological literature, blaming the unrestricted proliferation of chemical pesticides and their use by people who ignore their potentials for harm (41). On the other hand, the beneficial effects of pesticides in agriculture have been saving millions from hunger; and public health medicine extols their properties to exterminate the carriers of diseases, such as malaria, typhoid and encephalites. Based on these facts, Lord Rothschild
accuses R. Carson's book of being one-sided indictment against DDT. After considering the return of malaria in certain countries because of the abolishment of that pesticide, he concludes:

Such are the risks of a no-risk society. Are we getting too clever by half? Of course not; but we must not allow the results of our cleverness to make us panic, and we must remember that one man's poison may be another man's life (42).

What can never be forgotten when dealing with the environment is that people's life and well-being depend on it as much as its quality depends on people's care, and that the physical environment is only one link in a complex chain. It is not sensible to go from a previous conception of man on the top of the universe and nature to serve him, to a new one where nature becomes and untouchable deity and man is a malefic appendix.

2.4 SOCIAL RESPONSIBILITY UPON THE ENVIRONMENT

Environment, in its natural aspects, is essentially a public commodity to be both enjoyed and cared for. This subject can be considered through three different facets:

- public awareness of environmental threats;
- government environmental attitudes showed through legislation;
- costs of pollution.
The environmental movement presents two distinct phases, according to the predominant interest in each period: first of all the conservation of natural resources, and later the struggle against pollution.

From the end of the nineteenth century till the early Sixties it was not really a popular movement, even in the rich countries. There was concern by individuals and small groups, but directed only to the conservation of natural resources, including their protection and restoration. G. Siehl reminds us that most of the major conservation organisations active today were founded in the late 1800's and early 1900's, such as the Sierra Club, the Audubon Society, the United States National Parks Association, the Society of American Foresters, and the International Association of Game, Fish and Conservation-Commissioners (43). Some other organisations, as the Civilian Conservation Corps, Tennessee Valley Authority, Friends of the Earth, and Resources for the Future have been founded later.

Besides their efforts in protecting the environment, the conservation organisations have played a good part in educating the public to the importance of protecting the environment, and quite certainly they may be acknowledged for preparing the actual environmental movement, which started in the 1960's.
The passage from a purely conservationist attitude to an anti-pollution cry is said to have been provoked by R. Carson's *Silent Spring* (41), in 1962. The emotional style she used to denounce the pollution of rivers and land by chemical pesticides alarmed the public, which increased its participation, both directly and through pressure on the government, to maintain vigilance on environmental issues. The danger of pollution and other environmental threats then became a popular subject among scientists too.

The conservation organisations, previously concentrated in the simple objective of natural resources, broadened their interest as to include also the quality of environment. Pressure groups have been created to fight specific problems. Different segments of the adult population have been sensitised. Youth expressed its concern about nature through the philosophy of the hippie movement. So, by the end of the Sixties and early Seventies the control of environmental pollution was already a sensitive subject with a very political content. In some countries, like West Germany, England and France, people established their Ecological Party which has been influential in government decisions. The United States Environmental Protection Act of 1970 provides for public participation on the protection of the environment.
Citizens' opinion has been formally consulted by governments when making decisions on the quality of the environment. This is the case analysed by J. Wohlwill during the 1972 general election in California, when the population was consulted about adopting the California Coastal Zone Regulation Act, which has passed with 55% of the votes (44). In the same article, J. Wohlwill reviews previous researches on the sociopolitical content of environmental attitudes. The results of these previous researches, plus his own findings and the observations made by W. Hines and G. Willeke (45) indicate that environmental concern cut across different segments of our society, although it has been found more strongly correlated to the following socioeconomic characteristics:

a. income: the upper-middle class people, who tend to have higher income, is more likely to join the environmental movement, while it does not threaten their right to land and home ownership;

b. education: a characteristic of the defenders of the environment is a good education, at either average or high level. They are also well informed through the literature and the media;
c. political preference: the environmental attitude has been associated to sociopolitical liberalism, as for instance the Democratic Party in the United States (in opposition to the Republican Party);

d. social group: ecological sympathy, as a manifestation of social group, is possibly more closely related to the dominant group than to racial minorities.

These comments could be extended to explain by analogy why the concern about the environment is an attitude more frequent in developed countries. In the backward countries the environment is considered a commodity to be used in order to survive and reach development, their main goal. Where the protection of nature has to compete with alleviating hunger and oppression, it is understandable that the environmental movement is not so popular.

The media have played an important part in educating and alerting population against the pollution risk, and in voicing people's opinions and complaints about the quality of life they experience. W. Heines and G. Willeke show television as the most active medium in the environmental mission, followed by newspapers, the latter being important for people of higher education and social class (45).
The argument against generation of nuclear energy, a constant theme on the media, has received its most recent expression in the cinema through "The China Syndrome". On the musical scene, the suite 'Minamata', by Toshiko Akioshi, is the echo of complaints made by Japanese fishermen against the mercury poisoning of the water in that town.

If one looks through any publication that advertises public events in any metropolis, one is certain to find either a demonstration, or a meeting to protest against the installation of a nuclear power plant, or the transport or burial of nuclear waste, the poisoning of water, land or air, or some other kind of environmental threat.

All these observations show that as the layman becomes better informed about the causes and consequences of pollution, he begins to participate in the debate and is prepared to take action in defence of a better quality of human life, compatible with respect for nature. That is why an environmental information system has such an important educational role in developing countries, leading people to concern for nature.
2.4.2 Governmental Attitudes

Governments of different countries, mainly the most technologically advanced, have responded to public manifestations against environmental nuisances by creating and enforcing legislation, and also by establishing quality standards.

Usually the first wave of legislation passed to prevent or abate pollution in any country comes as part of a sanitary legislation package. This is why legislation about water pollution – the earlier to be developed as part of sanitation measures – is more voluminous and advanced. Examples of this early legislation on pollution are United Kingdom Sanitation Acts of 1875 and Public Health Act of 1848, and United States Rivers and Harbors Refuse Acts of 1886 and 1899. Nevertheless, the first comprehensive legislation on water pollution is American and dated from 1948.

The control of atmospheric pollution comes after that of the clean water. England was the pioneer in air pollution control, as a result of its earlier industrial development. In 1863, as part of the Alkali Act, the country got its first legislation about air pollution and industrial effluents. At the beginning of the Fifties more strict control became necessary to abate London fog, and the Clean Air Act 1956 was passed and later amended.
In the United States, the first official measure to control air pollution is found in state legislation, passed in California in 1960, in order to cope with the fog of Los Angeles. The first federal legislation came as the Clean Air Act of 1963.

The problems of solid waste disposal and noise abatement are quite recent in legislation. The United Kingdom Litter Act was the first legal control of solid waste in England, followed later by new legislation on the disposal of generic solid waste and specific waste, such as the industrial and poisonous. English legislation about noise started with the Noise Abatement Act of 1960.

While England and the United States created their legislation quite early, and amended it later as necessary, some other countries, like France and Japan, awoke to the pollution problem much later and passed a single programme of legislation in the Sixties. However the comprehensive view of environmental pollution is really an issue of the Seventies. In England it was in 1974 that the Department of Environment was created in its present structure and the latest Control of Pollution Act was passed. In 1970, the United States Environmental Protection Agency - EPA - was created as the federal organisation to control the American environment, and two comprehensive legislation have been

As pollution sometimes crosses the borders of the original country and becomes an international affair, specific controls are agreed between the nations involved, or set up by an international organisation. This is the case of an agreement between the United States and Canada signed in 1909 concerning the pollution of the Great Lakes. Another example is the Commission of the European Communities, which is aware of the environmental problems involving some countries in the Continent, like the pollution of the river Rhine and the Mediterranean Sea. The first statement of its intentions has been presented through the Action Programme of the European Communities on the Environment, which was approved by the Council of Ministers in 1973.
Both the establishment of quality standards and the imposition of legislation are equally important for the control of pollution. Standards, according to V. Sussman, are related to the acceptable quality of a determined part of the environment, taking into account political, economic and social factors; they prescribe pollution levels that cannot legally be exceeded during a specific time in a specific geographic area (46).

In the United States, California set first quality standards: in 1914 for drinking water, and in 1959 for air. At federal level, 1966 is the date when water quality standards have been approved, and 1971 for air quality.

Canadian drinking water standards were established in 1968. The already mentioned Action Programme of the European Community includes also quality standards to be adopted.

The establishment and rise of standards require technological knowledge and basic amount of equipment. This is the main reason why most of the developing countries have not yet established their own standards. However, by adopting foreign standards, they are frequently misled into imposing a too severe control upon emissions, which is likely to discourage industrial expansion.
2.4.3 Cost of Pollution

Two aspects of the problem must be considered:

. the social costs attributable to environmental pollution;

. the way that costs of controlling pollution are usually distributed.

The question of social cost is discussed by K. Kapp, who explains the concept as covering all direct and indirect losses undergone by a group of individuals or the general public, in consequence of unrestrained economic activities. As far as pollution is concerned he analyses the social costs of both air and water pollution. The main losses caused by air pollution include: damage of human health, harmful effects on plant and animal life, corrosion and premature deterioration of materials, delays and disturbance of transportation. The estimates of annual costs of air pollution in the United States vary from 2 to 7.5 billion dollars. He sees the future solution rather in better technology than in the reinforcement of strong legislation.

Covering the social costs of water pollution, K. Kapp mentions separately the problems of industrial pollution in the developed countries and the organic contamination of rivers in the developing nations. The adverse effects
upon human health, loss of livestock, destruction of crops, loss of soil fertility, decrease of property values, damage of recreational facilities, decrease of rivers' navigability, corrosion of concrete and steel structures in the rivers and barrages, and depletion of major non-renewable resources.

Estimates for pollution abatement in the United States during the next decade total $10.6 \text{ billion dollars.}$

Part of this pollution is caused by domestic sewage, for which the whole population is responsible. However, the most harmful effects come from industrial pollution and so, according to K. Kapp, they should not be the responsibility of the community. Nevertheless society has been sharing with private companies and government the costs of industrial pollution as well, in unequal distribution of social responsibilities (47).

H. Stretton discusses the three alternative approaches being used by governments to distribute the costs of pollution control: by taxation, regulation or public ownership.

The taxation policy is adopted in two different situations, and with specific objectives:

- on pollutant emissions of factories, in order to stimulate producers to develop less polluting techniques;
... on the use of environmental amenities, as parks and nature reserves for example, with the objective of discouraging the consumption of threatened resources.

The taxation, or 'polluter pays principle', has been adopted since the OECD Ministerial Conference, in May 1972, as part of its Guiding Principles Concerning the International Economic Aspect of Environmental Policies. The main argument against it is a social one: rationing the use of scarce resources by price and controlling pollution by internalising social costs into product prices increases inequality because it affects only the low income part of the society. It is also argued that it may not be environmentally effective, since some firms may find it is cheaper to pay the tax rather than to pay for new equipment.

The second alternative - regulation - involves the establishment of legislation-and standards. It can be environmentally very effective, but has the same negative social effect, because these measures increase production costs and firms therefore distribute the increases amongst consumers.

The third alternative suggested by H. Stretton is that industries causing pollution should be taken into public ownership for ease of control. The objections include: it does not reduce cost (may even increase it), though
it may redistribute some profits; it can be less efficient under public management (well known as bureaucratic) and may not improve the environmental condition.

After criticising the three alternatives, H. Stretton suggests that a mixed solution should be looked for, which could be environmentally efficient, economically feasible and socially equitable (48), a perfect solution which however seems to be too idealistic.

2.5 MAIN LINES OF THE ECOLOGICAL THOUGHT

Three basic lines can be identified in environmental discussion through the literature: conservationist, developmentalist or technocratic, and ecodevelopmentalist.

2.5.1 Conservationists

This group represents the largest part of the ecological movement. It has been characterised by a narrow line of thought, as it sees the protection of the environment as an end, and blames external, isolated factors, such as technology, population increase or economic growth, for the deterioration of the environment. Using these arguments, it has created the so-called 'doomsday literature', which emphasises the risks of world growth and advancement in a limited environment. There are

As regards the institutions associated with this group, it is worth mentioning the Club of Rome (Italy), Friends of the Earth (England), Sierra Club (USA), all involved in publishing, research support and alerting public opinion. The Club of Rome's Project on the Predicament of Mankind has been made famous through the report *The Limits to Growth* (16), prepared by a MIT group.

2.5.2 Technocrats

This group is formed largely of government planners, many economists and some scientists. They are the most outspoken defenders of the Third World's development and freedom. In reacting against the conservationists, the tone of their writings has taken another equally extreme
position. While conservationists define quality of life on the basis of a clean environment, technocrats understand it on the sole basis of development, without much concern for the nature. The motto of the technocrats is 'produce-pollute-clean'.

H. Stretton (48) and J. de Castro (54) speak as social scientists. H. Kahn (55), E. Gerelli and J.-P. Barde (56), and W. Beckerman (38)(39) represent the point of view of economists; and M. Ozório de Almeida (57) expresses some ideas shared by the governments of the Third World. Nevertheless, the bulk of the technocrat's literature is represented by government documents, and speeches made by representatives of the developing countries in international fora, like the General Assembly of the United Nations.

2.5.3 Ecodevelopmentalists

This is the most recent line of the environmental movement, launched in June 1973 by Maurice Strong, as Executive Director of the United Nations Environmental Programme - UNEP - during the first meeting of the Supervising Council of this programme. It can be considered a product of the 1972 UN Conference on the Human Environment, when the problems of development and environment were confronted. The concept of ecodevelopment represents a compromise between the two extreme
approaches previously described, as it integrates the ecological prudence and look forward a development which harmonises cultural, economic and ecological factors (58).

I. Sachs has been disseminating this idea of an environmentally compatible development, and his article *Environment and Styles of Development* (59) is a comprehensive analysis of the question. Recently interviewed in Brazil, he reviewed some achievements of the movement and compared its philosophy with that of the intermediate technology group (60).

A theoretical approach of ecodevelopment is made by R. G. Wilkinson in *Poverty and Progress*, an ecological model of economic development (61), while N. Myers analyses China's policy as a typical example of environmentally sound development (62). B. Ward's *Progress for a Small Planet* can be also included in this category, although she is biased towards the Western World (63).

Even though they do not mention ecodevelopment, two authors deserve mention, as defenders of a balanced position, in the same line as the ecodevelopmentalist. They are J. Maddox, with *The Doomsday Syndrome* (17), and A. Sauvy, with *Zero Growth* (64). They both discuss all extremist arguments in an optimistic way, and present some possible solutions for both developed and developing worlds.
J. Dorst, in *Before Nature Dies*, calls for the reconciliation of conservationists and technocrats, as regards a rational management of Earth's resources:

The 'protectors of nature' must learn that the survival of man requires intensive agriculture and a complete transformation of certain areas; they must abandon a number of sentimental prejudices, some of which have done serious harm to the cause they are defending. On the other hand, the technocrats must admit that man cannot free himself from certain biological laws, and that a rational exploitation of natural resources does not involve transforming habitats automatically and completely. They must understand that the preservation of natural areas constitutes land-use quite as much as their modification. A realistic agreement between economists and biologists can and must lead to reasonable solutions and assure the rational development of humanity in a setting in harmony with natural laws (65).
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INTERNATIONAL APPROACH TO ENVIRONMENTAL POLLUTION AS A DEVELOPMENTAL ISSUE

Although the way each country deals with its own environment is likely to affect the whole world, not all nations have either capital or technology enough to adopt the best measures to use their natural resources rationally. As a result of this deficiency, backward countries might disregard environment safeguards in their effort for development. Since all nations are conscious of this situation, the management of the environment has become a subject for which concern is shared internationally, mainly as regards environmentally sound means of development.

Various aspects concerning the environment have been discussed regionally by representatives of countries in the same continent, to examine their own problems. On a wider front, these national representatives have discussed the problems of the global environment, under the sponsorship of both intergovernmental and international organisations. In both kinds of meetings, the approach of debates has been political, economic or scientific, depending on the forum, or the opportunity. Nevertheless, the way countries act in, and react to, the international discussion of environmental matters depends on the economic group they belong to:
advanced countries or Third World. It is even more noticeable when voting any proposition in international meetings (e.g. at the UN General Assembly): usually developing countries constitute one group and Western capitalist countries another, as their objective are quite different. The communist countries will vote with either the developing or the developed countries, depending on the matter and their own interest.

3.1 THE ORGANISATIONS

The United Nations system through its specialised organisations, agencies and regional commissions, has been one of the most active organisations in discussing the technological, economic and social aspects of the deterioration of environment in the less developed countries.

To start with, the Secretariat-General of the United Nations itself has taken several environment related initiatives on housing, transportation, science and technology. The General Assembly has always played an important part in all areas related to both development and environment protection. In parallel, many United Nations divisions and specialised agencies formulate programmes and projects concerned with the environment in developing countries within their specific area of action. The coordination, as far as the environment
is concerned, has been centralised since December 1972 at the United Nations Environmental Programme - UNEP.

Before 1973, the function of catalyst was performed by the Economic and Social Council - ECOSOC - which is now the intermediary between the UNEP and the General Assembly. UNEP's role goes beyond the United Nations system, to act outside as a focal point for environmental action and then promote coordination among national and international organisations, and to encourage them to give due emphasis to the environment in their deliberations(1).

Along with this main goal, UNEP has been seriously involved with demonstrating to the world that there exists a close relationship between environment and development, and recommending that the United Nations should convene all possible means and ways to support financially and technically the developing countries to achieve both progress and environmental benefits.

This idea has been brought to the practical plane through UNEP's programme, which concentrates on the following areas:

. human settlements and habitats;
. human health and well-being;
land, water and desertification*;
- technology and the transfer of technology, trade and economics;
- conservation of nature, wildlife, genetic resources and oceans;
- energy

Two activities have been planned to support these areas of concentration:

- Earthwatch system of monitoring, information exchange and assessment, to be accessed by governments, and world organisations;
- public information and education on environmental trends.

Part of this public information activity is the yearly survey 'State of the Environment' which has been published since 1973. Financial support for specific projects comes from the Environment Fund, a division within UNEP.

UNEP carries out some activities by itself, such as: promotion of conferences and expert meetings, basic research to support specific joint projects, or internal decisions, or training of national teams of officers, research workers and experts. However, most of the activities are joint projects conducted with other organisations of the United Nations system, or governments, or scientific institutions.

*Desertification is the word used in UNEP's documents to characterise the process or risk of a piece of land becoming a desert.
The main collaborators for the environmental programme in the United Nations system are:

a. the Regional Economic Commissions which have sponsored development programmes with a slant to the environment in areas such as water pollution, side effect of dams and power plants, basic survey to trace the state of the environment in the region.

b. the United Nations Conference on Trade and Development - UNCTAD - which, as part of its more general interests and responsibilities in the area of international agreements on commodities, is concerned with the tariffs policy and any discriminatory measures imposed by developed countries, on the grounds of environmental considerations, on the commodities exported or imported by developing countries.

c. the United Nations Industrial Development Organisation - UNIDO - which has, as a general goal, to give technical assistance to developing countries in the analysis of environmental aspects related to industrialisation. It has been specifically involved in projects such as: survey of land-based sources of pollution of seas, review of environmental impact of all sources of energy, and alternative styles of development and technology.
d. the United Nations Development Programme - UNDP - which has supported different kinds of projects towards environmentally sound development, in the field of industry, agriculture, housing and others directly related to the control of pollution and environmental sanitation.

e. the Food and Agriculture Organisation - FAO - which has helped developing countries in the control of pests and diseases in crops, along with assessing environmental effects of agricultural chemicals on man and ecological systems, and avoiding their undesirable effects. Supporting activities undertaken by FAO are training programmes for experts, regional seminars and researches.

f. the Inter-Governmental Maritime Consultative Organisation - IMCO - which is concerned with the harmful effects of chemical, radioactive and various other waste on marine biota, looking after the legal and scientific aspects of this particular type of pollution.

g. the International Atomic Energy - IAEA - which has, as fringe area of action, helped other organisations in research and effective control and prevention of radioactive contamination of sea, fresh water, atmosphere, land and crops. It has also advised them in the use of radiation techniques for environmental assessment and management.
h. the World Bank Group, consisting of the International Bank for Reconstruction and Development - IBRD - the International Development Association - IDA - and the International Finance Corporation - IFC - which has been always financing development programmes, and in 1970 created the position of Environmental Advisor, allocated to an expert, who takes environmental considerations into the formulation and appraisal of development projects submitted to the Bank for support. Among these projects are: construction of dams, irrigation systems, sewage works, airports, power and fertiliser plants, petrochemical and mineral exploitation industries.

i. the International Civil Aviation Organisation - ICAO - which has participated in research into the establishment of standards and other different actions related to noise in airports and generic noise pollution caused by planes.

j. the International Labour Organization - ILO - which is concerned with atmospheric pollution and other unhealthy conditions in places of work.

k. the United Nations Educational, Scientific and Cultural Organization - UNESCO - which is deeply involved in environmental programmes as part of its scientific activities.
These are its main issues:

- There is a Department of Environmental Sciences and Natural Resources Research, which is composed of a Division of Natural Research, an Office of Oceanography and an Office of Hydrology;

- Man and the Biosphere - MAB - is a scientific programme managed by the Natural Research Division, which started in 1970. It has the participation of UNESCO's member-countries, which have their own national commissions. MAB is intended to study the rational use and conservation of resources of the biosphere, the relationship between man and the environment now, and the possible effects on the biosphere in the future. The programme includes scientific, economic and technological lines of study;

- Intergovernmental Oceanographic Commission - IOC - which is a permanent body which participates in the study of, and activities relating to, the preservation and abatement of marine pollution through its International Working Group on the Study of World Marine Pollution, created in 1973;

- Environmental education programme, including research, training and conferences;

- Global Investigation of Pollution in the Maritime
Environment - GIPME - is a programme designed to investigate marine pollution problems; multidisciplinary programme of research and experiment on arid zones and humid tropic areas; international hydrologic programme, started in 1974; participation with the WMO in the IGOSS pilot project on marine pollution by petroleum; participation in the joint programme Group of Experts of Marine Pollution - GESAMP - with other organisations of the United Nations system; m. the World Meteorological Organization - WMO - which has two main lines of research and activities related to environmental pollution: climatic changes caused by pollution and the abuse of nature, and collection of world data to monitor background atmospheric pollution. Its program World Weather Watch, operated through 8,500 land stations and hundreds of ships, has been extended to include a network of air pollution monitoring stations; n. the World Health Organization - WHO - which is involved with health aspects of environmental pollution, such as microbiological contamination of waters as a consequence of poor sanitary conditions, and the effects of chemicals and fumes resulting
from urban and industrial development. WHO created an Expert Committee on the Planning and Administration of National Programmes for the control of adverse effects of pollutants;

o. the United Nations Advisory Committee on the Application of Science and Technology to Development - ACAST - which is the central body in the United Nations system dealing with the application of science and technology in the development process.

Outside the United Nations system many other international organisations are also dealing with environmental pollution, some of them touching indirectly the interests of the developing countries. Some of these organisations are:

a. the International Union for Conservation of Nature and Natural Resources - IUCN - which is a non-governmental organisation - NGO - founded in 1948, which has a scientific approach to environment, focusing the rational use of natural resources. To achieve this, IUCN promotes meetings of experts, prepares ecological guidelines for economic development of specific areas, and publishes literature to inform people;

b. the International Council of Scientific Unions - ICSU - which decided to develop research on environmental matters, and established a Scientific
Committee on Problems of the Environment - SCOPE;
c. the North Atlantic Treaty Organization - NATO - which is concerned with environmental threats in two ways: in its practical aspects of combatting the problem, by sponsoring pilot studies through the Committee on the Challenges of Modern Society - CCMS - created in 1969; and in its scientific aspects, by supporting researches in the ecosciences, through the NATO Ecosciences Programme, established in 1971. The main areas covered by the Ecosciences Programme are: sub-lethal toxicology, taxonomy, pollution indicator organisms, and environmental data management;
d. the Council of Europe which is acting in the field by promoting group of studies and conferences on pollution and helping specifically European countries in the development of their anti-pollution legislation. As part of this assistance, it has assigned a Committee of experts to study existing legislation on pollution prevention; from this study resulted a Declaration of Principles ('Clean Air Charter') intended to serve as a guide for member governments;
e. the Commission of the European Communities which deals with pollution problems mainly through the Council of the European Communities' Working Party
on the Environment. It has established the European Community's policy and action programme for the coming years, both in the field of pollution control and in that of the improvement of the whole environment. As part of this programme, the Commission is interested in seeking common solutions to environmental problems, with countries inside and outside the Community, including developing nations. Within this context, the European Development Fund is prepared to ensure that environmental safeguards have been provided in the projects presented to it for funding. The Fund has a further function of supporting a policy of the Community related to the removal of heavily polluting industries from its territory. For this purpose it has set aside money to be used to ameliorate pollution produced by these European industries transferred to any less developed country outside the Community. The fund is also willing to consider the support of projects dealing with methods of industrial production which minimize pollution, and with intermediate technologies. Another point which the Community is alert to is that environmental policies of the Community and member states must not affect trade between the Community and the developing countries.
The information system for the environmental programme of the Community includes the setting up and constant updating of an inventory of sources of information on the environment within the Community, the creation of environmental databases, and the publication of programmes and subsequent follow-up of the progress. The environmental Chemical Data and Information - ECDIN - part of this programme, is a subsystem for information on chemical compounds, which is currently being set up at the Ispra Establishment, Italy.

f. the Organisation for Economic Cooperation and Development - OECD - which has, among some others, two aims related to the subject in question: the highest possible economic growth, and a rising standard of living in the member countries. Since 1970 it has an Environment Committee, which is involved in urban environment, in water and air management, and in controlling the undesirable occurrence of chemicals in the environment;

g. the Inter-Parliamentary Union which adopted, in its fifty-seventh Inter-Parliamentary Conference in 1969, a resolution on the role of parliaments in the protection of the human environment and conservation of natural resources;
h. the Organisation of African Unity which is concerned with African development and natural resources management. Some of its affiliated organisations are involved in research on animal health, soil, and phyto-sanitation;

i. the Organisation of American States' - OAS - objectives include the economic, social and cultural development of the Americas. As part of them, OAS is concerned, through the Inter-American Economic and Social Council, with the better utilisation of natural resources, and the improvement of the quality of life of people in the member countries.

As previously stated, the United Nations has been the most active organisation in relating environmental pollution problems to problems of underdevelopment, looking for common solutions. Certainly because the problems are big and varied, most of the components of the United Nations system work to some extent in this area. The great majority of the programmes are joint efforts of United Nations organisations, and are either promoted or coordinated by UNEP, the specific body to deal with environmental matters. However, many others are the initiative of different United Nations organisations, and are not under direct coordination of UNEP.
As a result, there is overlap of efforts in some areas, as for instance marine pollution, causing dispersion of resources and information.

3.2 UN International Conferences on the Environment

From the beginning of the Seventies environment started being discussed as a facet of development in the UN's conferences and at the General Assembly. As a result, the subject has often been approached from both political and economic points of view, rather than as scientific and technological matter. The United Nations Conference on Human Environment, held in Stockholm in 1972, is considered the turning point, as regards the linking of environment and development. It was preceded and followed by other regional meetings of equal importance, as far as the developing countries were concerned. The most important were the Founex Panel in 1971, and the Cocoyoc Symposium in 1974. Besides these, the UNEP Governing Council has often discussed environment-development relationship quite emphatically in its sessions.
3.2.1 The Founex Panel

From 4 to 12 June 1971, at Founex, Switzerland, a group of twenty-seven experts in the fields of development and environment met at the United Nations' request, to discuss the interrelationship between these two fields, and how developing countries could beneficially participate in the Stockholm Conference.

At this time environment was defined in the narrow sense of water and air pollution problems to be dealt with through technology and legislation. On these lines, the environmental question was a concern for industrial countries, and they were already directing their attention to halt the deterioration of their environment.

From this perspective, people in developing countries worried that policies and actions taken by wealthy nations to conserve and protect their environments would hinder the development of the poorer nations. Besides this, the backward countries wondered if their scarce resources should be diverted from development priorities to the protection of environment.

The Panel took into consideration both the actual pollution problems caused by industrial activities and rapid urbanisation, and the environmental disruption
derived from underdevelopment. The discussion has been supported by nine working papers and seven background papers prepared by individual participants.

The Group concluded that there are two broad categories of environmental problems in developing countries: many problems derived from poverty or underdevelopment, and some problems arising from industrial and urban growth, as the process of development gets under way. The main foci of environmental disruption in these countries have been identified in both traditional and modern agriculture processes, in river basin development projects, in industrial technology and location, in transport system, and in human settlements (including housing, health and socioeconomic organisation). The attention has been called of governments in those countries to adopt environmentally sound policies and direct them towards development. These actions would allow developing countries to overcome poverty and its by-products without repeating the mistakes of the developed countries.

On the other hand the Panel appreciated the concern of developing countries about being adversely affected in the international exchange, on the grounds of environmental protection. Their concern related to new obstacles probably arising in the technology transfer and international trade. They fear that, by using
environmentally sound arguments, developed countries might place them at a disadvantage through clever manipulation of market devices (such as dumping of goods and erection or removal of tariff barriers), which always tend to favour the advantaged over the disadvantaged nations.

These fears have been accepted as legitimate, and recommendations made in this respect to the United Nations, anticipating the Stockholm Conference and further actions. The Panel suggested to the developing countries the adoption of a strategy that would take advantage of the environmental concern of industrial societies. This new strategy would harness the drive for an improved environment to a general campaign against world poverty. The Panel thought this would be necessary in order to gain the support of the developed nations.

Then a new definition of quality of life has been suggested by the Panel, in order to emphasise the different priorities and means to get it:

The quality of life in a poor society should be defined in terms of a selective attack on the problems of mass poverty, and development plans should attempt to quantify the improvement that is being sought in eliminating the worst forms of malnutrition, squalor, disease and ignorance (2).
Summing up, it could be said that this Panel had two great achievements to its credit:

- broadening the concept of development to something more than merely economic growth, to embrace social and political issues for people's benefit, including the environmental interest;

- broadening the concept of environment than just problems of pollution, to incorporate human and social aspects, including development.

The conclusions of the Panel resulted in the official position of developing countries in the Stockholm Conference, and reflected through their active participation in the debates and considerable influence in the recommendations.

3.2.2 The Stockholm Conference

The United Nations Conference on the Human Environment, which took place in Stockholm, from 5 to 16 June 1972, witnessed the participation of 113 States. The conference was the result of recommendations of the United Nations Economic and Social Council in its 1555 plenary meeting of 30 July 1968 (3), and General Assembly's resolution adopted in its twenty-third regular session of 3 December 1968 (4).
The basis for the Conference has been settled by the United Nations through some special meetings:

- internal meetings of the Preparatory Committee, which had the role of advising the Secretary-General, in the period 1970-72, for the preparation of the Conference;

- regional meetings of experts promoted by the United Nations Regional Economic Commissions and the United Nations Economic and Social Office of Beirut, in 1970-71, to discuss the specific problems of each region;

- meeting of the Group of 77, at Lima (Peru), in October 1971, in order to establish the position of these countries in the Conference, and make suggestions to the United Nations about some topics planned to be discussed in the Conference.

The following ideas were common to all these mentioned meetings, as the expression of developing countries points of view and concerns:

a. there is a pollution of 'misdevelopment', and a pollution of underdevelopment, both of them deserving attention, but through different approaches;

b. the conservation of the environment and the promotion of development should be effected at one and the same time: underdevelopment is in itself a pollution of the environment;
c. environment should receive a sectorial approach in national development planning;

d. it should be considered as the sovereign right of the country to exploit fully its own natural resources in accordance with national plans and national priorities;

e. measures for the protection of the environment should not be a luxury developing countries cannot afford;

f. developing countries should not be penalised in terms of international trade on the grounds of environmental protection;

g. developing countries should have access to new non-polluting technology at a minimum cost because their balance of payments is already overburdened;

h. developing countries should exchange information among themselves about their own researches and practical experiences;

i. an international infrastructure for environmental information and education should be developed.

All these points have been discussed again during the Stockholm Conference itself, along with a wide range of environmental topics, which were grouped into six broad subject areas on the agenda:
a. Planning and management of human settlements for environmental quality;

b. Environmental aspects of natural resources management;

c. Identification and control of pollutants of broad international significance;

d. Educational, informational, social and cultural aspects of environmental issues;

e. Development and environment;

f. International organisational implications of action proposals.

The studies and debates were conducted in such a way as to use the scientific knowledge of the participants and contributors to establish a plan of action on the protection of the environment within a new concept introduced at the Conference. Having taken the idea from the Pownex Panel that underdevelopment is in itself the worst kind of pollution, the Stockholm Conference looked at the environment in a broader way and from a social, human perspective:

. of all things in the world, people are the most precious;

. the environmental movement could succeed only if there was a new commitment to liberation from the destructive forces of mass poverty, racial
prejudice, economic injustice, and the technologies of modern warfare;

- environmental factors must be an integral part of development strategy;

- the concept of 'no growth' could not be a viable policy for any society, but it was necessary to rethink the traditional concepts of the basic purposes of growth;

- the new technological order must be guided to achieve a better balance among the major elements which determine the level and quality of life;

- it is necessary to find new international means for better management of the world's common property resources, and better means of exercising national sovereignties collectively with a greater sense of responsibility for the common good (5).

The main achievements of the Conference were condensed in the 'Declaration of the UN Conference on the Human Environment', which proclaimed seven basic statements and twenty-six principles as the core conclusions of the meeting and the common thought of the 113 nations taking part in it. On the practical side, these principles have been converted into an Action Plan for the Human Environment, comprising three types of actions:
the global environment assessment programme (Earthwatching), including: evaluation and review, research, monitoring and information exchange;

environmental management activities, such as: goal setting and planning, international consultation and agreements;

international measures to support the national and international actions of assessment and management: education and training, public information, organisation, financing and technical cooperation.

A final resolution of the Conference recommended the United Nations General Assembly to establish the Governing Council for Environmental Programmes, composed of representatives of member-nations, and an United Nations Secretariat to coordinate environmental actions within the United Nations system.

3.2.3 After Stockholm

Accepting the recommendations of the Stockholm Conference, the General Assembly, in its 2112th plenary meeting, established both the United Nations Environmental Programme - UNEP - and the Governing Council, through the Resolution 2997 (XXVII) of 15 December 1972, which was adopted by 116 votes in favour, no abstentions and ten votes against. Since then UNEP has been playing
the coordinating role in relation to environmental discussion and action at international level, both within and outside the United Nations system.

Launched at the Stockholm Conference, the concept of ecodevelopment has since been set in strong relief by the UNEP in its approach to the management of international matters concerned to the environment.

In the post-Stockholm period, the Symposium on Patterns of Resource Use, Environment and Development Strategies was an important event to channel the voice of developing countries in confirming their position about the relationship between environmental concern and development. This meeting was a joint effort of UNEP and UNCTAD and took place in Cocoyoc, Mexico, in October 8-12, 1974. At the end of the Symposium the basic conclusions and recommendations were adopted by the participants and issued under the title of The Cocoyoc Declaration.

The above declaration emphasised that the root of the environmental disruption lies in the socioeconomic structures:

The problem today is not primarily one of absolute physical shortage but of economic and social maldistribution and misuse; mankind's predicament is rooted primarily in economic and social structures and behaviour within and between countries (6).
Then it recommended some solutions:

The task of a sateamship is thus to attempt to guide the nations, with all their differences in interest, power and fortune, towards a new system more capable of meeting the 'inner limits' of basic human needs for all the world's people and of doing so without violating the 'outer limits' of the planet's resources and environment (6).

This declaration also includes the acceptance of alternative means of development, more suitable to the local conditions and socioeconomic goals of each country:

We reject the unilinear view which sees development essentially and inevitably as the effort to imitate the historical model of the countries that for various reasons happen to be rich today. For this reason, we reject the concept of 'gaps' in development. The goal is not to 'catch up' but to ensure the quality of life for all, with a productive base compatible with the needs of future generations (6).

All the proposals implied significant changes in the present patterns of growth, development and living standards in both developed and developing countries.

Another meeting of interest for Latin America was organised jointly by UMEP and FAO, in Bogotá in July 5-10, 1976. Latin American countries met then to discuss their regional problems related to both environment and development. They established priority lines of action, and the administrative and legal structure that they would need.
In all of these meetings it has implicitly or explicitly been suggested that improvement in information services is one of the ways that the conditions of underdevelopment can be bettered. But like a vicious circle, the existence of an environmental information system in developing countries is determined by factors inherent to the local socioeconomic and political conditions, as discussed in the next chapter.
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THE DESIGN OF ENVIRONMENTAL INFORMATION SYSTEMS IN DEVELOPING COUNTRIES

Two groups of political and socioeconomic factors, as presented in Table 1, can strongly influence the design, implementation and management of government environmental information systems in developing nations.

These determinants derive partially from the very nature of the society of backward countries, that is from their underdevelopment. There are some basic features of underdevelopment - focused on 4.1 - which are common to all developing countries and likely to interfere with the quality and sometimes with the very existence of an official environmental information system. Some of the features listed in Table 1 - e.g. bureaucratisation - are not peculiar to underdeveloped countries. However, in combination with the other factors of underdevelopment they are more likely to be a drawback for the existence of information systems than when they occur in advanced countries.

The other group of intervening factors which will be discussed in 4.2 result from the environmental policy adopted by the governments of a country in the management of its natural resources and in the control of pollution. Three basic kinds of policy can be adopted, as related to the main lines of environmental thought,
that is conservationist, ecodevelopmentalist, or technocratic. Each of these lines uncover a different perspective to consider the environment, as discussed previously in 2.5. Then the focus and concern given officially to the management of the environment itself will determine the level of priority given to an environmental information system. Since the users of such a system would be principally authorities in environmental agencies, governmental policy would be a strong indicator of the type of demands for information and services placed upon the system.

The identification of some of these two groups of factors has been tried, and the result exhibited concisely in Table 1. In this respect, the factors discussed hereafter should be seen not as overriding influences but as tendencies which in any case will confirm the sensitive character of an environmental information system and its political role in a developing country.

4.1 THE IMPLICATIONS OF UNDERDEVELOPMENT

The status and characteristics of underdevelopment affect every single area of planning, including that of information systems.

H. Bernstein sees development as resulting from a desire to overcome malnutrition, poverty and disease, and
Table 1: FACTORS AFFECTING THE DESIGN OF ENVIRONMENTAL INFORMATION SYSTEMS IN DEVELOPING COUNTRIES

<table>
<thead>
<tr>
<th>Features of Underdevelopment</th>
<th>Components of Environmental Policy</th>
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<tbody>
<tr>
<td>1. Poverty</td>
<td>1. Strategy on natural resources</td>
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<tr>
<td>2. Dualistic economy</td>
<td>2. Industrial development objectives</td>
</tr>
<tr>
<td>3. Technological gap</td>
<td>3. Pollution criteria and parameters</td>
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<td>4. Unproductive bureaucracies</td>
<td>4. International exchange platform</td>
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<td>5. Contingent nature of development programmes</td>
<td>5. Attitude towards public participation</td>
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<td>6. Control of information media</td>
<td>6. Subject areas of R &amp; D encouraged</td>
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<td>7. Idolatry of foreign models</td>
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<td>8. Nationalism</td>
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<td>9. Deficient educational system</td>
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To embrace such features of social justice, as equality of opportunity, full employment, generally available social services, equitable distribution of income and basic political freedoms. H. Bernstein comments that this scenario embodies a value judgement concerning society's needs (1).

His statement is an indirect description of the syndrome of underdevelopment, which the poor nations strive to overcome. Some indication of these problems can be gained by examining, in Table 1, the features of underdevelopment, which are relevant factors in the life cycle of an environmental information system.

The first factor - poverty - can be expressed both through shortage of capital as far as government finance is concerned, and paucity of per capita output. According to P. Baran, these are the two main characteristics of backward countries and account for their designation as underdeveloped (2).

As far as information systems are concerned, the main implication of poverty, in both its facets, is that information is not a priority at all. Poor countries have to struggle for survival, and so their scarce resources are allocated to basic areas, such as health, agriculture, education, transport, and the implementation of industries. As a consequence, the entire information
process, from its generation to the internal dissemination and exchange among the agencies, is seen as a luxury and either kept at an inadequate level - quantitatively or qualitatively - or not embarked upon at all. Collecting and processing local data are problematical and unsatisfactory as the result of deficiencies in equipment and personnel. The access to foreign information meets technological barriers (like obsolete computers or inadequate communication systems), and financial restrictions (such as devaluation of local currency in the international financial market, balance of payments, and royalties). Salaries are low and do not attract professionals from environmental sciences to work as information scientists.

The second characteristic of underdevelopment is what C. Furtado calls a dualistic economy, resulting from the penetration of modern capitalistic enterprises into archaic structures. It is likely to produce a hybrid structure, part tending to behave as a capitalist system, part perpetuating the features of the previously existing system (3).

This duality is reflected in the information scene by the fact that there are often just two kinds of services: either the 'grass roots' information of a practical character, for some specific groups of workers, or the scientific and technological information for an
elite. An example of the first one is the dissemination of agricultural information for rural workers, usually conducted at the instigation of, and with help from, FAO. The second of the two types - scientific and technological information for research workers - is more prestigious and receives a better share of the scarce resources. This partially happens because of its elitist characteristics and links with the international scientific community. A further reason is that, in the eyes of government, information for research workers indirectly supports technological advancement, a goal usually set in development programmes. This support is often given to the scientific community by supplying them with either foreign 'models' (patents, processes, etc.) or theoretical information to tackle specific problems on a short term basis. This narrow focus may be explained by the existing tendency in developing countries of not usually investing in long-term research programmes, since they are pressured by immediate needs.

This leads to the consideration of the third factor, which is the existence in developing countries of a technological 'gap'. In some of its implications this gap affects the process of information transfer, noticeably in electronics (data processing and communication), transport and micrographics.
Sharing information resources among organisations within the same country is a big problem where large distances cannot be overcome by good communication and transport system. This same barrier is found in the access to international networks or database systems, when the appropriate communication technology is not available. Poor countries face concern the prospect of a paperless society, like that foreseen by F. Lancaster (4), as they are not technologically prepared to participate in this progress; they have no money to import the necessary technology from abroad, and yet they could not survive without information generated in the advanced countries. It may be seen that technology invented by developed countries for their practical purposes and own economic reasons creates enormous problems for developing countries. One of the options presented to the Third World is the adoption of alternative technologies more suitable to their present conditions. But as seen for D. Solla Price (5), it would probably mean a return to traditional printing stage as the West goes paperless; to use mechanical processes, while the developed countries take advantage of electronics and holography. Obviously these options very often do not satisfy the developing countries either. It is sometimes felt that alternative technologies are merely methods promoted by developed countries to divert the more back-
ward countries from full development. Besides, the adoption of alternative information technology would not solve the problem if the foreign information is presented in a higher technological form, as they would not be able either to integrate into an international network or 'decode' the information they could get. The question of scientific information and the technology necessary to process it in developing countries has therefore the same socioeconomic and political components as the whole subject of development itself.

P. Baran points out the existence of a vast unproductive bureaucracy and a military establishment as typical handicap of backward countries, and among the principal obstacles to their economic growth (6). When it happens to have a military government, a frequent situation in developing countries, the result will be a military red tape in official organisations and services, with doubled bad effects. Just as this factor obstructs general development, so also it influences negatively the promotion of information systems:

- a huge amount of resources is wasted in these redundant institutions to the detriment of the productive sectors of the country;

- an excessive hierarchisation slows down the administration and the decision-making process, hinders
communication between different levels within the same organisation and among different ones. A further problem for information systems is that in such governments they are usually placed at a low hierarchical level.

- military beliefs and attitudes promoted by the central government make it very rigid and illiberal; as a consequence of defence being overemphasised by a military government, excess secrecy obstructs the free flow of information;

- internal struggle for power among civil organisations and between civil and military organisations results in gaps and overlaps in the areas to be covered, in loss of authority, and discontinuance of the system or service in question. As far as information is concerned, there is a tendency for some 'fashionable' sub-areas to be covered by a number of institutions whilst others receive no attention at all.

Linked to the above, is the fact that development programmes are in practice contingent upon a number of other factors. As a result of this contingency, some government programmes never come to be reality; some others are interrupted, with waste of effort and resources. Both internal and foreign pressure are responsible for this feature, along with incompetence
of authorities, absence of long-range planning and lack of resources. In such conditions, the stability of an environmental information system will depend on:

- the convictions of the ruling group in the central government about the value of formal information;
- the position given to information in general and to the specific subject - environment - in the main plan of government, and government's short-range goals towards development;
- how highly assessed is this specific sector supported by the information system, both by the internal and international market;
- approval granted by foreign creditors and political controllers.

The sixth factor listed - control of information media - is part of the political scenario within which the movement to development occurs. All means to bring information and education to the population are under certain kind of control by both national government and foreign bodies, the latter being represented by government agencies (including intelligence services), multinational companies, political groups and supranational organisations. National government itself operates through a system of either direct or indirect censorship, since it is usually very sensitive to criticism, does not believe in the public's capacity for
participation, and values excessive secrecy about official plans and data. This secrecy affects the transfer of information both to the national population and to foreign governments. Not only newspapers, radio and television are affected, but also the printing industry, mainly as concerned to publishing social sciences (books and periodicals). In addition to censorship, the government may control media by imposing severe economic constraints, like limitation of credit, and obstacles to import equipment and material.

Foreign influence in this specific case - control of information channels - is part of a broader politico-economic domination of poor by wealthy countries. So, it is manifested through both politico-ideological control and economic measures. The control may be exercised over the government, a specific national group or economic area, or directly over the population. Thus funding may be offered to a project or withdrawn from it according to the circumstance, as related to the interest of the specific foreign group or country at the time. Political ideology is disseminated in reading material and conferences, on the grounds of foreign cooperation in the national programme of education. Public opinion is frequently misled by campaigns carried through the media by foreign economic groups interested in the implementation
of business in the country, which would despoil the environment as a result.

Another facet of the international control of information channels is represented by the international news agencies. Developing countries do not have their own agencies, and news is transmitted to the world via international agencies (e.g. UPI, Reuter), which tend to either select maliciously the news to be published or distort the message received from local correspondents. Control over environmental information may become even tighter because overall the subject area deals with the knowledge of existing natural resources, the performance of industries, and the health condition of the population. National governments try to hide this kind of information from local public to avoid pressures, and from other governments in order to preserve national sovereignty.

On the other hand, foreign governments do their best to obtain this key information so that they may achieve domination of the political scene and have a hold on the economic potential of the country. Notwithstanding the vigilance of developing countries, data on their natural environment can be collected and processed with more accuracy by developed countries, thanks to the higher technology owned by the latter. For instance, in the case of images obtained by satellites, which are
easily available in the United States, but sometimes considered a 'national security matter' in the country from which the image is taken.

Foreign influence is also apparent, in a broader context, in the slavish imitation ('idolatry') of foreign models by developing countries. This attitude adopted is contradictory, as they reject intellectual colonisation and overvalue their own national characteristics. This is the result both of media control and of a whole politico-economic manipulation of backward countries by the developed nations, which has prevailed for centuries. Foreign products and ideas are promoted so massively in developing countries that they inhibit the generation of a national model and/or appropriate technology. T. dos Santos identifies this syndrome with the underdevelopment itself and, calls it 'dependent capitalism' (7), as A. Frank explains it through his theory of 'metropolis-satellite polarisation' (8). Both theories imply a condition of stagnation, within which the dominated country is prepared to consume products and information which the dominant country wants to disseminate and sell. In such a context, an information system in an underdeveloped country must attempt to deal with (and may break it) the monopoly of information by some foreign groups, and with the difficulty in selecting what is really needed from what is an artificial need created by the external producer or controller.
It is a further complication that within this setting the environmental information system has the role of encouraging and supporting research groups to develop national knowledge and consequent technology appropriate to the local environment.

Reaction to foreign domination can range from 'idolatry' of foreign models to an overestimation of national values. Nationalism is a common feature of developing countries, which is revealed in the international forum by overstressing each country's right to self-determination, and control over its own natural resources. Extreme nationalism tends to have a negative effect on information systems, as it makes the country impermeable to external ideas and developments, besides creating obstacles to the exchange of information. Here again the question of secrecy is relevant, since over-secrecy might impede the supply of information about specific aspects of the environment, such as natural resources and health both to foreign countries and supranational organisations.

A last factor - a deficient educational system - is one of the basic handicaps of developing countries. As far as environmental information systems are concerned it affects all levels: information professionals need better training in both information techniques and subject content; the specific users, that is the environ-
mental managers and scientists are not aware of the information resources available, and how to obtain and use them; the whole population needs to have free access to all levels of education and information in order to be able to achieve a better quality of life and then value a clean, balanced environment.

4.2 THE IMPLICATIONS OF ENVIRONMENTAL POLICY

The sensitive nature of a national environmental information system makes it entirely dependent on the policy adopted by the central government in relation both to human and natural environment, as it is intended to support government programmes and it is, moreover, maintained by government.

Six points have been identified in Table 1, as the main components of environmental policy which could determine the basic characteristics of an environmental information system. These components are:

1. Strategy on natural resources
2. Industrial development objectives
3. Pollution criteria and parameters
4. International exchange platform
5. Attitudes towards public participation
6. Subject areas of R & D encouraged
4.2.1 Conservationist Policy

When the central government adopts a conservationist policy in the management of environment the results may be as follow:

1. Strategy on natural resources:
   emphasis on natural resources, looking forward their protection for ecological reasons, and to preserving them for future generations. As a whole, in this situation there will be a smaller volume and less variety of data to be managed by the information system than under any of the other two policies. However, the area of natural resources will probably be the strongest feature in the system.

2. Industrial development objectives:
   the government will probably not encourage the implementation of industries because it values a clean environment more than the economic growth of the country. Environmentally sound technology would be welcome, even though government is not deeply involved in supporting its development. The information system will have a weak monitoring activity and a lack of data on both pollution and socioeconomic environment, but a good deal of information on alternative technologies.
3. Pollution criteria and parameters:
regulations to control pollution are very restrictive, as part of the scheme to discourage industrial development. There will be emphasis on the promotion and collection of studies like environmental impact statements.

4. International exchange platform:
conservationists are usually prone to consider the environment as a common inheritance to all living beings. If held in governmental circles, this attitude is likely to lead authorities to adopt, in diplomatic and international discussions, an open position about environmental subjects. It may also lead to a disposition towards the free international exchange of information and willing participation in any international information networks.

5. Attitude towards public participation:
government will welcome public participation in environmental affairs. However, the fact that government is already attending to environmental needs may mean that less public pressure is exerted on the subject and accordingly that less information support is demanded. If it really occurs, the information system will not be a priority for government.
6. Subject areas of R & D encouraged:
government will tend to sponsor educational and research programmes (and so the supporting information services) in subject areas related to natural sciences and landscape planning. There will be a tendency for the users of the information system to be scientists and researchers besides the environmental managers.

4.2.2 Ecodevelopmental Policy

When government has taken an ecodevelopmental line the whole planning system is directed to environmentally sound socioeconomic development, presenting the following specific tendencies:

1. Strategy on natural resources

Nature is seen as a benefit to be shared by the whole world and a resource to be used and managed individually by each country. Information will be needed about:

. the basic components of the environment (air, water, soil), from both the theoretical approach of nature and a practical view of local environment;

. products of soil and water, the so-called renewable natural resources, from both naturalistic
and economic points of view, from both global
and local approach;

- mineral resources, their nature, reserves, careful means of exploitation, and research
data on potential renewable substitutes;
- recycling of resources.

2. Industrial development objectives:

Industrial expansion is an important issue, and
government emphasises the development of technology
appropriate to physical and socioeconomic environ­
ment of the country. Transfer of technology is
considered in accordance with priorities of the
recipient country.

The information system will develop a collection of
data and documents both on technological and on
socioeconomic facets of the industrial development.
Hard data will be demanded as much as qualitative
information. All possible information on resource­
conserving, raw material-saving, low-energy, low­
waste and non-encroaching technologies should be
collected and made available. Information should
also be supplied on methods of assessing environ­
mental impact and undesirable deterioration by
natural disasters and human misuse. The social
sub-set of the information system dealing with the
human environment is going to be highly considered and
demanded by the government.
3. Pollution criteria and parameters:

Pollution control regulation is quite comprehensive and more flexible, as the parameters vary regionally according to the carrying capacity of local environment. This flexibility is part of the strategy to attract industries and keep them under the control of the local environmental agency. Monitoring systems, in this case, must be quite complex, and the resulting data are going to be a subset of the information system. The environmental impact statements are equally valuable. Information on the social aspects of pollution resulting from poverty and bad sanitary conditions might receive high consideration.

4. International exchange platform:

Ecodevelopment pays particular attention to developing countries sharing the same problems and similar environmental conditions. However most of the studies and researches are carried out in developed countries. Backward nations adopting an ecodevelopmental policy are usually open to international exchange of information, even though they are also very zealous in pursuit of their national sovereignty. The developing country will always expect to receive information from the developed world, but tends to be reluctant to supply informa-
tion about its own resources and policies, if the requesting country is not an ally or does not belong to the same politico-economic group. In this context the developing country may participate officially in international information networks, but the ambivalent nature of its participation may create some practical difficulties with the other members, and ethical problems for information workers.

5. Attitudes towards public participation:

The government will encourage public participation, which is expected to occur from all representative groups of society, manifesting different positions. It will result in high pressure on the government and, consequently, on the information system. Data and document collection must range from conservation of natural resources, and the social aspects of human environment to the high technology for industrial development.

6. Subject areas of R & D encouraged:

The government will give incentives to educational and research programmes in a variety of environmental related subjects, such as Natural Sciences, Agriculture, Environmental and Sanitary Engineering, Environmental Medicine, Urban and Landscape Planning. The information system must be prepared to satisfy
demands related to these programmes. Users will also represent the following variety of interests: environmental managers, governmental planners, scientists and technologists, social scientists, researchers and lecturers.

4.2.3 Technocratic Policy

A technocratic government tends to mean development at any cost, with environmental disruption accepted as a by-product of progress. In these circumstances the tendencies are as follows:

1. Strategy on natural resources:

Nature is regarded solely as an economic resource to be used in the most profitable way. The information required about natural resources will always show the economic bias of the government, and will stress the demand of quantitative aspects and the available technology to exploit existing resources. Data on natural resources, mainly mineral reserves, are a fundamental requirement by the government, and usually considered a sensitive subject.

2. Industrial development objectives:

A technocratic government tends to understand development as synonymous with economic growth, and consider industrial expansion as the way to reach it.
It will have little concern for protecting the environment and preventing pollution. Information will be demanded on cheap, profitable technologies, whether or not they are harmful to the environment.

3. Pollution criteria and parameters:

Pollution control regulation is quite limited and parameters very lax, so that industries are not deterred from coming to the country. Some monitoring is performed in order to alleviate the consequences of heavy pollution. Social information related to the pollution of poverty may eventually receive some consideration as marginal interest, to back up development programmes.

4. International exchange platform:

Backward countries with great ambition to develop try to get the maximum in resources and knowledge from outside in order to reach their goals more quickly. At the same time they attach some secrecy on information about their own natural reserves, which they plan to exploit on their own behalf. These countries have a very conflicting international relationship, as they need and want help; but they are not willing to renounce some rights to their national sovereignty in exchange. It rebounds on the information scene by creating an ambiguous position: central government controls the main
decisions about international exchange and is eager to receive information but very secretive in giving it to foreign countries. This position makes it more difficult for them to participate in international networks, or to collaborate with the information system of supranational organisations.

5. Attitude towards public participation:

The government will not give incentives to public movements in favour of protecting the environment, but these will probably occur as a result of the official neglect of both natural and social environment. Nor will programmes of environmental education be given much incentive. However the information system will be asked to follow up the development of the ecological movement, both on national and international levels, in order to provide government with necessary information to support its policies and promote good environmental public image. Anyhow the information system will probably be a high priority for a technocratic government, as it associates technological information with economic development.

6. Subject areas of R & D encouraged:

The government will give incentives to the development of applied knowledge. R & D information will be accordingly promoted, mainly in the areas of indus-
trial technology, Agriculture and all different branches of Engineering, where the abatement of pollution will also be included. Users will be mainly government planners and technologists.

The following chapters focus on the environmental situation in Brazil and the perspective of an information system to assist the environmental agencies in the country. Such an environmental information system will be determined by the fact of Brazil being a developing country and having, for many years, adopted a technocratic environmental policy, factors whose implications have just been discussed in the present chapter.
REFERENCES


The international community is poorly informed about the Brazilian environment and its management because of the shortage of publications which take a global approach to the subject, or which discuss the socio-economic implications of environmental management within the context of underdevelopment. For different reasons, both foreign and local writers fail to give this clear picture to the public.

The few foreign scientists and journalists attentive to the environmental issue in Brazil tend to analyse it from a single standpoint fashionable at a given time, as for instance now, the deforestation of the Amazon region, or the slums of São Paulo and Rio de Janeiro. Very frequently these analyses are flawed both because of the lack of global knowledge of the situation and the politico-economic bias of Western authors.

On the other hand, local information through the traditional means of monographs and magazine articles is also scarce because of some components of the present picture of the country:

a. the federal government has adopted a technocratic policy, which gives the environment little attention;
b. the environmental system of the government has been newly established and is still trying to sistematise its knowledge of the whole situation under the coordination of one body;

c. equally recent is the study of environmental sciences at the universities. Thus, there are few experts in the country capable of a holistic approach of the subject. The existing experts can write only from a specific point of view, such as Sanitary Engineering, Economics, Medicine, Biology, Urbanism or Chemical Engineering;

d. the printing industry is poor. This situation forces publishers to concentrate scarce resources on publications which could have a larger public. The potential number of consumers is already limited by illiteracy and poverty. The environment is not yet a candidate for a best-seller in Brazil;

e. central government is not interested in the promotion of mass education on the care of environment because public information and participation in official programmes is not a feature of a dictatorship - the form of government in power in Brazil since 1964. As a result, environmental matters have only very recently become a subject for debate amongst a broader audience, thanks mainly to the media;
f. censorship which were imposed by the central government and controlled by the military prevented printing and the media’s capacity to report on some governmental policies and facts, such as the ones related to the management of the country’s natural resources and public health.

The two main sources of information on the Brazilian environment are local media and governmental internal reports. They both constitute the fundamental information base for the present chapter, along with interviews conducted with managers of environmental agencies throughout the country.

5.1 CHECK-UP OF CONDITIONS

Brazil is the largest country of South America and the fifth largest in the world, among the following ones; which area is presented in square miles:

- USSR ................... 8,599,000
- CANADA .................. 3,851,809
- CHINA .................... 3,691,500
- USA ..................... 3,615,123
- BRAZIL .................. 3,286,487

The country is divided into five geoeconomic regions - North, Centrewest, Northeast, Southeast and South -
comprising twenty-one states, four federal territories and one federal district (the capital, Brasília). The states and territories are subdivided into 3,952 municipalities, the smallest political units of the country.

The North region consists of the states of Paraí, Amazonas and Acre, plus the territories of Amapá, Roraima and Rondônia. This is the largest and least populated region of the country, concentrating in the great majority of the remainder Brazilian Indians. Most of its area is still covered by the Amazon equatorial rainforest, and only 12% of its land is not under the risk of periodic floods caused by the many rivers which cross the region.

The Northeast region consists of the states of Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe, Bahia and the territory of Fernando de Noronha. It is the region which concentrates the most contrasting aspects: semidesertic areas and exuberance; extreme poverty and wasteful bourgeoisie.

The Southeast region includes the states of Minas Gerais, Espírito Santo, Rio de Janeiro, and São Paulo. This region presents some characteristics in comparison with the others: it is the most developed and the most
densely populated, has the highest levels of income, and aggregates the best agencies of social services.

The South region consists of the states of Paraná, Santa Catarina and Rio Grande do Sul. Its population descends basically from European immigrants. It is the second most developed region of the country.

The Centrewest region comprehends the states of Goiás, Mato Grosso and the federal district, Brasilia. Its varied landscape presents dense forests, a dry savannah and periodically flooded marshland. It is scarcely populated. Apart from Brasília that is a white-collar town, the region presents an agricultural economy, land property is concentrated in few hands and the living standard of the population is low.

Most of the country has a tropical climate, with an average 25°C temperature, the extreme levels pertain to the Northeast region (28°C-38°C) and the South (11°C to freezing). The topography presents five eighths of the territory as a plateau, and three eighths as plain and lowlands; the highest mountain is Pico da Neblina, in the North, with 3.014m high. Because the country has a huge area and so diversified physiographic conditions, it presents a variety of both resources and problems, in the social and the natural environment.
As resources are concerned, Brazilian total potential­ity is still unknown. The economy relies on both agriculture and industry, and Brazil leads the international market about some agricultural products. It is the largest producer of coffee, banana, manioc and sugar cane; the second largest producer of oranges, maize and cocoa; the third largest producer of soya beans, and the fourth largest of tobacco, peanuts and beef cattle.

In the industrial field the main factories are ship­building, motor cars, metals, foodstuffs, textiles and chemicals.

As regards the problems, some of them - poverty, illness, inadequate technology - are closely related to the underdeveloped facet of the country, as much as some others - industrial pollution, urban crowd - could be considered by-products of its development, as it will be discussed hereafter in the present chapter.

5.1.1 The Social Environment

Brazilian population in 1977 was the world's seventh biggest in the following rank:

CHINA..................975,200,000
INDIA..................622,700,000
According to official statistics, in 1975 the population had risen to 107,051,173, and is estimated to be 120,000,000 in 1980, and 222,112,247 in the year 2000 (2). In fact the birth rate has dropped from 4.65% in 1890 to 3.84% in 1970. A parallel decrease in death rate from 3.02% to 0.94% in the same period might explain the overall growth, which evolution from 1940 to 1980 can be observed in Table 2.

Population distribution is very uneven among different regions, and between rural and urban areas. The occupation of Brazilian territory by Portuguese in 1500 started from the Atlantic coast, which is still highly populated, concentrating two-fifths of the urban population, most of economic activities and jobs, and the best social conditions (such as health service, education and cultural opportunities).

In 1970, the mean distribution of population throughout the country was 11.2 inhabitants per square kilometer, but regional variations included: North region with only 1.01, Southeast region with 43.38, and the Greater São Paulo with 1,023.74 inhabitants per square kilometer.
**TABLE 2: POPULATION GROWTH IN BRAZIL**

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL (1,000)</th>
<th>URBAN Total (1,000)</th>
<th>URBAN %</th>
<th>RURAL Total (1,000)</th>
<th>RURAL %</th>
<th>BIRTH RATE %</th>
<th>DEATH RATE %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1940</td>
<td>41.236</td>
<td>12.880</td>
<td>31.2</td>
<td>28.356</td>
<td>68.8</td>
<td>4.35</td>
<td>2.48</td>
</tr>
<tr>
<td>1950</td>
<td>51.945</td>
<td>18.783</td>
<td>36.1</td>
<td>33.162</td>
<td>63.9</td>
<td>4.33</td>
<td>1.87</td>
</tr>
<tr>
<td>1960</td>
<td>70.993</td>
<td>32.005</td>
<td>45.1</td>
<td>38.988</td>
<td>54.9</td>
<td>4.34</td>
<td>1.26</td>
</tr>
<tr>
<td>1970</td>
<td>94.509</td>
<td>52.905</td>
<td>55.8</td>
<td>41.604</td>
<td>44.2</td>
<td>3.84</td>
<td>0.94</td>
</tr>
<tr>
<td>1980*</td>
<td>120.000</td>
<td>80.000</td>
<td>66.7</td>
<td>40.000</td>
<td>33.3</td>
<td>3.49</td>
<td>0.74</td>
</tr>
</tbody>
</table>

*estimate

**SOURCE:** Banco Nacional de Habitação - BNH

Just two megalopoles - São Paulo and Rio de Janeiro - situated in the Southeast region concentrate some 18% of the total population of the country. The estimated concentration of 66.7% of population in urban areas by 1980 is another datum of the uneven distribution. This dislocation from rural to urban and mainly to metropolitan areas started in the Thirties with policies of federal government encouraging industrialisation in order to replace imported goods.

An accelerated growth has been present since the Fifties, as it can be noticed in Table 2. It could be added that by 1949 agriculture and industry contributed equally to the gross domestic product with 26%. The situation has changed in 1973, when agriculture contributed with only 15%, and industry with 33%. Yet in 1973 the urban area, considered in its whole contribution, was responsible for 85% of the gross domestic product.

E. Reis & S. Schwartzman analyse the problem of spatial dislocation as a result of the dualism of Brazilian society: a large majority of the population living in underdeveloped and poor conditions look for a better quality of life in the major urban centres, which concentrate a modern and affluent sector, oriented towards the patterns of the developed countries (3).
This conclusion has been confirmed somehow by W. Baer & P. Geiger, who explain this massive urbanisation of the country, and the socioeconomic inequalities among regions through the patterns of industrialisation of Brazil, based upon the Centre-South since the very beginning. By 1907 the accumulated industrial production of São Paulo, Rio de Janeiro and Rio Grande do Sul totalled 77% of the overall industrial production of the country. In 1970, the Southeast region, with 42.7% of the Brazilian population, had 80.3% of the industrial production and provided 64.5% of the gross domestic product, in contrast with Northeast region which concentrated 30% of Brazilian population but contributed only 12.2% to the domestic product (4).

Various aspects of the differences and inequalities among regions can be observed in Table 3, such as:

a. the gigantic area of the North region has a low population density, only few big towns, low production, and low per capita income;

b. almost the same situation applies to Centrewest region, and it could be added that the plans and initiatives towards intensive exploitation of both regions are quite recent;

c. the Southeast region presents a contrast with the previous regions because in a relatively small area it concentrates a big population and a complex
<table>
<thead>
<tr>
<th>REGIONS</th>
<th>AREA (Km²)</th>
<th>POPULATION</th>
<th>DENS. INH./Km²</th>
<th>NO. URBAN NUCLEI</th>
<th>PRODUCT* Cr%</th>
<th>MONTHLY PER CAPITA INCOME (Cr%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NORTH</td>
<td>3,581,180</td>
<td>3,603,860</td>
<td>1.01</td>
<td>6</td>
<td>2.109</td>
<td>570</td>
</tr>
<tr>
<td>CENTREWEST</td>
<td>1,879,455</td>
<td>5,073,259</td>
<td>2.70</td>
<td>7</td>
<td>2.980</td>
<td>570</td>
</tr>
<tr>
<td>SOUTHEAST</td>
<td>924,935</td>
<td>39,853,498</td>
<td>43.38</td>
<td>51</td>
<td>67.034</td>
<td>1.660</td>
</tr>
<tr>
<td>SOUTH</td>
<td>577,723</td>
<td>16,496,493</td>
<td>29.35</td>
<td>42</td>
<td>17.849</td>
<td>1.060</td>
</tr>
<tr>
<td>NORTHEAST</td>
<td>1,548,672</td>
<td>28,111,927</td>
<td>18.23</td>
<td>51</td>
<td>13.612</td>
<td>470</td>
</tr>
<tr>
<td>TOTAL (Brazil)</td>
<td>8,511,965</td>
<td>93,139,037</td>
<td>11.2</td>
<td>157</td>
<td>515.000</td>
<td></td>
</tr>
</tbody>
</table>

* US$ = Cr$ 4.60 in July 1970

** Banco Central do Brasil estimate: US$ 500.00

*** In some critical areas of Northeast region there are still now people whose yearly income is under Cr$500.00

SOURCE: Comissão Nacional de Regiões Metropolitanas e Política Urbana - CNPU

Bresília, 1977. (Based on 1970 census)
socioeconomic system, to have the highest production and per capita income;

d. the South region is average: the smallest in size, the best distribution of population, and high per capita income, even though the production is only medium;

e. the Northeast region has a small area, and problems of population size and distribution, since people tend to concentrate in big towns. It has the lowest per capita income of the country, for although its overall production is close to that of the South region, the population is much higher and socioeconomic opportunities are much less than in the South.

R. Albuquerque & C. Cavalcanti also agree that the agglomeration of most of the economic activities in the Centre-South of the country is unfair and generates inequalities. However they focus the problem upon the local factors which have provoked the rural exodus and impeded the development of both North and Northeast regions. For Northeast they blame the factor of draught; concerning the North, they suggest the obstacles to development were concentration on monoculture and industrialisation of rubber, and the delay in actually populating and integrating Amazonia to the economically used areas of the country (5).
A theme common to most of the writers cited is that the urban concentration of industries and of other important economic activities associated with the available social apparatus, is considered responsible for regional inequalities and the underdevelopment of rural areas. However the question can also be discussed from the opposite point of view by analysing its implications upon cities and metropoles.

The President of Brazil in 1976, addressing a National Symposium of Urban Policy, mentioned as the positive side of urbanisation that the city constitutes the vanguard of the process of industrialisation and economic modernisation of the country, and has been the leaver into the labour force towards political protest, and socioeconomic demands. On the other hand he pointed out some negative effects of the fast and uncoordinated process of urbanisation, as it has occurred in Brazil:

- unbalance between the economic power of cities and their weak infrastructure, mainly in relation to the social agencies;

- disproportion between the accelerated and premature growth of metropoles and the atrophy of small towns, destituted of minimum socioeconomic conditions for progress, and unable to retain their own residents;
generation of social tensions in the metropoles because of frustration of individuals facing a decaying quality of life in a polluted environment (6).

These conflicts are basically rooted in the point that urban agglomeration in Brazil results from internal migration of working class people looking for better opportunities in cities. Since they are short of resources, they have to shelter themselves in either very cheap or unoccupied areas, which means living on the periphery of cities or in places with very poor hygienic conditions. In this way slums are generated.

In having to apportion its wealth amongst a large and deprived population, a metropolis becomes desstructured and ends up with inefficient sanitation and health services, educational system, housing, energy, communication, transport, employment and leisure organisation.

To confirm this picture, one may quote the president of the Comissão Nacional de Regiões Metropolitanas e Política Urbana - CNPU - who stated in interview that the greatest social problems of Brazilian society lie probably in the nine metropolitan regions, because of the large concentration of industries and people crammed together in a decaying environment with conflicts caused by large inequalities among social classes. Approaching the question this way, he believes the most effective environmental policy should start by solving the social problems of metropolitan regions (7).
To complete the picture of the Brazilian social environment some other data must be added. The main resources of information for this section were: the Brazilian National Report to the Stockholm Conference (8), a study done by the Ministry of Interior on the conditions of Brazilian environment, and governmental structure and actions to deal with the matter (9), the II National Development Plan - II PND - for 1975-79 (10), and the Anuário Estatístico do Brasil (2).

The situation is still critical, in spite of the improvement already registered and the ambitious goals set by the government in the II PND. Large pockets of absolute poverty can still be found in the Northeast region, in rural areas and on the periphery of cities. The economic policy of the government has growth as the main goal, showing an impressive increase of GDP during last three decades, as it can be seen through figures at the constant prices of 1949:

<table>
<thead>
<tr>
<th>Year</th>
<th>GDP (in Cr$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1950</td>
<td>2,444,800,000.00</td>
</tr>
<tr>
<td>1955</td>
<td>3,400,000,000.00</td>
</tr>
<tr>
<td>1960</td>
<td>4,729,000,000.00</td>
</tr>
<tr>
<td>1965</td>
<td>5,895,000,000.00</td>
</tr>
<tr>
<td>1970</td>
<td>8,492,900,000.00</td>
</tr>
<tr>
<td>1975</td>
<td>12,618,000,000.00</td>
</tr>
<tr>
<td>1978</td>
<td>15,308,200,000.00</td>
</tr>
</tbody>
</table>
But this goal has been achieved at high social costs for the bulk of the population, in the form of a high cost of living, a decrease in real value of wages and salaries, unemployment, malnutrition, poor housing conditions, and the deterioration of environmental conditions. These social consequences derive partially from the economic strategy of government being based on the upper and middle classes. The result of such a policy has been the widening of the gap between social classes. The government itself, in the II PND, accepted the blame for the socioeconomic inequalities existing in the country, and expressed its conviction as to the urgent need for a change in policy, in order to guarantee both growth and redistribution simultaneously; and concluded that:

"the problem of income, in Brazil, is a problem of distribution and of level, to eliminate poverty" (11),

referring to both the gaps between classes and the absolute poverty.

The following data are intended to portray the socioeconomic level of the population:

a. in 1970, 51.5% of the population were under 20 years old;

b. 51.4% of urban population over 13 years old were illiterate in 1970. It was a goal of the federal government to reach 90% of full literacy (people
over 15 years old) in the whole country by 1980, but this figure is too optimistic;
c. only 31.7% of the population were economically active in 1970, showing the situation had worsened since 1940, when 34.1% of Brazilians were active. It is anticipated by the Government that this proportion will have risen to 42.1% in 1980;
d. 20% of the economically active were women, a number which has increased by 8% from 1940;
e. 50.7% of the total economically active population earned less than US$ 43.47* a month in 1970. It is still accepted that 50% of the people living in towns of over 50,000 inhabitants earn less than twice the minimum wage. Unemployment and underemployment has risen since 1940 and one reason often suggested is the insufficient growth of the industrial sector of the economy. Industry has not created enough jobs to employ the mass of 6,500,000 workers released from agriculture as a consequence of the accelerated change occurring in the economic structure of the country since 1940. Government plans are directed towards converting the 4,800,000 jobs offered by industry in 1970 into 8,600,000 jobs in 1980, which will represent a rise of 79%, and increase of 3.5% per year in the overall employment opportunities;

* US$ 1.00 = Cr$ 4.60 in July 1970, when the minimum wage used to vary regionally from Cr$ 187.20 (Rio de Janeiro and São Paulo) to Cr$ 124.80 (Northeast).
f. the 1970 per capita income was estimated in US$ 500.00, and personal consumption per capita in US$ 375.00. In an inflationary economy, these data can be more meaningful if analysed in association with the low proportion of families possessing some basic durable goods, such as cooking stoves (gas or electric)... 43% of all families radios........................................... 59% ' ' ' ' ' refrigerator............................... 26% ' ' ' ' ' television set............................ 24% ' ' ' ' ' car.............................................. 9% ' ' ' ' ' In rural areas these rates were obviously much lower. Government prospects for 1980 are the increase of per capita income to over US$ 1,000.00 and personal consumption per capita to US$ 740.00;

g. the cost of living has increased impressively. Taking the working class in São Paulo as an example, the index (wholesale + building construction + retail) presents the following figures, at 1951 prices:

<table>
<thead>
<tr>
<th>Year</th>
<th>Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1951</td>
<td>100</td>
</tr>
<tr>
<td>1960</td>
<td>657</td>
</tr>
<tr>
<td>1965</td>
<td>6.741</td>
</tr>
<tr>
<td>1970</td>
<td>25.171</td>
</tr>
<tr>
<td>1977</td>
<td>1.523</td>
</tr>
</tbody>
</table>
It makes the pure economic growth (either GNP or GDP) a suspicious measure of the improvement of the country's condition, as far as the population is concerned, once GNP, GDP and cost of living all rise equally fast.

In the present work the health and sanitary conditions of the country have been reviewed through the II PND (10), through a study performed by P. Singer et al. about preventive medicine in Brazil (12), and by direct interview with the environmental managers.

As an overview of the problem, Singer et al. found that:

- since the beginning of this century medicine and sanitation have progressed quite a lot in the country, helping to reduce the incidence of some of the main pestilential diseases (13);

- health conditions in Brazil have deteriorated since 1960, in relation to infectious and parasitical diseases, because the economic deterioration of population meant increased concentration of income, lowering of real minimum wage and consequent decreasing of the consumption capacity of workers (14);

- there is a strong correlation between the mortality rate and the socioeconomic level of different sectors of Brazilian population (regional variations), which led them to conclude that 'avoidable' death in the
country is a product of poverty, lack of education
and lack of sanitation (15);

psychiatric and chronic-degenerative diseases have
increased in the more developed regions of the
country, a fact that suggests an interrelation
between economic development, environmental
deterioration and the increase of this group of
diseases (15);

Some other data are:

a. only 55% of the urban population had water supply
   service in 1970. The sanitation plan aims to serve
   80% of that group by 1980, and quite possibly this
   estimate will be surpassed. It must be noted however
   that the conditions of supply vary from only piping
   the water, to a very sophisticated treatment of the
   water before delivering it, depending on the local
   conditions (level of pollution, availability of
   resources and laboratories);

b. only 30% of the urban population were served by a
   proper sewerage system in 1970, and it is worth
   mentioning that only São Paulo and Rio de Janeiro
   have over 50% of population served. The sanitation
   plan looks toward reaching 50% by 1980, a quite
   ambitious goal to achieve. Shortage of resources
   of both government and population, and lack of
   sanitary education are the main causes delaying
the progress of sanitary works in the country.

An absurd situation exists where the sewerage system has been built but a large proportion of the population does not allow the local authority to connect their houses to the main, either because they cannot afford to pay for the service or they do not see the need for it. From the point of view of the local authorities in poor regions, the general complaint is that they cannot afford to pay interest to the federal agency - PLÂNÂSA - in charge of controlling and financing sanitary works throughout the country;

c. life expectancy is estimated to increase from 59 years old in 1970 to 65 years old in 1980;

d. the death rate is expected to decrease from 0.94%* in 1970 to 0.74% in 1980;

e. the birth rate is estimated to fall from 3.84% in 1970 to 3.49% in 1980, the fall being accentuated in urban areas;

f. infant mortality has decreased from 20.23% in 1941 to 10.8% in 1970. Nevertheless, the government recognised in the national health programme, in 1975, that 30% of the infant population in the country is undernourished, even including the developed areas. For example, 12% of the deaths of children under four years old in São Paulo is caused by malnutrition (16);

* The 1970 death rate varies with the sources used: BNH: 0.94%; IIPND: 0.99%; Singer et al.: 1.01%
g. over 40,000,000 Brazilian suffer from verminosis transmitted through contaminated food, water and direct contact of barefeet with soil. This disease is considered a by-product of combined factors, such as poverty, deficient education and lack of sanitation;

h. in 1975 malaria was prevalent in an area of 6,900,000 km² of the Brazilian territory, inhabited by 42,100,000 people. Malaria is a disease typical of areas without sanitation. The highest levels of incidence are likely to happen in the North region, and in areas of the states of Maranhão, Santa Catarina, Mato Grosso and Goiás;

i. in 1975 over 3,000,000 people suffered from schistosomiasis (or bilharziasis), another by-product of low sanitary conditions. A tendency for this disease to increase has been observed in the period 1970-75. The areas of highest prevalence are: Northeast region, and the states of Minas Gerais, Paraná and São Paulo;

j. since 1950 some measures have been taken against Chagas disease, which is linked to poor housing condition, but the disease has been increasing every year. It is estimated that over 4,000,000 people are affected by the disease;
1. tuberculosis has decreased quite a lot in the country from the last century, but it is still a serious public health problem, especially in the North because of low hygienic conditions, deficient education, and malnutrition;

m. leprosy is still quite frequent in the North, Southeast and Centrewest regions, and in the states of Maranhão and Paraná. It occurs principally among poor people, living in low hygiene conditions;

n. yellow fever is typical of Amazon region, in about 3,800,000 km². A secondary risk level includes the states of Maranhão*, Mato Grosso*, Goiás*, Minas Gerais, São Paulo, Paraná, Santa Catarina, and Rio Grande do Sul, where the virus occurs periodically, hitting mainly primates. This disease results from lack of sanitation;

o. plague had since 1935 been reduced to some areas of high poverty and low sanitation in Northeast region. But in 1974 the disease recurred in eight states, including developed regions, suggesting that sanitary conditions are still poor all over the country;

p. goitre is a problem in some inland areas where the incidence has for many years been over 16% of school children;

q. trachoma, which is linked to misery, ignorance and insanitary conditions, occurs mainly in rural areas

* That is those parts of these states not included in the Amazon region.
and has been diagnosed in 572 municipalities in the states of Bahia, Pará, Paraná, Pernambuco and Piauí.

From the picture presented by P. Singer et al. (12), it may be concluded that the poor health of Brazilians is a consequence of the country's underdevelopment, and the government's present economic policy has done little to alleviate these conditions. This deteriorating social standard constitutes most of the environmental pollution in Brazil, a typical situation of all developing countries, as discussed in both the Founex Panel and the Stockholm Conference.

5.1.2 The Natural Environment

The deterioration of the Brazilian environment must be analysed through an economic perspective, since it results from economic exploitation of its natural resources and industrialisation. For over three centuries, after Brazil's discovery in 1500 by Portugal, natural resources were exploited by the colonising country and its allies. These would supply in return the manufactured goods, but not the technology, because a decree of 1785 prohibited the implementation of factories in the colony. Brazil became politically independent from Portugal in 1822, but this fact did
not change the pattern of exploitation of its environment. As a result of its political immaturity, poor finances, non-existent technology, and scarce social opportunities for the development of the bulk of the population, Brazil has been kept in condition of dependence on the international economy. Today the conditions of the country have obviously improved as compared to last century, and the level of dependence is less intense, but the substance of the problem is still the same. The government achieves no more than to change, from time to time, the direction of dependence, that is the foreign country (or group of countries), which plays the double role of supplier/exploiter, as in the colonial times. And internally the lack of education, resources and technology still create the conditions for Brazilians to degrade their own environment. Both the state of dependence and the internal substandard conditions are typical of underdevelopment.

R. Campos, who was Brazilian Minister of Finance in the early stage of the developmental race, justifies technological and economic dependence to external suppliers, and also the surrender of the country's natural resources to foreign exploitation, as a step towards advancement. He considers both situations as facets of the fallacy of a bad-tempered nationalism, which has been manifested in the Brazilian economy in relation to the policy of petrol and mineral resources exploitation, and foreign
capital investments. He concludes that the kind of nationalism advocated by some political groups could be fatal to Brazil, since it only objects to the participation of foreigners in the internal economy, but is unable to supply internally what it rejects from abroad (16).

A quite different approach is presented by D. Matz, who has sympathy for the environment of developing countries. Based on C. Furtado’s O Mito do Desenvolvimento Econômico, D. Matz states that it is the desire for economic development which makes poor countries accept dependence on and exploitation by the wealthy. Unfortunately, the desire to escape from poverty and backwardness is usually accompanied, in developing countries, by a parallel impulse towards emulation of developed nations growth. In order to grow, developing countries usually choose one (or both) of these two strategies: expansion of industrial production and increase of the exports of primary products. Both of them are likely to lead to deterioration of the environment through an increasing artificial demand for natural resources; on top of this, industrialisation may also cause pollution by using wasteful methods or non-appropriate technology (17). The situation described by D. Matz is a quite accurate description of how and why the Brazilian natural environment becomes despoiled.
Regarding the industrialisation of Brazil, its early stage was restricted to small workshops intended to produce rudimentary agricultural implements, textile and sugar mills. Both W. Baer (18) and a report of the Federação das Indústrias do Estado de São Paulo (19) assert that it happened in the sixteenth century, under the inspiration and coordination of the Jesuits, at the captaincy of São Paulo. But, according to the report cited (19), W. Dean (20) and H. Schlesinger (21) actual factories were introduced only by the nineteenth century, starting in São Paulo, where a foundry was established in 1810, a cotton textile mill was built in 1811 and, in 1836: a sugar refinery was the first plant to use steam power. After São Paulo, the industrial expansion also reached Rio de Janeiro, Minas Gerais, Rio Grande do Sul and Pernambuco, at the same time that production was diversified. Development was very slow in the beginning, so that in 1881 there were only 44 factories in the country. However, by 1890 the country had 636 industries, giving jobs to 54,169 people. As capital investment is concerned, the distribution was:

60% .................. textiles
15% .................. food
10% .................. chemicals
4% .................. timber
3.5% .................. clothing
3% .................. metals
During the present century industrial expansion resulted in substantial increases in the number of factories, as shown by the following figures:

<table>
<thead>
<tr>
<th>Year</th>
<th>Factories</th>
</tr>
</thead>
<tbody>
<tr>
<td>1920</td>
<td>13,569</td>
</tr>
<tr>
<td>1940</td>
<td>43,418</td>
</tr>
<tr>
<td>1960</td>
<td>110,771</td>
</tr>
<tr>
<td>1970</td>
<td>200,000</td>
</tr>
</tbody>
</table>

W. Suzigan interprets the industrial development of Brazil and presents some historical facts. He suggests that the first industrial boom occurred in the period 1895-99, thanks to factors such as: governmental protectionist policy forbidding import of goods; some utilisation of hydraulic potential to produce energy; expansion of capital (both, internal, arising from coffee cultivation and, external, through foreign credit and investment); construction of railways in the Southeast region; and the creation of a limited internal market.

After this first boom, other flourishing periods for industry have been:

- immediately after the World War I;
- during the Thirties, mainly 1933-36;
- after the World War II, mainly 1958-62;
- from 1968.

Overall, from 1911 till 1932 industry experienced an average growth of 3.6% yearly; from 1933 onwards it has
grown at around 8.5% a year. For W. Suzigan, the Brazilian economy till the Fifties concentrated in the development of agriculture and commerce, a policy which was an obstacle to the earlier industrialisation of the country; only from 1957 did industrial development become the main priority for government (22).

This emphasis on the development of primary production (basically agriculture) associated with trade is confirmed by A. Vilela and W. Suzigan, when they show that the main products exported by Brazil in the period 1839-1945 were: coffee, rubber, leather, sugar, cotton, cocoa, mate tea, and tobacco, in this order of importance (23).

The changing of economic goals through an aggressive policy towards scientific and technological development is evaluated by E. Guimarães and E. Ford, throughout governmental programmes elaborated in the period 1956-73 (24).

W. Suzigan et al., after analysing the behaviour of the whole economy, foresee that the development of Brazilian industry will, in the near future, be promoted by the combination of three factors: growth of the internal market, diversification of industrial exports, and replacement of imports by national products (25).
Three further points are worth mentioning, since they may be considered some of the components of a situation likely to produce pollution. First of all it should be remembered that, in a country with hydro-electric potential of 150,000,000 kwa, 80% of the energy utilised by industries till 1940 was thermal, produced by either charcoal or wood, contributing to air pollution and deforestation as by-products.

The second point is the tendency, from the early stage of industrialisation, to concentrate factories in the South-Centre of the country, where, accordingly, the migration (foreigners and Brazilians) was directed (26). The third point, mentioned by W. Dean is the obsolescence of equipment in use after the World War II, associated with the production of waste (27). Later in 1967 J. Pereira found that the situation had improved but still 30% of industries in São Paulo had no equipment dated 1955 or later (28).

Regarding D. Matz's observations (17), the evolution of Brazilian economic policy towards the 'myth of development' has then followed the pattern which leads developing countries from dependence and foreign exploitation to environmental pollution and despoliation of their own natural resources.

The other aspect of the genesis of environmental deterioration in the country - pollution of poverty - has been already presented in the review of the social environment in 5.1.1.
On the whole, the environmental distortions resulting from industrialisation, deficient sanitation and exploitation of natural resources can be grouped into six broad categories:

- soil and subsoil exploitation
- flora and fauna dilapidation
- fresh water pollution
- marine pollution
- air pollution
- noise pollution

a. Soil and subsoil exploitation

In 1977, only 4% of the Brazilian territory was cultivated. (Though the percentage of utilisation could be stated as 19% if pastures were also taken into account).

Traditional methods prevail in agriculture, some of them inherited from Brazilian Indians. The use of mechanisation and fertilisers is still restricted to the big farms, since peasants are poor and insufficiently educated, have very little technological support, and only very feable social assistance from the Government.

Some of these traditional methods, such as burning to clear space, and practicing shafting cultivation, result in soil empowerment and erosion. On the other hand, lack of assistance leads rural workers
to misuse technology (equipment, chemicals and processes), resulting in problems identical to those associated with traditional methods.

The Brazilian national report to the Stockholm Conference lists some examples of areas in the country, for which soil has been exhausted:

- the Minas Gerais Wood Zone (Zona da Mata Mineira): the forest was cut down to make way for the monoculture of coffee. Today this area has become a large pasture;

- Paraíba Valley has also been exhausted by monoculture of coffee. Today it is used mainly as pastures and industrial sites, even though some small farms still exist;

- Northeast Wood Zone (Zona da Mata do Nordeste): the forests were replaced by sugar cane plantations. This massive change interfered with both the soil and the climate, and is thought to be one possible cause of the aridity of Northeast 'Sertão', a candidate area for desertification;

- Palm-Tree Zone (Zona dos Cocais), an area in between Amazon, Northeast and Centrewest regions, where part of the Amazon equatorial forest was burnt long ago. Today only palm-trees grow in the area (29).
The question of deforestation, in order to open motorways or to build factories, or to make pastures, or merely to produce charcoal, is an ever controversial subject, which has been debated in Brazil and outside, mainly in connection with the Amazon rain forest. Foreign countries protest against the destruction of the 'world's lung', a very controversial argument even among the scientists. However an actual problem for Brazil is the vulnerability of its soil (mainly in the equatorial region) to laterisation. This phenomenon occurs as a consequence of bioclimatic changes, and results in erosion and loss of fertility of soil.

Regarding erosion, the problem areas listed by the report are:

- some areas of the state of Rio de Janeiro, specially in the mountains and hills nearby the cities of Rio de Janeiro and Petrópolis;
- River Doce Valley;
- Ribeira do Iguape Valley;
- River Itapicuru Valley;
- litoral of the states of Santa Catarina and Paraná (29).

As a consequence of the erosion, the three above-mentioned rivers became silted, lost their navigability, and are likely to flood more easily, besides having had their ecology modified. The river Doce, for instance, flooded
early in 1979 covering its entire medium and low valley, including towns.

The eroded areas as a whole experience change in their microclimates, showing an increase in thermal amplitude, as a result of the modifications introduced in the ecosystem. The landscape has been affected, as have certain safety aspects, as for example, the frequent cracking and collapse of inhabited hills in Rio de Janeiro.

A further problem is the dry areas of the Northeast, the so called 'Polygon of Droughts', which covers 936,933 km² from Maranhão to the North of Minas Gerais. The risk of desertification is very high, and efforts have been made to recuperate the area. Enormous social problems are associated with the situation, since 25% of Brazilian population live in this area, of which the economy is based mainly in agriculture and cattle raising, both activities often destroyed by long droughts.

Soil pollution by chemicals - fertilisers and pesticides - has been another problem in Brazil. It is the result of lack of information and specific training of rural workers, who spread the chemicals randomly and exaggeratedly, contaminating soil, crops, air and water, and affecting both humans and animals. H. Alves comments that, out of the 34,000,000 ha cultivated in Brazil,
only 18.5% have been treated with pesticides, at an average of 18kg per hectare. However the highest consumption of pesticides pertains to the South-Centre part of the country, where the level is considered among the highest in the world, with alarming consequences (30).

W. Almeida introduces biological agents as another factor of soil contamination. It happens very often in Brazil, in both rural and urban areas where the sanitary conditions are poor (31).

A further agent of soil degradation in Brazil is solid waste, which can be considered a factor of water and air pollution as well. The problem is analysed by W. Oliveira, who refers to 1971 statistical data to describe the situation in the country, restricted to only urban areas. There was found to be some kind of service to collect and remove litter in 100% of the capitals and in 81% of towns, serving to 52% of the urban population. Disposal of solid waste is usually carried out in open-air sanitary deposits; less often it is thrown into the sea or into rivers. Very exceptionally, it is incinerated or recycled. In 1971 there were 16 factories producing composites from litter, and 15 incinerators in the country (32). Apart from recycling, all other forms of disposal of solid waste have been producing considerable pollution.
As far as subsoil is concerned the exploitation refers to extraction of minerals and petrol. Petrobras, a Brazilian quango, is responsible for prospecting, extraction, refinery and distribution of petrol. Petrobras has been blamed to cause some environmental problems, specially in Rio Grande do Sul, but it has now created its own department of environmental protection. In parallel, quite a lot of marine pollution has been caused by oil-tankers and ships filling and washing up. The oil reserves in Brazilian subsoil are still unknown and the oil already found is a relatively modest amount.

On the other hand mineral extraction is a major business in Brazil, even though knowledge about its entire mineral potential is still limited. Extraction has occurred without much concern for the environment, mainly as regards the extraction of crystal, diamonds and semi-precious stones. As an example, the state of Minas Gerais, which has good reserves of iron, gold, gems and semi-precious stones, has been ravaged: soil and subsoil are revolved; holes and galleries are opened and abandoned later; mountains of iron ore are literally cut down; rivers are silted and fouled by chemicals and ore waste.

A considerable amount of the capital invested in the extraction of minerals is foreign, though this may not be immediately apparent because companies are disguised
under a national trade name. This is again a confirmation of D. Matz's point of view about foreign exploitation of national natural resources without environmental concern or much profit for the developing country explored (17).

b. Flora and fauna dilapidation

This aspect of the environment is marginal to the main focus of the present work, which is concerned with pollution. Besides, some problems have been discussed under soil exploitation, since they are common. So, some points will be mentioned briefly, only to complete the picture of the state of Brazilian environment.

In 1500, at the time Portuguese colonisers arrived in the country, Brazil had 5.190.000 km² of forests, well conserved till 1911, when it still had 5.018.333 km². In 1970 the area covered by forests dropped to 3.400.000 km². The distribution is very uneven, and 90% of the existing native forest of the country is in the Amazon region. The areas of most intense exploitation are: the pine zone in Paraná, the plateau of São Paulo, the River Doce Valley and Wood Zone both in Minas Gerais, and more recently the Amazon region. As regards urban areas, replacing trees by skyscrapers has been a common pattern of urbanisation in Brazil.
Recently, starting from the 'rehumanisation' of Curitiba (Paraná), trees, gardens, and parks came back to urban plans again.

Government intervention refers to the creation of national parks and reserves, the adoption of controlling legislation, and the institution of fiscal incentives for reforestation. The formation of a 'green belt' around industrial areas has been observed recently, as a fringe-control of pollution.

Treatment of Brazilian fauna has been parallel to that of flora. As a consequence of forests being chopped down, wild life was also affected negatively. Brazilian fauna is considered very varied, but numerically poor in relation to other continents. There are 4,266 known species of vertebrates and over 680,000 species of invertebrates in the country. It is estimated that 70% of the Brazilian fauna have been lost as a consequence of changes in the habitat, mainly due to deforestation. Predatory hunting and fishing have also contributed to their destruction. As with flora, the protection of fauna is conducted through legislation, and the institution of national parks and reserves. However, the continental dimension of the country is an obstacle to control.
c. Fresh water pollution

The sources of fresh water pollution in Brazil are:

- Domestic sewerage and waste: This is the largest single cause of pollution, and affects the whole country, principally in areas with high demographic concentration. It constitutes a serious health hazard because most of it is permitted to enter the water course in its natural state. It has been the main agent in the dissemination of waterborne diseases. On top of this, most detergents on sale are still non-biodegradable, and petrol stations and some small industries use the ordinary sewerage system to drain their waste. Poverty and lack of sanitary education lie at the root of this kind of pollution.

- Agriculture wastes: Three basic sources of water pollution from agricultural activities are pesticides, fertilisers and minerals from the soil. The water is contaminated either directly during the application of these chemicals or indirectly through irrigation and rain which carry them from the soil to the nearest water course. Part of the problem results from lack of education of rural workers, who do not know how to use these chemicals properly, and are not aware of their side-effects.
Pesticides are also much used by public health and sanitation services to extinguish specific carriers of disease, such as insects, in some areas of Brazil.

Industrial effluents: This problem is more acute in urban areas and near industrial sites, particularly in the Southeast, South and Northeast regions. Most enterprises, which carry pollutant activities, process their effluents before disposing of them into a water course. But sometimes they do not, or they do it inefficiently, or accidents happen despite safety installations. Facing actual problems in the above mentioned regions, there is a growing concern amongst the population about increasing industrial pollution, which is a by-product of regional economic concentration and governmental policy towards industrial growth.

Fresh water pollution is particularly critical in certain areas of Brazil, such as:

the state of São Paulo, where a combination of high industrial and demographic concentration in the metropolis and big towns have transformed the rivers Tietê, Piracicaba, Capivari, Sorocaba and Jundiaí into an open-air sewerage system with very high content of chemicals. The two most polluted areas of the state, as far as fresh water is concerned, are the Greater São Paulo and Cubatão;
rivers Guaíba, Sinos, Gravataí and Caí, in the state of Rio Grande do Sul, due mainly to industrial waste. Pollution of rivers and streams by agricultural waste is also serious in Rio Grande do Sul. The towns more deeply hit by industrial pollution of rivers are Porto Alegre, Novo Hamburgo, São Leopoldo and Gravataí;

river Paraíba do Sul and tributaries, which run through the states of Minas Gerais, São Paulo and Rio de Janeiro, and are polluted by domestic, industrial and agricultural waste. River Paraíba is the main source of water supply for 70% of population of the state of Rio de Janeiro, situated downstream;

rivers Beberibe, Capibaribe, Botafogo, Jaboatão, Gurjaú, Paratibe and Pirapama, all in Pernambuco. These are polluted by chemical industries, sugar mills and domestic sewage. Recife, the regional metropolis, is traversed by the rivers Capibaribe and Beberibe. Silting of rivers is the main cause of periodic floods in Pernambuco;

Minas Gerais, where industries and specially mineral extraction have been polluting most of rivers. There is greater concern about rivers Velhas, Paraopeba and São Francisco. Belo Horizonte, the capital of Minas Gerais, is traversed by the river
Arrudas, which has been converted into a putrid sewerage and a source of periodic flood;

- in the state of Paraná attention has been paid to the rivers Iguaçu and Tibagi, polluted by both domestic sewage and industrial waste;

- Salvador, capital of Bahia, has its water supply endangered by chemical pollution of the industrial district of Camaçari located upstream;

- in Rio de Janeiro, the lakes Rodrigo de Freitas and Jacarépaguá, which have been constantly polluted by domestic sewage.

**d. Marine pollution**

H. Moreira emphasises the importance of the sea for Brazil, since the country has 4,500 miles of its territory reached by the Atlantic, which represents 96% of its external commerce; business through tourism, an important reserve of protein, and source of free leisure for all social classes (33).

The sources of marine pollution in Brazil are:

- industrial effluents
- domestic sewage
- solid waste
- petrol and its derivatives
- agricultural waste
- radioactivity
Guanabara bay, in Rio de Janeiro, owes 30% of its pollution to industrial effluents, besides being the main disposal of solid waste and sewage for that megalopolis. Out of a total 260,000 m³ of sewage disposed of daily, only 10% is previously processed. The amount of petrol thrown into the Guanabara bay by ships, boats, oil-tankers and petrol stations has been estimated in over seven tons daily.

Yet in the state of Rio de Janeiro, the population is very concerned about the installation of nuclear plants in Angra dos Reis, a beautiful and still wild sea-resort.

In the state of São Paulo, the coastline near Santos is very polluted by industrial waste and the heavy activities of the busiest harbour of the country.

In the state of Bahia, the Todos os Santos bay and all the coastline nearby Salvador is polluted by both domestic sewage and industrial effluents (mainly mercury).

In the state of Alagoas, both the sea and the lagoons have been polluted heavily by both industrial and domestic waste.

The coastline of Rio Grande do Sul, partially polluted by industrial effluents, presented an alarming situation in 1978 when an extensive area had to be evacuated.
because of a poisonous gas coming from the sea. Yet in the South region, the bay of Florianópolis (Santa Catarina) and Paranaguá (Paraná) present an increase in pollution by domestic and industrial waste, along with petrol.

The danger from petrol leaking from ships, oil-tankers, terminals and also from extraction is a great concern in the country. Actually this kind of spillage from ships and terminals is quite frequent, and spillage from oil-tankers has also happened occasionally.

e. Air pollution

Atmospheric pollution in Brazil is not a generalised problem, but is limited to the metropoles and the industrial areas where, besides the factories, there is always a higher demographic concentration because of job availability. The principal sources of air pollution in these places are cars, followed by industries and incinerators of domestic waste. As an indication, in 1973, there were 1,000,000 cars in the city of São Paulo which consumed 2,800,000 m³ of petrol and 1,200,000 m³ of diesel oil (34).

The main pollutants are: carbon monoxide, sulphur dioxide, nitrogen oxides, hydrocarbons and particles (soot and dust). The states of São Paulo and Rio de Janeiro have the worst situation, even though all
metropolitan areas and the so called industrial districts show an increasing air pollution. In São Paulo, two areas have alarming levels of pollution:

- the Greater São Paulo, which includes the city of São Paulo and the industrial towns of Santo André, São Bernardo do Campo, São Caetano do Sul, Mauá, Osasco, Guarulhos and Diadema.

- Santos area, extending from Santos to Cubatão. The towns of São José dos Campos, Sorocaba, Campinas, Jundiaí and Taubaté, all industrial areas, have also problems, even though not so serious.

In the state of Rio de Janeiro, the metropolitan area is the one with critical levels, mainly due to cars. A. Araújo and N. Abreu have studied the levels of pollution in the different administrative districts of Rio de Janeiro according to several economic and demographic variables, to conclude that the situation is critical where a multiple use of land (industry, commerce and residence) occurs (35). Besides, the city of Rio de Janeiro, Volta Redonda is another focus of air pollution in the state.

It is worth mentioning that the increasing problems of the metropolitan areas of Belo Horizonte (Minas Gerais) and Porto Alegre (Rio Grande do Sul) originated in both cases from industrial discharges.
f. Noise pollution

The World Health Organisation has considered Brazil as the noisiest country in the world (36), and this is probably true, even though the average Brazilian would not consider noise as great a hazard as other forms of pollution. Here again it is a problem concerning mainly the urban areas with high demographic concentration. Most of the noise comes from traffic, followed by industries, commerce and social activities.

In relation to traffic, it should be noted that, in addition to the usual noise caused by heavy circulation of cars, many drivers illegally eliminate the exhaust pipe and use the horn quite frequently. In relation to commercial and industrial sources of noise, building construction, records shops, and street salesmen and buskers are the most representative sources. As regards social activities, sports, clubs, bars and fairs must be mentioned.

Though noise is a general problem in all cities, São Paulo, Rio de Janeiro and Belo Horizonte are considered the noisiest in the country.
5.1.3 Comparison of approaches

The presentation in 5.1.1 and 5.1.2 of the facts concerning both the social and natural environment has been based mainly on the literature, and reflects the points of view of scientists, technologists and the federal government of Brazil. In some way it could be biased by the selection criteria of the author of the present research. In order to test the accuracy of information and achieve a balanced view of the situation, the analysis of the literature has been counterbalanced by an analysis of the interview with the managers of environmental agencies and the press coverage of the environmental problems all over the country.

In sixty-two environmental agencies representing all states of Brazil, managers in charge of pollution control have been interviewed about both generic and specific problems of the environment. When speaking about general problems which affect each region, four areas have been isolated (Table 4):

a. social environment, as the most problematic, mainly in relation to sanitary conditions, individual income, public health, and basic education. The problems are particularly acute in the Northeast region, with the Southeast region just after it;
### Table 4: Environmental Problems of Brazil

<table>
<thead>
<tr>
<th>Areas</th>
<th>Problem</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Human Environment</td>
<td>Socio-economic problems in general</td>
</tr>
<tr>
<td></td>
<td>Unemployment and underemployment</td>
</tr>
<tr>
<td></td>
<td>Low income</td>
</tr>
<tr>
<td></td>
<td>Cost of living</td>
</tr>
<tr>
<td></td>
<td>Basic education</td>
</tr>
<tr>
<td></td>
<td>Sanitary and environmental education</td>
</tr>
<tr>
<td></td>
<td>Housing</td>
</tr>
<tr>
<td></td>
<td>Safety</td>
</tr>
<tr>
<td></td>
<td>Sanitation</td>
</tr>
<tr>
<td></td>
<td>Public health</td>
</tr>
<tr>
<td></td>
<td>Food and nutrition</td>
</tr>
<tr>
<td>2. Economic Development</td>
<td>Government finance and economics</td>
</tr>
<tr>
<td></td>
<td>Underdevelopment</td>
</tr>
<tr>
<td></td>
<td>Pollution control impeding industrial development</td>
</tr>
<tr>
<td></td>
<td>Non-compromising mentality between industrial development</td>
</tr>
<tr>
<td></td>
<td>development and environment</td>
</tr>
<tr>
<td>3. Government Organization</td>
<td>Social, political and administrative structure of the country</td>
</tr>
<tr>
<td></td>
<td>Lack of infrastructure</td>
</tr>
<tr>
<td></td>
<td>Governors' incapacity</td>
</tr>
<tr>
<td></td>
<td>Insufficient human resources in the environmental area</td>
</tr>
<tr>
<td>4. Land Use</td>
<td>Accelerated occupation of land</td>
</tr>
<tr>
<td></td>
<td>Urban concentration</td>
</tr>
<tr>
<td></td>
<td>Industrial concentration</td>
</tr>
<tr>
<td></td>
<td>Territorial space (extension and distances)</td>
</tr>
<tr>
<td></td>
<td>Underpopulation</td>
</tr>
<tr>
<td></td>
<td>Rural exodus</td>
</tr>
<tr>
<td></td>
<td>Transport and communication</td>
</tr>
<tr>
<td></td>
<td>Waste and deterioration of natural resources</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Areas</th>
<th>No. Agencies per Region</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
</tr>
<tr>
<td>1. Human Environment</td>
<td>(12)</td>
</tr>
<tr>
<td>2. Economic Development</td>
<td>2</td>
</tr>
<tr>
<td>3. Government Organization</td>
<td>1</td>
</tr>
<tr>
<td>4. Land Use</td>
<td>2</td>
</tr>
</tbody>
</table>

**Source:** Interviews with environmental managers. Brazil, 1977-78.
b. keeping the balance between development and pollution. The worst problems mentioned are in the Southeast region, with the Northeast region after that;

c. organisation of the government as related to the hierarchical structure, the capacity of governors and availability of resources. These constraints have been mentioned mainly by Centrewest and South regions;

d. land use: all regions to a greater or lesser extent have been affected by this problem. While the Southeast region - the most affected one - suffers from the effects of both urban and industrial concentration, the North and Centrewest undergo the problems of underpopulation, big territorial extension and communication over big distances, besides the misuse of natural resources. A meaningful coincidence is that problems concerned with the huge territorial space of the country (distances and extension), in connection with deficient system of transport and communication have been mentioned by managers in almost all regions.

Considering the physical environment specifically, the problem areas mentioned were (Table 5):

a. water pollution is the most critical and widespread problem, caused mainly by industrial effluents and
TABLE 5: PROBLEMS IN THE PHYSICAL ENVIRONMENT

<table>
<thead>
<tr>
<th>AREAS</th>
<th>PROBLEM</th>
<th>NO. AGENCIES PER REGION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. WATER POLLUTION</td>
<td>Fresh water pollution by industrial chemicals</td>
<td>N (6) CW (12) NE (18) SE (18) S (8) Total (62)</td>
</tr>
<tr>
<td></td>
<td>Fresh water pollution by sugar cane industry</td>
<td>3 9 3 4 4 19</td>
</tr>
<tr>
<td></td>
<td>Fresh water pollution by mineral extraction</td>
<td>5 1 2 1 5 6</td>
</tr>
<tr>
<td></td>
<td>Fresh water pollution by agriculture</td>
<td>2 2 2 3 2 8</td>
</tr>
<tr>
<td></td>
<td>Fresh water pollution by organic wastes</td>
<td>1 6 3 2 5 17</td>
</tr>
<tr>
<td></td>
<td>Deterioration of rivers sources</td>
<td>1 1 1 2 2 5</td>
</tr>
<tr>
<td></td>
<td>River silting</td>
<td>1 1 1 2 2 5</td>
</tr>
<tr>
<td></td>
<td>Marine pollution</td>
<td>1 1 1 2 2 5</td>
</tr>
<tr>
<td>2. SOIL DETERIORATION</td>
<td>Misuse of soil</td>
<td>1 2 2 1 2 5</td>
</tr>
<tr>
<td></td>
<td>Soil erosion</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>Desertification</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>Deforestation</td>
<td>1 1 2 1 1 6</td>
</tr>
<tr>
<td></td>
<td>Flooding</td>
<td>1 1 1 4 3 4</td>
</tr>
<tr>
<td></td>
<td>Dry subsoil</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>Drought</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td>3 AIR POLLUTION</td>
<td>Air pollution by industries and cars</td>
<td>1 1 2 1 1 2 3 2 9 9</td>
</tr>
<tr>
<td></td>
<td>Air pollution by mineral extraction</td>
<td>1 1 2 2 1 5</td>
</tr>
<tr>
<td></td>
<td>Bad atmospheric conditions for dispersion</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td>4 POLICY AND ADMINISTRATION</td>
<td>Mislocation of industrial poles</td>
<td>1 1 6 1 1 7</td>
</tr>
<tr>
<td></td>
<td>Airports near towns</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>Lack of classification for fresh water</td>
<td>1 1 1 1 1 2</td>
</tr>
<tr>
<td></td>
<td>Lack of environmental control</td>
<td>1 1 1 3 5 1</td>
</tr>
<tr>
<td></td>
<td>Lack of definition of administrative and legal competence</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>Support given to polluting industries</td>
<td>1 1 1 1 1 1</td>
</tr>
<tr>
<td></td>
<td>No problem</td>
<td>2 2 2 2 2 2</td>
</tr>
</tbody>
</table>

organic wastes. The areas showing greater concern about this problem were Southeast and Northeast regions. Obviously it is not a problem in the Amazon area;

b. soil deterioration is the second most serious problem, especially in the Northern region, which is concerned about soil impoverishment, dryness of subsoil, droughts, flooding and deforestation. Deforestation and flooding are actually widespread concerns;

c. air pollution, in the third ranking position, is a generalised problem, caused mainly by industries and cars. Southeast, Northeast and South regions are the most concerned about it.

d. environmental policy and administration is pointed out as the fourth problem-area, which interferes directly with pollution control because of a lack of coordination of activities and a delay in classifying both the fresh water and the atmospheric carrying capacity. These problems affect mainly Northeast and Southeast regions. The conflict between industrial development policies and environmental protection policies shows up here throughout two complaints of agencies against government: mislocation of industrial poles and governmental support given to polluting industries.
A first comparison between the survey based on the literature and that on managers' evaluation of their own regional problems indicates the following areas of agreement:

- The problems concerned with the social environment in Brazil are the most acute in the present time;
- As far as natural environment is concerned, fresh water pollution is the most widespread problem, caused by domestic, industrial and agriculture waste. Problems related to land and soil use come next;
- The Southeast region struggles mainly against negative sub-products of development while the pollution of poverty pertains particularly to the Northeast region;
- The role of central government is ambivalent in relation to environmental control policy and activities;
- The existence of a conflict between the country's aspirations for short-term development and its environmental concern.

Slight differences may be found when these common points are compared with press reportage of the facts. Table 6, which shows the data, is the breakdown by subtopics of press coverage of pollution issues in Brazilian papers,
<table>
<thead>
<tr>
<th>ISSUES REPORTED</th>
<th>COUNTRY N</th>
<th>CO</th>
<th>NE</th>
<th>SE</th>
<th>S</th>
<th>TOTAL OF ISSUES (1)</th>
<th>TOTAL OF PUBL. (2)</th>
<th>AVERAGE TIMES REPORTED (1/2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENVIRONMENTAL POLLUTION</td>
<td>36</td>
<td>1</td>
<td>8</td>
<td>77</td>
<td>13</td>
<td>135</td>
<td>255</td>
<td>1.89</td>
</tr>
<tr>
<td>FRESH WATER POLLUTION: INDUSTRIAL</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>25</td>
<td>70</td>
<td>119</td>
<td>284</td>
<td>2.36</td>
</tr>
<tr>
<td>FRESH WATER POLLUTION: DOMESTIC</td>
<td>6</td>
<td>8</td>
<td>9</td>
<td>53</td>
<td>5</td>
<td>81</td>
<td>108</td>
<td>1.33</td>
</tr>
<tr>
<td>MARINE POLLUTION</td>
<td>5</td>
<td>9</td>
<td>33</td>
<td>6</td>
<td>5</td>
<td>53</td>
<td>108</td>
<td>2.04</td>
</tr>
<tr>
<td>AIR POLLUTION</td>
<td>5</td>
<td>10</td>
<td>137</td>
<td>4</td>
<td>4</td>
<td>156</td>
<td>205</td>
<td>1.31</td>
</tr>
<tr>
<td>LAND USE AND SOLID WASTES</td>
<td>3</td>
<td>3</td>
<td>45</td>
<td>6</td>
<td>6</td>
<td>61</td>
<td>70</td>
<td>1.15</td>
</tr>
<tr>
<td>NOISE POLLUTION</td>
<td>4</td>
<td>6</td>
<td>3</td>
<td>41</td>
<td>4</td>
<td>58</td>
<td>58</td>
<td>1.00</td>
</tr>
<tr>
<td>NATURAL RESOURCES CONSERVATION</td>
<td>55</td>
<td>19</td>
<td>17</td>
<td>153</td>
<td>15</td>
<td>283</td>
<td>347</td>
<td>1.23</td>
</tr>
<tr>
<td>SOCIAL ENVIRONMENT</td>
<td>39</td>
<td>6</td>
<td>12</td>
<td>67</td>
<td>7</td>
<td>132</td>
<td>233</td>
<td>1.77</td>
</tr>
<tr>
<td>TOTAL</td>
<td>160</td>
<td>26</td>
<td>44</td>
<td>96</td>
<td>76</td>
<td>1078</td>
<td>1668</td>
<td>1.55</td>
</tr>
</tbody>
</table>

SOURCE: Analysis of Brazilian newspapers
Brazil, 1977-78.
showing the average frequency any particular issue has been reported in the main newspaper of twenty-three states. These data result from the analysis of newspaper cuttings collected during one year about Brazilian environment. A sample of one random week per month has been selected, which totals 34 days covered, 1,073 single environmental issues reported in the press, and 1,668 items of news published. Three aspects are worthy of analysis in this table: the number of environmental issues reported, the subtopics given emphasis by the press, and the range of dissemination of news.

Regarding actual issues reported, there is evidence that Southeast region is the most problematic area, and suffers from all kinds of distortions in both social and natural environment. The Northeast region is the second most polluted area, and its concerns are mainly related to fresh water pollution by industrial effluents, misuse of natural resources and inadequate social environment. Analysing the same data from the subtopics shows that 53% of the occurrences related to the use of natural resources (283 issues), air pollution (156 issues) and the social environment (132 issues). At the bottom of the list, marine pollution seemed to be a less serious problem with only 53 occurrences.

However the emphasis given by press to environmental topics does not follow the pattern of their frequency.
It seems that the press tends to focus on issues likely to cause greater disturbance among general public, such as industrial pollution and marine pollution, mainly the so called 'ecological disasters'. As an indicator, marine pollution, the least frequent issue, was the second most emphasised subtopic; each single issue on this subject has been reported on average of 2.04 times. In the same way, fresh water pollution by industrial effluents has been reported 2.36 times, and was the most emphasised area as far as press coverage is concerned. Noise pollution is neither frequently reported nor emphasised.

Regarding the range of dissemination of news, it is interesting to note that, out of the sample, only very few issues have been reported outside the region where they occurred. These events were:

- marine pollution along the coastline of Rio Grande do Sul by unknown cause (either red tide*, or organic waste, or mercury, or another poisonous chemical).

Very unusually it has been reported in newspapers of seven different areas: Rio Grande do Sul, Santa Catarina, Paraná, São Paulo, Rio de Janeiro, Minas Gerais and Brasília;

marine pollution in coastline of Bahia by an industrial emission, which contained lead and cadmium from COERAC, has been reported through Bahia, Rio de Janeiro, Sào Paulo and Brasília;

the deforestation of Jambreiro Wood in the Greater Belo Horizonte, in order to facilitate operation of the foreign company which exploits the iron reserves in that area. This issue was reported in Minas Gerais, Rio de Janeiro, Sào Paulo and Brasilia.

The larger dissemination range of these facts may be contrasted with, for instance, the minimal reporting of news such as the pollution of Rodrigo de Freitas lake in Rio de Janeiro, and the atmospheric pollution of the Greater Sào Paulo, which have been covered only by newspapers of the region. This is probably because, even though they are serious problems, the two cases cited became chronic, and were not 'news' any more in the etymologic sense of that word.

Another observation is about the role played by press in shaping public opinion on environmental issues: even though industrial pollution is not the biggest environmental problem of the country, it is the one which attracts the greatest public concern, as a reflex of the press emphasis on this subtopic. One more facet of this interaction of the press with the public, is the creation by Jornal do Brasil, an important newspaper
of liberal line, of a serial cartoon - *Capitão Eco contra o Dr. Polu* - devoted to children's environmental education.

A further observation is that the press exercises quite strong pressure on government policies, and acts sometimes to control the fulfilment of conditions or sanctions imposed by government to pollutant enterprises. This is an impressive achievement if the official constraints imposed on the Brazilian media since 1964 are to be taken into account.

Summing up the situation shown by the data and the literature, the problems of both natural and social environment are of great concern in Brazil. Actually they are more critical in the Southeast, Northeast and South regions, where many of these problems may be attributable to high demographic concentration in conjunction with heavily industrialised areas.

On the other hand the problems in both North and Centre-west regions are due either to underdevelopment or to natural phenomena, and both these factors can also interact, since underdevelopment can express itself in many ways. Could it be that man has not learnt how to live in harmony and peace with natural phenomena, which he experiences at first as outwardly hostile and leads him in turn to defend himself with a destruc-
tive aggression? Even so, natural resources and wildlife resist human exploitation represented, in the case of Brazil, mainly by foreign companies and individuals, with the consent of Brazilian government. However, an even more critical situation affects the social environment, because man is the environmental component often forgotten and mistreated in those two regions. Both North and Centrewest regions may be considered a future reserve of the country.

The Northeast region suffers from the consequences of misuse and abuse of both land and man. The condition of health of the population is substandard. There is a big gap between social classes, mainly because of inequalities in the division of income and property. Unequal distribution of property tends to force the owner of a small area of land to exploit it to the point of exhaustion. On the other hand the big landowner underuses his land and usually opts for the monoculture of sugar cane and its subsequent industrialisation, which has been one of the main sources of pollution in the region. Then, because of a combination of social inequalities, inappropriate methods used in agriculture, and climatic reasons, the Northeast region faces poverty, scarcity of water and soil 'desertification'. It results in unemployment, poor health, malnutrition, misery and a major move of the lower class
towards the big cities (especially to the South Centre of the country), almost as if they were the El Dorado. Because the emigrants are not qualified, do not have any savings, and do not obtain the expected social assistance from government, the move South can represent for them even worse misery; sometimes even leads them to crime, in order to maintain an existence, and often results in penury and premature death.

In both the Southeast and the South regions the quality of life deteriorates mainly due to four basic reasons:

- the inadequacy of means to exploit the natural resources;
- pollution caused by the concentration both of industries and heavy population in urban areas;
- the incapacity of urban plans to incorporate social demands of population; and
- the low incomes of the bulk of the population, in contrast with the opulence of the small upper-class.

On the whole, it can be said that in Brazil industrial pollution - a by-product of development - coexists with the pollution of poverty closely linked to the weak health and low socioeconomic level which exist in developing countries.
5.1.4 Public awareness

As far as public opinion is concerned, both direct observation and the analysis of newspaper cuttings indicate that it is divided into two different ideologies. Some people welcome industrial development, and therefore pollution, as it means socioeconomic improvement for them. The others fight for the preservation of natural resources and against pollution, because they see the environment as being valuable in itself. An example of this polarity has been witnessed in 1977, concerning public reaction to the installation of Braskraft, a pulp and paper industry, in the river Paraopeba valley, in the state of São Paulo. In all towns crossed by this river or its tributaries, both the pro and the against groups have carried out demonstrations about the proposed new factory in the area. The protesters created the ADEVAP, an association to represent the defenders of the Paraopeba Valley for complaints to the government. The group in favour campaigned for the likely improvement in the economy of the population of the valley through better job opportunities and Brakraft's investments in the area. This situation forced both the government and representatives of the factory to give public explanations through the media for several times. It is perhaps premature to suggest that the ecological movement is the seed of
the redemocratisation of the country. Nonetheless, the implications of the incident brought back a facet of public right to information and to free manifestation of opinion in the modern Brazil.

Notwithstanding the existence of groups such as this and similar public activities in defence of the environment, the ecological movement in Brazil is a very recent phenomenon. The issues have been introduced by Brazilian journalists, writers and scientists, who took an interest in the growing concern shown in Europe, North America and Japan. The debates assimilated the ecological movement as a foreign ideology proclaimed, at the beginning, in rhetorical statements, 'preaching' to a distant public. After the initial period, public participation started, and the focus of debates and complaints has been transferred to the actual problems of Brazil.

There are many individuals currently working on the present environmental front, out of whom four deserve special mention for their pioneer work, each one in a different arena:

- José Cândido de Carvalho, a university professor, writer and ecologist, who is a conservationist of moderate views. He has been for a long time the representative of Brazil in international scientific organisations and meetings, such as the IUCN and the MAB;
José A. Lutzemberger, the first and best known popular leader of the ecological movement in the South of the country is a radical conservationist. In the line of the international 'doomsday literature' he published the *Manifesto Ecológico Brasileiro*, in 1976, the first public declaration in Brazil condemning the deterioration of the global environment (37). He is the president of AGAPAN, an association for environmental protection in the state of Rio Grande do Sul;

Miguel Ozório de Almeida, a diplomat and environmentalist of the developmental line, was the guiding spirit and the flame behind the projection of Brazilian environmental policy onto the international stage. At both the Founex Panel and the Stockholm Conference he led the block of developing countries in order to formulate their environmental policy. His voice in defence of developing countries environment is registered in the proceedings of these meetings and the United Nations General Assembly;

Paulo Nogueira Neto, a university professor who has been invested as the first Secretary of the Environment in the Central Government. In this position he became an effective defender of the environment, in spite of both the technocratic tendencies of the government and the ambitious entrepreneurs acting
in the country. It may be said he takes an ecodevelopmental line of action.

Even though the ecological movement in Brazil, as everywhere, started as a manifestation of an elite of intellectuals, today it is tending to become a mass movement, thanks to the role played essentially by the media. The influence of press has already been commented upon in 5.1.3, as a leading force in shaping public opinion. Recently television, the most popular medium in Brazil, has increased its coverage of environmental issues. News about environmental facts of either local, national, or international interest frequently receive emphatic attention from it. Documentaries are presented about conservationist topics, and on the negative by-products of incautious use of both traditional and modern techniques to deal with natural resources. Even TV soap operas have assimilated the motif and sometimes explore the theme of public concern about the environment. It is worth mentioning the First National Symposium on Media and the Environment, in Manaus, from 21 to 26 January 1979, which had the main objective of formulating policy for mass communication on environmental issues (38).

The Catholic Church, which is a powerful sociopolitical agent in Brazilian society, has also taken sides in favour of environmental protection. In some of the affected areas, priests have introduced a so-called
'ecological mass' every Sunday. An annual celebration at Easter, denominated 'Fraternity Campaign', had the preservation of the environment as its motif for 1979; the motto was 'Preserve o que é de todos' an exhortation to people to care about nature, a common resource of mankind (39). The CNBB, the representative body of Brazilian bishops has exercised strong sociopolitical leadership in the country, and played an important part in the defence and education of the population, mainly the poor and oppressed people. As far as the environment is concerned in this particular characteristic of CNBB, mention should be made of the guidance given to Northern fishermen to protest against the pollution of fresh water and the sea in the region. Their protest was presented during a meeting promoted by the specific sector of CNBB (Pastoral dos Pescadores do Regional NE...2), in April 1978. The active presence of CNBB and specifically of the progressive bishop Don Helder Camara in the battleground of the social environment is well known in Brazil. On the whole the environmental part played by Church consists of educating and alerting the population about threats to human rights, including the right to a better quality of life.

Regarding the use of the environmental theme in the arts, some examples can be mentioned from the literature, from the plastic arts and from popular music. A national
hero was created by the writer Mário de Andrade in his play Macunaíma, which satirises some sociopolitic elements of Brazilian culture. The diagnosis made by Macunaíma (the hero) of the problems of the country's environment is still pertinent, after fifty years:

'little health and lots of aunts are the illness of Brazil'.

Moving to the present time, Brazilian best-seller Jorge Amado published in 1976 Tieta do Agreste, a novel which focuses on the industrial pollution in the state of Bahia.

In the area of the plastic arts may be mentioned the paintings and sculptures of Frans Krajcberg, who explores ecological motives, mainly the destructive actions of humans against nature. In August 1978, Krajcberg with the painter Seep Baendereck and critic of arts Pierre Restany made their protests against the deforestation of the Amazon, and made a claim for a naturalistic art, through the Manifesto do Rio Negro/ Naturalismo Integral. Another artistic manifestation of environmental appreciation was the exhibition promoted by the environmental agency of the state of Minas Gerais. It happened in Belo Horizonte, in 5 June 1979, and the theme was art and the perception of the environment by Mineirian artists.
In the musical scene two examples can be cited: *Águas de Março*, composed by Antônio Carlos Jobim at the beginning of the Seventies, describes the countryside environment during the last rainfall of the Summer season; and *O REINO ENCANTADO DA NATUREZA CONTRA O REI DO MAL* by Ivan Jorge was the official tune presented by Salgueiro samba-school during 1979 carnival in Rio de Janeiro, and approached the struggle between nature and the destructive powers of war, pollution, pest and drought.

All the agents mentioned here act directly or indirectly in defence of the environment, and they are all informal educational ways of leading the population to a greater concern for their own habitat. At the same level of informal education, meetings and public debates have been promoted by the environmental agencies in each state, and by various associations. Special campaigns of public information and education have been launched by organisations such as Fundação Brasileira para a Conservação da Natureza (Brazilian Foundation for Nature Conservation) - FBCN, o Instituto Brasileiro de Desenvolvimento Florestal (Brazilian Institute of Forests) - IBDF, Companhia de Tecnologia de Saneamento Básico e Proteção Ambiental - CETESB and Fundação Estadual de Engenharia do Meio Ambiente - FEEMA. As part of its educational programme, CETESB supported a short
series of cartoons, in which Monica, a well-known character among young readers, teaches them about the different kinds of pollution and suggests new attitudes to protect the environment and themselves.

On the formal education side, since 1977 the Ministério da Educação and SEMA (through the Ministério do Interior) have been working together to establish objectives and programmes for the introduction of environmental subjects in the three tiers of education (primary, secondary and higher education). The achievements so far are:

- preparation by the Ministério da Educação, of an experimental programme for the primary and secondary, to be tried out by the state Secretariats of Education in schools;

- implementation of a special programme (first and second tiers) for the area of Brasília;

- programme prepared in conjunction by the Ministério da Educação and CETESB;

- project for the first cycle prepared by MEC/PREMEM/CECISP;

- introduction of the subject Environmental Sciences at the basic courses of the university for Engineering students, as a compulsory subject;

- review of curricula of Sanitary Engineering course, at the university, in order to improve its environmental context;
implementation of courses for the preparation of technicians in the field of basic and environmental sanitation;

- creation of the Centro de Recursos Hídricos e Ecologia Aplicada (Centre of Water Resources and Applied Ecology), at the Escola de Engenharia de São Carlos, SP (School of Engineering of São Carlos - SP);

- creation of courses of Ecology at both master's and doctor's level, in several universities;

- promotion by the universities of short refresher courses for teachers at all levels (40).

It is hoped that, as governmental programmes on environmental subjects have been effectively implemented at all levels and all over the country, Brazilians will have a more peaceful relationship with nature, and will, by extension, have a better quality of life.

5.2 GOVERNMENT ENVIRONMENTAL SYSTEM

Brazil is a federal republic ruled by the 1967 revised constitution. Each state and territory has relative autonomy, represented by the government and legislation. All these unities are joined under a representative form of government to constitute the Union, or Federation. All these unities are joined under a representative form of government to constitute the Union, or Federation.
As far as the federal government is concerned, the country is managed by the combination of three authorities or powers:

- the Congresso Nacional is composed of the Senado Federal and the Câmara dos Deputados, which are elected by direct ballot to represent the states and territories. For the last fourteen years, two political parties were represented in the Congress: ARENA (National Renewal Alliance) and MDB (Brazilian Democratic Movement); the two-party system has just been abandoned, to give way to a multiple party system. The Congresso Nacional is the legislative power of the Union;

- Executive power is exercised by the Presidência da República with the assistance of the Ministers, who are responsible for each specific sector of the administration. Under the present Constitution, the President and the Vice-President, are elected by an Electoral College. Ministers are appointed by the President. Attached to the Presidency there is the Conselho de Segurança Nacional (National Security Council), its advisory body, composed of the President, Vice-President, all ministers and the Chiefs of Staff of the armed forces. Decisions related to data processing and communication technology are among the concerns of the Conselho de Segurança Nacional;
the Judicial power of the Union is exercised by the Supremo Tribunal Federal (Supreme Federal Court), the Tribunal Federal de Recursos (Federal Court of Appeals), and several Tribunals (Military, Electoral, Labour and special ones).

On the state level, the executive authority lies with the Governor, the legislative power with the Assembly, and the judicial power with state tribunals.

Regarding the management of the environment, there are different levels of power and areas of decision-making:

- the Presidência da República is the only authority in power to stop the activities of a pollutant industry considered relevant to the national development and security, according to the Law-Decree 1113, of 14 August 1975. SEMA, the Secretariat of the Environment (described below) may suggest the closure of a factory, but such a suggestion has first to be analysed by the Ministério da Indústria e Comércio (Ministry of Industry and Commerce) and then evaluated by the Secretaria de Planejamento da Presidência da República (Secretariat of Planning) and the President of the Republic who takes the final decision;

- land zoning policy, intended to control industrial concentration (and therefore pollution) in critical areas is a responsibility of the Secretaria de Planejamento da Presidência da República;
the Secretaria Especial do Meio Ambiente (Secretariat of the Environment) - SEMA - created under the Ministério do Interior (Ministry of Interior) by the Decree 73.030, of 30 October 1973, is the body on the federal level which has most of the responsibility for the environmental control. It coordinates the activities of the other federal, regional and state organisations; advises these organisations about technical and legal aspects of the environment, and sets norms and quality standards. Exceptionally SEMA can also act to intercede in the region where the local environmental authority either has not been implemented yet or it needs help. SEMA itself is advised by the Conselho Consultivo do Meio Ambiente (Advisory Environmental Council) - CCMA -, and carries out its programmes either by making agreements with other governmental organisations or by contracting out to private enterprises;

every Ministry, which has environmental related areas of action or policy-making, manages its own programmes independently, but usually in consultation with SEMA;

at the state level, there is usually an environmental agency for the duties connected to the executive control, such as planning and implementing programmes, monitoring sources of pollution, and penalising polluters. Another organisation at state level is the environmental council, in charge of policy-making and advising both the agency and the state government;
noise pollution and solid waste collection are the responsibility of local government;

the closure of polluted beaches and spas to public use can be determined either by local, or state, or federal authority because of the general danger to public health.

Three main constraints limit SEMA's controlling power:

its dependent condition, hierarchically subordinated to the Ministério do Interior. It would be more powerful either as an independent Ministry or at least directly subordinated to the Presidência da República;

its poor budget, which prevents SEMA from carrying out a comprehensive programme more quickly and from supporting regional projects. As far as the availability of both financial and technological resources is concerned some state environmental agencies are more powerful than SEMA, which makes central coordination a very uneasy job;

dispersion of environmental control responsibilities under different authorities. Besides the levels of power already stated above, the specification of areas deserves clarification.

Decree 73.030, governing SEMA's creation, states that its activities must be carried out without interfering with each Ministry's specific responsibilities.
However, the facets of environmental conservation and pollution control are so diversified that they cut across the powers of different Ministries, as shown by the following data:

- flora and fauna, including the creation and management of national parks and reserves, are the duty of the Instituto Brasileiro de Desenvolvimento Florestal (Brazilian Institute of Forests) - IBDF - a body of the Ministério da Agricultura (Ministry of Agriculture) created in 1967;

- research, and data collection and processing about natural resources is under the responsibility of the Superintendência de Recursos Naturais (Superintendency of Natural Resources) - SUPREN - of the Fundação Instituto Brasileiro de Geografia e Estatística (Brazilian Institute of Geography and Statistics) - FIBGE - the statistical board of the Presidência da República;

- policy, research and experiments related to fish breeding and fishing belongs to the Superintendência do Desenvolvimento da Pesca (Superintendency of Fishing) - SUDEPE - another body of the Ministério da Agricultura;

- the Diretoria de Portos e Costas (Directorate of Harbours and Coastal Sites) of the Ministério da Marinha (Ministry of Navy) controls pollution caused by ships in both the sea and fresh water. For this
purpose, at the state level it is represented by the Capitania dos Portos (Captaincy of Harbours). The Diretoria de Portos e Costas (Directorate of Harbours and Coastal Sites) represents Brazil in all international committees and meetings concerned with marine pollution;

the Diretoria de Hidrografia e Navegação (Directorate of Hydrography) of the Ministério da Marinha performs two environmentally related activities. It runs the Banco Nacional de Dados Oceanográficos (National Oceanographic Data Bank), which has a subsystem for pollution control, with data on pollutants detected in Brazilian sea waters. The second activity is the representation of Brazil in some international organisations concerned with the environment, such as the COI, the WHO and the IGOS;

the Instituto de Pesquisa da Marinha (Research Institute of the Navy), another body of the Ministério da Marinha, does research on marine life, including also the effect of pollution on the ecosystem;

the Instituto Nacional de Meteorologia (National Institute of Meteorology) — INEMET — of the Ministério da Agricultura holds most of meteorological data;
the Conselho Nacional do Petróleo (National Council of Petrol), attached to the Ministério de Minas e Energia (Ministry of Energy), monitors petrol prices and consumption, and inspects the extraction of both petrol and coal so as to control pollution. PETROBRAS, the commercial enterprise in charge of extracting, refining and distributing the petrol, has a Divisão Especial de Segurança e Engenharia de Meio Ambiente (Division of Technological Safety of the Environment) - DESEMA - which makes the environmental policy of the enterprise and supervises the work in order to minimise the pollution;

the Departamento Nacional de Água e Energia Elétrica (National Department of Water and Electric Energy) - DNAEE - of the Ministério de Minas e Energia was created in 1974 to be responsible for the management of water resources in the country. As part of this duty, DNAEE imposes specific legislation about fresh water use (Código das Águas); monitors roughly the quality of water in the federal rivers through an alerting network which checks temperature, conductivity, dissolved oxygen and pH; maintains a data bank about quantity of water, and plans additionally to have another for water quality, by checking the pollutants discharged into the rivers;

ELETROBRÁS, a commercial enterprise intended to produce and sell electrical energy, is linked to the
Ministério de Minas e Energia. It has its Advisory Body for Environment since 1975, which is concerned mainly with erosion, rivers silting and navigability, fish breeding, and reforestation. Other environmental concerns are their impact studies carried out before constructing power stations (a series of these has been made by Dr. Goodland, the American ecologist). ELETROBRÁS also checks periodically the quality of the water used in the stations (temperature and chemicals), but only to safeguard its equipment; in 1977 an agreement has been signed with SEMA about the transfer of this informations;

- the Comissão Brasileira de Grandes Barragens (Brazilian Committee of Big Dams), another quango linked to the Ministério de Minas e Energia, has the responsibility for evaluating the impact dams are likely to cause, or, have already caused, to the Brazilian environment;

- Comissão Nacional de Energia Nuclear (National Commission of Nuclear Energy) - CNEN - a statutory organisation of the Ministério de Minas e Energia, performs researches, establishes norms and supervises the use of radioactivity sources in the country;

- NUCLEBRÁS is a quango linked to the Ministério de Minas e Energia, which is in charge of projecting,
implementing, operating and evaluating the performance of nuclear power plants, being built in Brazil, including their impact upon the environment;

the Projeto RADAMBRASIL (RADAMBRASIL Project), a research group of the Ministério de Minas e Energia surveys and analyses the physical environment of the country, collects, processes and disseminates the resulting data;

the Instituto de Pesquisas Espaciais (Institute of Space Research) - INPE - is a statutory organisation of the Secretaria de Planejamento da Presidência da República (through the Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council of Scientific and Technological Development) - CNPq. It processes images obtained from satellites (LANDSAT, NOAA, TIROS-N, SMS/METEOSAT, SKYLAB, NIMBUS), which are used for its research staff and sold to the public (with the exception of some areas considered of 'national security' concern);

Comissão Brasileira de Pesquisa Espacial (Brazilian Commission of Space Research) - COBAE - is the advisory body of the Conselho de Segurança Nacional da Presidência da República in charge of coordinating and following up the execution of the national programme of space activities, including the analysis of the environmental impact;
the Departamento de Aviação Civil (Department of Civil Aviation) - DAC - of the Ministério da Aviação (Air Ministry), looks after the environmental impact likely to be caused by modern aircrafts (for instance supersonic planes), and both air and noise pollution generated by airport traffic. It is also the institution with legal power to control air traffic, mainly from the standpoint of flight safety;

the Departamento Nacional de Produção Mineral (National Department of Mineral Production) - DNPM, created in 1974 under the Ministério de Minas e Energia, supervises geological surveys, and mineral extraction, besides imposing the taxes and specific legislation which controls the extraction of minerals and spring water;

Companhia de Pesquisas de Recursos Minerais (Company for Mineral Surveys) - CPRM - a quango bound to the Ministério de Minas e Energia since 1969, has responsibility for stimulating new surveys, and researches about Brazilian water and mineral resources;

the Departamento Nacional de Obras Sanitárias (National Department of Sanitation) - DNOS - acts in the fields of health, sanitation and regional development, in order to help the committees in matter of water supply, sewage works, improvement of soil and water conditions, irrigation and flood prevention;
the observation of sanitary conditions in the working environment is the responsibility of the Ministério do Trabalho through the Departamento de Higiene e Segurança do Trabalho (Department of Working Hygiene and Safety);

- the Comissão Nacional de Regiões Metropolitanas e Política Urbana (National Commission of Metropolitan Regions and Urban Policy) - CNPU - an inter-ministerial body created in 1974, is in charge of controlling the growth and improving the quality of life in urban and metropolitan areas, according to the National Policy of Urban Development;

- the Secretaria de Indústria e Tecnologia (Secretariat for Industrial Technology) of the Ministério da Indústria e Comércio (Ministry of the Industry and Commerce) formulates policy for the industrial development of the country and gives incentive and support to prioritary industries. As part of its responsibilities, there is a technological programme for the prevention of industrial pollution. The Instituto Nacional de Tecnologia (National Institute of Technology) - INT - supervised by this Secretariat and mainly concerned with industrial processes and patents, runs also a Grupo de Poluição Industrial (Study Group on Industrial Pollution);

- the Banco Nacional de Habitação (National Housing Bank) - BNH - is responsible for planning and
executing both the National Housing Plan (through mortgage) and the National Plan of Sanitation - PLANASA. The latter is intended to give incentives and to lend money to state companies in charge of local sanitation. Goals stated in the PLANASA achieve to supply water to over 80% of urban population, and sewarage services to about 50% of urban population (all metropolitan regions and capitals, and the big towns). PLANASA also manages the Programme for Pollution control in the states - PECON - intended to prevent and abate water pollution caused by sewage;

- the Departamento Nacional de Obras contra as Secas (National Department of Drought Control Works) - DNOCS - is in charge of government hydraulic studies and works for the dry areas, along with the responsibility of developing these areas and improving their environmental conditions;

- the policies and activities related to Public Health, Sanitation and Environmental Health, from the medical standpoint are the concern of the Ministério da Saúde (Ministry of Health), through the Secretaria Nacional de Ações Básicas de Saúde (National Secretariat of Sanitary Vigilance), the Superintendência de Companhias de Saúde Pública (Superintendency of Public Health Campaigns) - SUCAM - and the Fundação Serviços Especiais de Saúde Pública (Foundation of Special Services of Public Health) - FSESP;
regulation of pesticides use is a responsibility of the Ministério da Agricultura, through the Secretaria Nacional de Defesa Agrícola (National Secretariat of Agricultural Defence), which also holds the data about pesticide consumption;

the measures related to the control of air pollution by cars (such as determination about fuel components, urban traffic zoning, location of motorways, and pollution caused by merchant ships) are a responsibility of the Ministério dos Transportes (Ministry of Transports), mainly through its Coordenação de Ciência e Tecnologia (Coordination of Science and Technology) and the Superintendência Nacional de Marinha Mercante (National Superintendency of Merchant Navy) - SUNAMAM;

major decisions on legal aspects concerned with traffic are the competence of the Conselho Nacional de Trânsito (National Council of Traffic), a body of the Ministério da Justiça (Ministry of Justice);

policy making, planning and supporting of industrial poles are the concerns of the Ministério da Indústria e Comércio, in conjunction with the Secretaria de Planejamento da Presidência da República;

the foreign policy of the country as regards the environment is the competence of the Ministério das Relações Exteriores (Ministry of Foreign Affairs), through the Departamento das Nações Unidas (Department of the United Nations Affairs) - DNU;
the three financing agencies of the Secretaria de Planejamento da Presidência da República have their own environmental groups and independent policy to fund environmental projects. Overall, the Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council of Scientific and Technological Development) - CNPq - supports small research projects, mainly concerned with the development of ecosystems; the Financiadora de Estudos e Projetos (Fund for Studies and Projects) - FINEP - supports medium and large sized research projects, related to environmental health, natural resources and ecosystems; and the Banco Nacional do Desenvolvimento Econômico (National Bank of Economic Development) - BNDE - supports industrial projects;

the agencies of the Ministério do Interior devoted to regional development deal also with sanitation and environmental conservation. There are five of these organisations, each one looking after a specific region: SUDECO, SUDAM, SUDENE, SUDESUL and CODEVASF.

This very long list of institutions of the federal government, all dealing in some way with the environment, makes the job of SEMA, the official controller, very difficult and politically sensitive. Its sphere of action is therefore, unclear, appearing to be constrained, or at the very least overlapped by the other institutions. As a consequence, in the political scene
its power is diluted, and some of its responsibilities are prey to other institutions, e.g.: SUPREN, which intends to go much beyond its duty of collecting and processing statistical data on natural resources. Official information is often denied to SEMA, as much as the opportunity to participate in the decision-making process relating to environmental subjects; this is particularly the case in its relationship to the DNU.

The United Nations Economic Commission for Latin America - ECLA - in the study made about the state of the environment in this region, analyses the many functions attributed to SEMA in comparison with its position in the power structure of the government:

SEMA no dispone, sin embargo, de los recursos necesarios para cumplir todas las funciones que le ha encomendado el decreto de su formación. La ausencia de funciones de formulación de políticas y de ejecución dentro de SEMA se explica por la prerrogativa de la Secretaría de Planeamiento de la Presidencia de la República en todo lo que se refiere a la integración de políticas nacionales y porque la ejecución de programas específicos es principalmente competencia de los gobiernos estatales (41).

As far as the relationship of SEMA with the environmental agencies in the states is concerned, there is not any formal hierarchical link between them, since the latter are subordinated to a specific state secretariat, funded by the state, and ruled by state legislation. Thus SEMA and the state agencies are basically
committed to each other by a common concern about the environment and a common job to perform, in spite of the confusion as to formal lines of responsibility. But SEIA sometimes meets a situation when one of these agencies - like CETESB, in São Paulo - chooses to maintain an independent scheme, and can do so because it is much richer (from state government support and its own profit business) and has the largest environmental experience in the country, represented by technological knowledge and equipment.

The results of the present research carried out about the sixty-two Brazilian environmental agencies on both federal and state levels, may shed more light on the system and its potential. Of the sixty-two agencies, eighteen are federal and forty-four are subordinated to the state government (Table 7). The distribution of the agencies around the country is directly related to the level of development of the region and not according to its territorial size. This can be demonstrated by comparing on a map the size of the underdeveloped North and Centrewest regions. These two together cover half the area of Brazil, but they only have a total of eighteen agencies. This is the same number that can be found in just one region - the Southeast - which, while being considerably smaller, happens to be the most developed region in Brazil.
TABLE 7: ADMINISTRATIVE SUBORDINATION OF THE AGENCIES

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TOTAL 2 3 1 6 5 4 3 12 7 9 2 18 11 6 1 18 4 3 1 8 62

SOURCE: Interviews with the Environmental Managers
Brazil, 1977-78.
The same Table 7 shows that there is not an established pattern of administrative subordination of the agencies. At both federal and state levels, they are established under different authorities. In the federal government there is some concentration under the Ministério do Interior (Ministry of Interior), and in the state government it happens to be under the Secretaria de Obras Públicas (Secretariat of Engineering Works). Within the Brazilian pattern of governmental administration both these institutions come under a category of 'miscellaneous institutions', that is they cover many different subjects. This has the effect of placing these agencies in a kind of administrative limbo. The main reason for this random, odd subordination of environmental agencies could be because most of them are quite young and still finding their way. According to the nature of their institutional organisation and form of links to governmental structure they can be classified as:

a. governmental institutions, that is statutory organisations directly administered by either federal or state authority. These institutions - a total of 19 - are funded by federal or state government;

b. governmental agencies; these are 24 agencies with quite specific responsibilities, usually related to public services and are funded both by government and outside sources;
c. quasi-governmental institutions, in number of 19, are linked either to the federal or to the state government, and supported by a combination of private and public funding, and enjoying considerable autonomy.

All these agencies can be characterised in the main as technological institutions, since 64.5% of them have been described in this way by their own managers. 65% have been classified as political organisations and only one (1.6%) as merely administrative. All the others have been described as having a combination of characteristics, such as technico-administrative (6.5%) organisations.

On the whole the agencies have been assembled for the present study, into three groups, according to the broad area of action:

a. environment: 46.8% of the institutions act in this area, which embraces pollution control, natural resources conservation, wildlife, and related subjects;

b. sanitation: 40.1% of the institutions work in this area, supplying water and sewage works to the urban population;

c. fringe areas: 12.9% of the institutions act in areas related to either of those two above-mentioned, as for instance, in regional development, statistics
of natural resources, and foreign policy and international relationship of the country concerning the environment.

As a matter of specification, Tables 8 and 9 distinguish the areas of environmental action performed by the agencies. It must be observed that some of them have several areas of action. It can be noted from these tables that, except for the North region, the major concern is pollution control, both prevention and abatement, mainly related to water resources, which concentrate the attention of 59.7% of the agencies. Sanitation works come next, as an area of action of 40% of the agencies. The social aspects of the human environment come at a third level, followed by natural resources conservation, and finally waste recycling.

It will be readily observed in Table 8 that an unusual situation pertains in the North region. This region is the largest and one of the richest in natural resources in the whole country and yet has only one institution with the specific responsibility of caring for their conservation. When conservation is considered as only a subject of interest (and not as an area of action), two institutions in the North regard the topic, as shown in Table 9.

Another observation based on Tables 8 and 9 is the existing overlap of areas of action among the three categories
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SOURCE: Interviews with the Environmental Managers

Brazil, 1977-78.
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</table>

**SOURCE:** Interviews with the Environmental Managers

Brazil, 1977-78.
of agencies in environmental pollution control, sanitation and fringe areas. Although their work is supposed to be concentrated in a specific field, it extends in many cases to the related fields, so that they all end up working in the same basic fields, irrespective of the main objective of each of the three groups. As an example, three sub-areas can be observed in Table 9 as being characteristic of each group:

a. water pollution control, a typical area of environmental pollution control agencies, is a subject area shared by twenty-six of them plus eight agencies working in the field of sanitation, and three agencies in fringe area;

b. sanitation is a subject of interest to twenty-three sanitation agencies, one environmental pollution control agency and one fringe area agency;

c. urban planning, a typical subject of the fringe area agencies, receives the attention from two sanitation agencies, four environmental pollution control agency and agencies working in fringe subject areas.

The same situation can be observed through Table 8, as for instance for pollution abatement and social welfare. Twenty-one environmental pollution control agencies look after the abatement of pollution, an activity which is
also performed by twelve sanitation agencies and one agency for fringe areas. As far as social welfare is concerned, thirteen sanitation agencies work in this area, which is shared with eight environmental pollution control agencies and three agencies from fringe areas.

On the other hand some different areas are under-provided for, as for instance: waste recycling (Table 8), which is performed by only seven agencies in the whole country; and housing (Table 9), which is a concern of only two of the environmental agencies of the country. In the Table 9 it is worth observing how the category of 'natural resources' breaks down into specific areas: twenty-one agencies have an interest on the whole subject but only few of them are dedicated to a specific resource, and when it occurs, water is the greatest concern.

The short term objectives of Brazilian environmental agencies deal mainly with:

- implementation of government plans for sanitation (water supply, sewerage works, extermination of carriers, recycling of solid waste), in which 82.3% of the agencies are engaged;
- conservation of natural resources, which is a concern of 50% of the agencies;
control of industrial pollution, which is looked after by 45.2% of the agencies;

- environmental and sanitary education, dealt with by 32.5% of the institutions;

- technical assistance and consultancy on environmental subjects from the biggest to the smallest agencies, the potential and actual consultants representing 32.3% of the total agencies;

- the promotion of socioeconomic development of the Brazilian population is a concern of 30.6% of the agencies;

- the improvement of the quality of life takes up the attention of 25.8% of the agencies;

- the design and implementation of information system is an objective for 20.7% of the agencies.

Some other minor objectives are related either to economic planning or to controlling aspects of the environmental job.

On the other hand the long range plans of the environmental agencies (Table 10) have to do mainly with sanitation (48.4%), pollution prevention and abatement (30.6%), management of water resources (27.4%), development and adoption of both legal and technological environmental protection measures (24.2%) and management of flora and fauna (22.6%). As in the short term
### Table 10: Programmes Under Way at the Environmental Agencies

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</table>

Source: Interviews with Environmental Managers

Brazil, 1977-78.
objectives of planning, the development of information systems and resources is a minor concern (8.1% of the agencies). As can be observed, most of the programmes and projects are operating in the Northeast, Southeast and South regions. The North and Centrewest regions have few projects operating. Another point to be observed is that most of the projects are carried out by the agencies dealing with pollution control (except in the North region).

As far as personnel is concerned, there are 63,949 people working in the Brazilian environmental agencies. The distribution by specialisation (Table 11) shows the highest concentration in the area of sanitation (80.6%) compared to the smallest (6.7%), which works in the environmental agencies. The geographical distribution (Table 12) presents the highest concentration of workers in the Southeast region (57.2%). Only 9.1% of the total employees have a university degree (third tier of education), and 19.9% have a specific technical qualification (secondary tier of education). The others - the first tier of education - have attended junior high school or primary school, either for the complete course or, in some cases, only during part of it. The lack of basic education is worse in the North region where 89.2% of the workers are only at the first level. This is also reflected by the statistics which show that only 10.8% of the employees have qualification.
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**TABLE 11: PERSONNEL AT THE AGENCIES (BY TYPE OF AGENCY)**

**NUMBER OF EMPLOYEES PER TYPE OF AGENCY**
TABLE 12: PERSONNEL AT THE AGENCIES (BY REGION)

NUMBERS OF EMPLOYERS PER REGION

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Conversely, the Southeast region has the highest proportion (10%) of environmental jobs taken by people at the third level of education.

5.2.1 Internal Policy

The definition of an environmental policy for Brazilian government has been a complex job for the authorities, as it can be seen through the consideration of some realities of the country:

• A vast proportion of the population lives under the subsistence level, struggling against the pollution of poverty, i.e., malnutrition, lack of sanitation and epidemic diseases. This aspect should be a social concern of policy-makers;

• An enormous part of the country is not yet sufficiently inhabited and exploited economically in a way that will benefit the majority of the Brazilian population. This topic demands conservationist concerns from the policy-makers;

• The country's dedication to economic development has led some areas to industrial pollution and lowered the quality of life of the urban centres. Technologists and economists should cooperate with the policy-makers.
Before the Seventies, the Brazilian government had no specific policy for pollution control. The subject was vaguely approached in the Decree 24.643 of 10 July 1934 (Código das Águas), which regulates the use and treatment of fresh water, and in the Decree 49.974-A, of 21 January 1961 (Código Nacional de Saúde), dealing basically with sanitation and public health. The first governmental document to reflect publicly an explicit policy was the Law 5.318, of 26 July 1967, which contained the main directives, intended for governmental action and the main goals as a statement of the national sanitation policy. It embraced water supply, sewage works, solid waste disposal, environmental pollution, flooding and erosion. Since industrial pollution is a problem of the Seventies, the first time it came about in governmental plans was in 1970 in the Metas e Bases para a Ação de Governo (42). This official document contained the goals and guidelines for federal government in the period 1970-71, and stressed: health and sanitation, education, and technological development (mainly industrial). As part of the health plans it included the need to control environmental pollution in urban areas, mainly São Paulo and Rio de Janeiro.

The next governmental plan was the I National Plan of Development (I PND), for the period 1972-74 (43). It emphasised economic and technological development.
To implement this plan, special programmes were formulated in the I Basic Plan of Scientific and Technological Development (I PBCT) (44). Under these plans, the prevention and abatement of pollution and the overall environmental concern are only marginal topics, through sanitation, public health and agricultural technology. This is understandable when one remembers that the Minister of Planning of Brazil at that time declared unofficially to American newsagencies that Brazil could happily become an importer of pollution, as it had a lot left to pollute. Officially, through the Ministério das Relações Exteriores (Ministry of Foreign Affairs), the government declared that:

a. Brazil supports international movements in favour of the environment, like the Stockholm Conference, but it believes that the developed countries are the responsible for the world pollution and its abatement;

b. Brazil, like any other developing country deals with the pollution of poverty, and cannot accept any constraint on its efforts to develop;

c. there is a need for control of industrial pollution in some metropolitan regions in Brazil, for which a special policy was necessary. But the Brazilian environment has big carrying capacity for pollution because of its huge unoccupied areas;
d. economic growth and industrial development should have priority over the protection of the environment in a developing country (45).

Although very technocratic, one positive trend of this government was the creation of SEMA in 1974.

The period 1975-79 has been guided by the II National Plan of Development (II PND) and its corresponding II Basic Plan for Scientific and Technological Development (II PBDeT). Both of these focus on the preservation of the environment, the control of pollution, and urban development. In opposition to the previous governments, these plans stated an environmental policy, the main line of which was a compromise between economic development and the protection of environment, that is the national use of natural resources, promotion of social welfare and industrial development, avoiding pollution and deployment of the environment (46) (47).

The basic legislation for the control of industrial pollution was adopted during this government.

From March 1979 Brazil has another government. No environmental policy has yet been published, but some points can already be noted:

a. even though the military is still in power, the government has stated its programme towards liberalisation and redemocratisation of the country;
b. the President declared that development plans for the Amazon region are going to be guided by the policy of preserving its ecological equilibrium (48);

c. the initial economic policy adopted by the government was in favour of economic recession and slow growth. However, the Minister of Planning, responsible for this policy was changed, the same happening to the Minister of Finance. The new policy adopted aims faster growth towards economic development in the traditional capitalist style (49) (50). For the time being both policies tried by the present government have failed to improve the social environment, as the high inflation and cost of living have been lowering even more the quality of life of the population;

d. a comprehensive legislation including a new governmental structure for the environmental system, has been proposed long ago to the Presidency and is still waiting for approval.

These three points above suggest that the environmental policy of the present government is still a puzzle. The presence of environmental scientists in some governmental institutions, along with a better alerted population are a hope for some control over governmental actions in the domain of the environment.
It is worth mentioning that the Secretary of the Environment, Dr. Paulo Nogueira Neto, has been the same since SEMA, the federal body for the control of environment was created in 1973. As part of the present research he was interviewed in March 1978, when stated the policy of SEMA:

- the management of environment by Brazilian Government must include the improvement of socioeconomic conditions of the population, the surveillance of natural resources and the control of pollution. It means that government should look after both the problems derived from underdevelopment and from development;

- environmental control is a decentralised function: each state is responsible for the local control; SEMA's responsibility is to help or intervene whenever necessary;

- the exchange of environmental information and technology among countries should be a common pattern for governments, and Brazil, as a developing country, should not be afraid of having its interests and aspirations threatened by developed countries under the guise of environmental concern.

The comparison between SEMA's policy and the policy of the central government (planning and economic sectors) reflects the existing conflict at the federal government of the environment.
5.2.1.1 Environmental Legislation

The existing specific federal legislation about pollution control has been collected and published by SEMA (51). The main federal legislation includes:

- Code of Waters: Law-Decree 24.043, of 10 June 1934;
- Code of Forests: Law 4.771, of 15 September 1965;
- Code of Hunting: Law 5.197, of 3 January 1967;
- Code of Fishing, Law-Decree 221, of February 1967;
- Statute of the Land: Law 4.504 of 30 November 1964;
- Creation of SEMA: Decree 73.030 of 30 October 1973;
- Control of industrial pollution: Law-Decree 1.413, of 14 August 1975, complemented by the Decree 76.389 of 3 October 1975, and the Decree 81.107 of 22 December 1977;
Nuclear Energy and Radioactive Pollution: Law 4118 of 1962 and Law 6189 of 1974;

Water Quality Criteria (Mercury control): Edict 003/SEMA, of 11 April 1975;


Air Quality Standards: Edict 0231, of 27 April 1976;

Creation of a Group to Classify the Watercourses: Interministerial Edict 090, of 29 March 1978;

Industrial Use of Federal Watercourses: Edict 1332, of 17 November 1978, complemented by the Edict 002/SEMA, of 9 February 1979;

Water Pollution by Sugar Mills: Edict GM/323, of 29 November 1978;


At state level not all of the states have specific legislation for the control of environmental pollution. This is the existing legislation:

Ceará:
Law 10,148, of 2 December 1977 about the protection of water resources, including pollution control.

Pernambuco:
Law 7541, of 12 December 1977 about overall environmental pollution control.
Sergipe:
Law 1824, of 27 December 1973, regulated by the Decree 2792, of 17 April 1974, both about control of fresh water pollution and classification of water-courses.

Bahia:
Law 3.163, of 4 October 1973, regulated by the Decree 24.350, of 4 October 1974, about the environmental pollution control.

Rio de Janeiro:
Law-Decree 134, of 16 June 1975, about the control of environmental pollution; Law-Decree 112, of 12 August 1969 and Decree E 3217, of 3 October 1969 about noise control; Law-Decree 230, of 18 July 1975 and Decree 480 of 25 November 1975, about the control of rodents and insects; Decree 1632, of 21 December 1977 about fines imposed as a penalty for pollution.

São Paulo:

Parana:
5.2.2 Foreign Policy

As mentioned in Chapter 3, developing countries have presented an initial resistance to the international ecological movement for three main reasons:

- objections to the international exchange and trade being restricted by environmental concerns and anti-pollution measures;
- fear of developed countries shifting their financial resources from development projects in the Third World to the abatement of pollution within their own limits, in the Western World;
- developing countries have their own priorities, such as programmes of public health, housing, employment, road and public transportation, and industrial development. They are unwilling to divert their scarce resources from these programmes to the protection of the environment.

Brazil not only shared these concerns, but also led the developing countries in the pre-Stockholm meetings and the Conference itself to formulate and express these points as the basic position of the poor countries as regards the environmental movement.

Brazilian diplomats are said to be the ones who first linked environment and development. As stated by the
representative of Brazil in the ECOSOC, when discussing
the agenda of the Stockholm Conference:

The environmental factor is one of the com-
ponents of development planning in the same
way that the environment itself is an inte-
gral element of what one could call 'com-
prehensive' economic and social develop-
ment (52).

The same basic idea produced a famous saying at that
time: 'poverty is the worst kind of pollution'.
The leader of Brazilian delegation to the Stockholm
Conference defended this point of view in his speech:

For the majority of the world population,
the bettering of conditions is much more a
question of mitigating poverty, producing
more food, having better clothing, housing,
medical assistance, and employment, than
to see atmospheric pollution reduced.
In effect, economic development must in
future try to strike and balance between
the necessity of increasing the productivity
of man to assure his well-being and dignity
and the necessity of reducing to a minimum
the negative aspect which progress assumed
in the past. It was precisely economic
growth that allowed the developed countries
to show great progress in eliminating mass
poverty, ignorance, and disease. A country
that has not reached minimum satisfactory
levels in providing what is essential does
not have the conditions to divert substan-
tial resources for protecting the environ-
ment (53).

Overall, Brazilian foreign policy as it relates to the
environment could be summarised in the following points:

- the international concern and actions of any supra-
national organisation must not trespass up on na-
tional sovereignties and must accept the national
development frameworks as a fundamental parameter;
all pollution of world significance stems from the highly developed and industrialised countries, which should be the responsible for abating it;

most of the ecological problems of developing countries derive from their poverty and insufficient technology and include inadequate sewage and water supply, poor housing, and undernourishment. They can only be solved by development;

population growth must not be considered as an absolute threat to the environment in any country. Brazilian authorities see this as a private matter for family planning, as most of the country is still underpopulated.

A clear and unbiased view of Brazilian environmental policy is presented by T. G. Sauders, who analyses mainly foreign policy, associated with the facts and ideologies which motivated the above-mentioned policy (54).

The Brazilian position at the international fora has evolved since Stockholm, but is still resistant to a zero growth or at least slow development strategy. Since the launching of some of the UNEP's programmes, new concerns have been added to Brazilian representatives in international meetings related to the environment.
Thus these are the environmental subjects which usually worry Brazilian delegates:

- international environmental law (specifically maritime law);
- natural resources (mainly water) shared by different countries, and the associated need to establish previous consultation procedures to use them economically;
- national sovereignty over the national resources;
- ecodevelopment as a return to an agricultural economy;
- the use of information subsystems (GEMS and IRS) of UNEP as a means of domination of developing countries by the wealthy nations.

When interviewed for the present research in December 1977, Minister M. Azambuja, the spokesman of the Ministry of the Foreign Affairs for environmental matters and all the subjects concerned to the United Nations said that:

- Brazilian policy has evolved from opposition to the international environmental movement to a compromise, that is development in a clean environment. In order to achieve this, the country invests in the development of appropriate technologies;

- Brazil neither supports the 'doomsday' ideas of the Club of Rome nor the later belief in the inexhaustibility of world resources.
SEMA has found a strong barrier interposed by the Ministério das Relações Exteriores (Ministry of Foreign Affairs) against participation in UNEP's information subsystem and general exchange with other countries.

5.2.2.1 International Agreements

Excluding conventions concerned with the protection of natural resources, the following are the agreements signed by Brazil about subjects related to environmental pollution:


- Convention Relative a la Pose de Mônes Sous-Marine Automatiques de Contact. Hague, 1907 (Adhesion of Brazil: 1910)

Déclaration Relative à l'Interdiction de Lancer des Projectiles et des Explosifs du Haut de Ballons. Hague, 1907 (Adhesion of Brazil: 1914)


Sanitary Agreement between Brazil and Colombia, about the Amazon Region. Bogotá, 1972.


Sanitary Agreement between Brazil and Peru, about their common tropical areas. Amazon, 1976.


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In view of the increasing concern for environmental problems around the world, caused by either development or underdevelopment factors, environmental information has been greatly valued and heavily in demand. The users vary from supranational organisations, and government authorities to private companies, pressure groups and individuals. E. Dosa expressed this new dimension of environmental information during the workshop held at the Royal Melbourne Institute of Technology, in 1974:

Environmentalists, communities and large segments of the public discovered that well-marshalled information can provide stronger support for a cause, and more input into decision-making. Some groups, in fact, discovered that information can create a considerable power-base. This potential power, inherent to shrewdly used information, begins to worry some minds. The kind of individual who is concerned with the balance of scientific advancement, political utility and value judgements has traditionally been sensitive to both the benefits and dangers of information flow. Awareness of the global nature of environmental decision-making and management only heightened this sensitivity. The realisation of interdependence made it only too clear that one man's decision about how to use information, and for what purpose, always affects somebody else. The more efficient the operation of data bases, the more possibility exists for their exploitation by self-interests that are alien to environmental concepts (1).

Another aspect of the same matter is the interest manifested by different professional groups about environmental information, which is probably related to the
interdisciplinary character of this field. It is again M. Dosa, on a different occasion, who points out this aspect:

Each of the disciplines and professions began taking a long, hard look at the process, and discovered that environmental information not only represents economic and political currency, but it also reflects the relative place of that particular profession or discipline in a problem-focused community or society (2).

Though actual and potential users are aware of its importance, environmental information has some special characteristics which makes it more difficult to be gathered and organised by information professionals, and accessed by the user. Perhaps the most crucial of these characteristics, because it affects both the information professional and the users, is that environmental information draws upon so many disciplines, that most people cannot even agree on the bounders of the environmental sciences. It includes aspects of chemistry, physics, biology, geology, hydrology, chemical engineering, sanitary engineering, public health medicine, toxicology, operations research, economics, management, demography, sociology, urban planning, and law. However, these subjects are all focused from the environmental point of view. Other characteristics are discussed by M. Dosa (1), A. Somerville (3), and J. Gardner (4). Based on these authors one could possibly group the characteristics according to both the point of view of
the user and the librarian:

a. from the user's perspective:

- published literature about the various aspects of the environment are dispersed among a wide variety of sources;

- even the information covered by indexing and abstracting journals is not organised in a manner to provide effective and ready access from the environmental point of view;

- environmental data are often unpublished, and knowledge of their existence comes after long or intensive experience in the field;

- a large amount of information from both governmental and private enterprises sources is not available to the public as it is classified;

- individual specialists do not have sufficient awareness of the potential of fields beyond their own, nor do they have familiarity with other professional methodologies and approaches;

- it is difficult for the individual (or the group related to one only institution) to assess the environmental impact of his own values and life styles in the context of collective environmental needs;

- the dubious validity of available data, as the methods of collection are either unknown or not standardised.
b. from the librarian's point of view:

- the information professional looks at the field with a dual perspective: on one hand in order to analyse the information as a commodity, which is going to be 'consumed' by the user (outside view); and on the other hand to focus on the information process (inside view). The 'outside view' is going to give the librarian the psychological characteristics of environmental information, such as:

  - influence of group (or institutional) value systems and beliefs;
  - vulnerability to manipulation by either political pressures, or emotional considerations of conservationist, or pressure from economic groups;
  - conflicting interests of social groups.

The 'inside view' will give the librarian some characteristics related to the problems of gathering and organising the data and literature, such as:

  - sensitivity of the environmental information;
  - lack of awareness of existing data;
  - lack of data for social indicators related to the quality of life;
  - lack of consensus on priorities;
  - rapid obsolescence of data and literature;
lack of agreement on what data should be collected and in what form;

insufficiency of comprehensive reference sources for published information;

lack of socially-based guidelines on what sources and categories of data should be available to whom and through which channels;

dispersion of data and publications (most of them not available through ordinary publishers);

volume of data and publications;

lack of library subject classification for environmental sciences;

lack of standardisation in government information services;

inefficient indexing of environmental documents included in either databases or printed indexes;

lack of experience in dealing with informal means of information (e.g., interaction between the user and a technological gatekeeper);

urgency of information demanded for user's action;

impossibility of achieving specialised qualifications embracing the whole of the broad field.
Environmental information has also been discussed through other facets, mainly in connection with its organisation and the way it is communicated to users.

I. Crump, in a generic approach, discusses collection, storage and retrieval, going deeper into the aspects of classification schemes, sources of environmental information and collection building (5). Meanwhile he presents the subject of environmental classification broadly, discussing his own hierarchical scheme in comparison with existing systems. R. Seiful-Mulyukov takes up an antagonistic position in relation to the UDC 40 for Envirology and suggests using in its place the classification scheme and terminology under experiment at the VINITI (6).

Regarding the sources of environmental information, I. Crump (5) discusses mainly the published material at the three levels: primary (books, journal articles, reports, conference papers, etc.), secondary (abstracting and indexing periodicals, bibliographies, reviews), and tertiary (computerised data bases of bibliographical sources). He concludes that:

- there is a great surge of interest in environmental studies;
- there are many sources at all three levels which include a greater or smaller proportion of environmental information and a small number of sources
devoted entirely to the environment or specific aspects of the environment. His conclusions are shared by J. Kollegger, who discusses environmental sources of information in the American private sector, such as: directories, referral services, abstracting and indexing services, computerised data bases and resources on legal information. J. Kollegger presents an original classification of document systems and guidelines to assist the environmental researcher to choose a source.

Another comprehensive discussion of information for environmental planning, from the standpoint of sources of information, is undertaken by B. White. The main points are:

- very wide information base demanded, as the field is an interface of many subjects: there is an identifiable hard core but ill-defined boundaries;
- lack of reference sources;
- lack of standard textbooks;
- profusion of books, such as: description of research (mainly urban planning), practical manuals, descriptive and critical studies, and pseudo-sociological writing ('doomsday literature');
- importance and variety of development plans both those prepared by governmental agencies and those prepared on an ad hoc basis outside the legal system;
importance of governmental sources of information, such as: legislation, advisory publications about procedures and special problems, reports, and surveys;

minor importance of journals as a source of information for environmental planners, in contrast to their value for teachers and researchers;

great need for systematic current awareness of environmental planning in practice.

One of the aspects discussed by B. White seems to be valid for the whole field of the environment and not just for planning: despite the volume of publications as a source of information books come quite low down the scale (2).

Collection building is approached by both I. Crump (5) and T. Smailey (9). I. Crump analyses briefly the aspects of building a collection within both a specific topic (for an individual or a small group) and the entire scope of the environment. He reports to T. Smailey, who describes the ideal collection:

- the coverage of an environmental sciences library needs to be of considerable depth, as well as breadth to cope with both the specificity and cross-disciplinary nature of the field demands;
the heart of an environmental sciences library revolves around a central core of works each of which places primary focus on the examination of interactions and interrelations of various environmental sciences areas;

both the core and the fringe subject areas from which those core works stem should be strong. However, this is often not feasible for three reasons: first, budget constraints; secondly, restrictions inherent in the kind of constituency, program or interests being served; and thirdly the insufficient time devoted to selection. Then T. Smalley discusses possible alternative approaches and available sources to help the process.

A. Somerville focuses the main characteristics of environmental information and considers that from the standpoint of the cross-disciplinary nature of the field, the academic library in contrast to industrial libraries normally has the best basic collection to meet the information needs of environmentalists. On the other hand, industrial libraries generally have more experience in the field of data and non-documentary information provision, obtained through both formal and informal channels (3).

Improving retrieval of environmental information from computerised data bases is the subject discussed by
K. Durkin and J. Smith. They emphasise the rapid growth in both the number and the size of the bases, reflecting an average increase of a million references a year. To cope with this, they suggest a more efficient indexing of the material and more training of data bases users. Two standing needs to be met by these computerised information systems in the field of the environment would be: capability to answer more specific questions, and facility to respond at short notice to questions of immediate concern. In parallel, the system should also be prepared to provide information of continuing interests. So, different services should be provided, according to the specific situation and to user needs.

The authors comment on some of the approaches currently being used, such as abstracts journals, standard profiles, current awareness, retrospective searches, and cooperative activities (10).

G. Yska and J. Martin, in research carried out by the Commission of the European Community, identified 17 data bases carrying information relevant to environmentalists. As a result of the research, they listed ten large data bases likely to be useful to many areas, ten data bases of greatest relevance to the field of environment, and a list of secondary services in the area (11).

Public information is discussed by D. Rubin et al., who focus mainly on the role of the press in making the
population aware of environmental problems. This is considered the first step in creating a public consciousness of environmental matters. The other steps, also concerned with the press role, would be:

. open the access to information about both government and private companies regarding the environment;
. communicate available information to the public;
. develop a public understanding of underlying principles, issues and answers about environmental problems the public has been made aware of.

The authors discuss also the external and internal pressures suffered by media, which blunt their performance (12).

A particular approach is presented by M. Dosa of the non-governmental organisations (NGO) both as a source and a user of environmental information in the world network (13).

In such a complex and new subject field, having already so many sources of data and publications, it seems that the most crucial problem for information workers concerns the 'conversion' (retrieval and packing) of such a proliferation of data into useful, precise, aggregated information, likely to satisfy specific needs of the environmentalist.
6.1 INTERNATIONAL SCENARIO

It is noticeable, particularly after the Stockholm Conference that supranational organisations have expressed interest in setting up one of two kinds of systems: either internal environmental information systems, or international networks looking forward to the monitoring and improvement of global environment conditions. The United Nations has led this movement, the reason why it features so largely in the present topic. Besides the United Nations, the efforts made by the Commission of European Communities in the area of environmental information will also be focused separately.

The efforts of an isolated environmental NGO can be seen in the Environmental Law Information System - ELIS - designed and maintained by the International Union for the Conservation of Nature - IUCN, with the assistance of UNEP and the Government of the Federal Republic of Germany.

6.1.1 The United Nations Information Systems

It seems that most of the efforts towards coordination or processing of environmental information for the use of the international community is made within the United Nations system. Three of these information systems are
coordinated by the United Nations Environmental Programme under the sub-programme called Earthwatch:

- Infoterra;
- Global Environmental Monitoring System - GEMS;
- International Register of Potentially Toxic Chemicals - IRPTC.

These may be considered the main environmental information programmes with global scope which are currently available.

Four other information units within the United Nations deserve being mentioned as they are of some interest to the field of environmental pollution, such as:

- the International Nuclear Information System - INIS, of the International Atomic Energy Agency, which is operational since 1970, in Vienna. It is a computerized source of bibliographic information on nuclear sciences;
- the Marine Environment Data Information, held by UNESCO/IOC, in Paris, is a referral system intended to provide information on the capabilities of existing centres supplying information on the marine environment around the world;
- the Soil Data Processing System is under organisation by FAO, in Rome;
- the International Reference Centre for Waste Disposal,
of the WHO, in Geneva;

the World Vigilance of Water Quality is a joint project of UNEP, WHO, UNESCO and WMO, which is planned to be an input for the GEMS.

Besides the above-mentioned programme one should also cite the Global Investigation of Pollution of the Marine Environment - GIPME, sponsored by the UNESCO/ICO, and Man and the Biosphere - MAB, held by UNESCO, both of them actually generating and making accessible a great deal of information, as a by-product of researches conducted by them or on their behalf.

The three main environmental information systems held by UNEP - INFOTERRA, GEMS and IRPTC - are a by-product of the Stockholm Conference, as the way to make the concept of Earthwatch operative. At that meeting, a programme for the critical assessment of the global environment was proposed, under the name of Earthwatch. This programme would encompass four interrelated components: monitoring, evaluating and review, research, and exchange of information. These components were planned to be operational through three different information systems:

- an international referral system for sources of environmental information: it was initially named IRS and is now known as Infoterra;
a monitoring system to make an inventory of global resources and environmental quality—called Global Environmental Monitoring System—GEMS;

b. an information retrieval system about harmful substances—International Register of Potentially Toxic Chemicals—IRPTC.

a. Infoterra

the institution of UNEP's referral system to make available internationally environmental information related to development is the result of the recommendation 101 of the Stockholm Conference (14), endorsed by the Governing Council at its first session, in 1973, when UNEP's Executive Director was authorised to start the pilot phase of the system (15).

Even though the development of the actual system was authorised since 1974, it only became operational in 1977.

Infoterra's scope is to link up through an environmental information network the users, sources and managers of environmental information, and to introduce systematic procedures and communication channels by which to improve the flow of such information from those who have it to those who need it (16).
The main functional capability of the system is a directory of sources of environmental information, which is constantly updated by focal points, that is the national representatives of the system in each member country. The focal point is always a government department. Sources might be a government institution, a research group, a company, an university or an individual. Each source is described in the directory through numerical codes (or attributes) which give the field of expertise, the main characteristics of the source, and a note of the way it is willing to function as a source. The user's query is coded by the local focal point using the same subject attributes, and then the search is performed in the directory (either by computer or manually). The answer to the user will be a list of sources, which can be contacted directly.

By September 1979 the situation of Infoterra was:

- 100 focal points
- 7,200 registered sources
- 3,000 queries already answered

Infoterra is preparing to have the first evaluation of the system in 1981. After that, it may take new directions, as has been suggested by some focal points of the West: instead of dealing only with referrals, it could move to substantive information, having a document delivery service as a complementary help. The need for closer
interaction with the users, and for publicity campaign to promote Infoterra to the mass and to the information professionals has been frequently emphasised; especially in the meeting held in Moscow in October 1979. (17)

b. GEMS

GEMS is the monitoring component within the Earthwatch, which functions as a catalytic unit based at UNEP. Actually, it includes monitoring activities implemented through WHO, WMO, FAO and UNESCO, organisations which publish the data resulting from GEM's activities, according to their specific area:

- monitoring of oceans is performed jointly by WMO/ IPLAN, UNESCO/IOC and UNEP;
- monitoring of the atmosphere is performed basically by the WMO through its World Weather Watch, W.W.W., in collaboration with UNEP;
- monitoring-activities-related to human health are developed by WHO, FAO and UNEP;
- monitoring of renewable natural resources are undertaken by FAO, WMO, UNESCO and UNEP (18).

The creation of GEMS resulted from the decision of the Governing Council in its first session in 1973, which in the second session authorised the Executive Director to take the necessary measures to develop and implement the system (19).
The purpose of GEMS is to provide the Governing Council with an overall picture of the global state of environment, particularly trends undergone by critical environmental elements (20).

The resistance GEMS sometimes meets amongst developing countries derives from the point that, by monitoring the state of the environment (availability and quality of resources) within individual countries, it might interfere in the internal affairs of the nation and endanger its sovereignty, as the system could progress towards becoming a tool for a supranational government.

c. IRPTC

The International Register of Potentially Toxic Chemicals - IRPTC constitutes, with Infoterra, the information exchange component of Earthwatch. The development of IRPTC comes from the recommendation 74 of the Stockholm Conference (21), endorsed by the Governing Council of UNEP, which authorised its development at the third session, in 1975 (22).

The ultimate purpose of IRPTC is to help reduce the hazards presented by chemicals in the environment. It will be achieved by:

- supplying information on request;
- providing baseline data for assessment (and perhaps prediction) of hazards associated with particular chemicals.
The IRPTC will supply information to users from its own files and by using its network partners. The network will have this structure:

- a central unit;
- network partners who are willing to receive and answer questions;
- contributing sources available to the IRPTC;
- national or regional correspondents. (23)

The users of IRPTC may be: organisations of the United Nations system; any organisation concerned with the management of the environment; states members of the United Nations; health authorities; governmental authorities in charge of any area connected with the manipulation of chemicals; scientists engaged in research; chemical industries and similar organisations.

The data base will include information about each chemical attributes such as: identification, physical and chemical properties, analytical data, production and use, distribution and transformation in the environment, potential risks, exposure, standards and regulations, and emergency measures (24).

IRPTC is designed to collaborate with the two other units of Earthwatch in the following way:
by assembling data already collected by GEMS;
by serving as a sectorial focal point for Infoterra. On the other hand IRPTC will also use Infoterra's sources of information.

6.1.2 The European Communities Systems

In June 1971 the Council of Ministers of the European Community issued a Resolution to coordinate the activities of its Member States regarding scientific and technological information. The Council's attention was specially devoted to the creation and development of information systems towards the establishment of an European Network - EURONET. Later, an Action Plan was prepared for the period 1975-77, covering three basic topics of the information area:

- development and creation of system in different subject field;
- creation of a physical network for information handling;
- development of skills and tools in information technology.

As far as the control of pollution is concerned, the Plan of Actions foresaw an Environmental Management Information Network - EMIM, as part of EURONET.
An Environmental Protection Information Group - EPIG - was created at the Committee of Scientific and Technical Information - CIDST and coordinates the efforts within the organisation.

As a consequence of the Plan of Actions and the recommendation of the EPIG many projects have been carried out by the Community and its member countries:

- inventories of information sources are being compiled as an input of UNEP's Infoterra;
- a project of an information system for environmental law;
- a study about the need, use and existing services on conference papers relevant to the environment;
- the development of national (and regional) systems to supply information on environmental pollution;
- a study about the environmental coverage of various data bases (11);
- a study on the compatibility of existing multilingual environmental glossaries (25).

A specific source of information for the Environmental Management Information Network - EMIN is the Environmental Chemicals Data and Information Network - ECDIN. Its creation was decided in 1973 by the Council of Ministers, after a suggestion of the Scientific Committee
on Problems of Environment - SCOPE, a group within the International Council of Scientific Unions - ICSU. It has been developed and housed by the European Community’s Joint Research Centre, in Ispra (Italy) (26).

The basic principle of ECDIN is to store relevant information on any individual chemical compound produced in sizable quantities, irrespective of its use, function or presumed degree of toxicity. It is a hard-data system giving access to information on each chemical, concerning its production, properties, use pattern, disposal, persistence, dispersion tendency, conditions for breakdown, biological effects and toxicity, protection standards and regulations. Its users could be any organization dealing with chemicals, for instance: government authorities, research institutions, industries, experimental scientists and ecologists (27).

It is expected that closer links will be developed between ECDIN and UNEP’s IRPTC, in order to save global effort.
6.2 BRAZILIAN FRONT

In a broad context Brazilian authorities included information policy the first time in the official government programmes in 1972, as part of the I National Plan of Development - I PND (1972-74) (28), to be implemented through the specific projects drawn by the I Basic Plan for Scientific and Technological Development - PBDCT (29). They called for the organisation and implementation of the National Scientific and Technological Information System - SNICT, under the coordination of the Conselho Nacional de Desenvolvimento Científico e Tecnológico (National Council of Scientific and Technological Development) - CNFq, having as supporting information bodies the Instituto Brasileiro de Informação em Ciência e Tecnologia (Brazilian Institute of Scientific and Technological Information) - IBICT (formerly IBBD) and the Biblioteca Nacional (National Library). The system was visualised as a decentralised network of specialised systems. Two subsystems were emphasised in the plan: IBICT, coordinating the other component organisations, and the Ministério das Relações Exteriores (Ministry of Foreign Affairs (through its External Scientific and Technological Information Service - SICTEX) which would act as the intermediary between the foreign sources and Brazilian members of SNICT. Studies and projects, including the consultancy of UNESCO, were expected to be concluded by 1973. The II PND, official programme of the following government,
did not mention information, but its action programme, the II Basic Plan for Scientific and Technological Development - II PB5CT-devoted attention to the problem, again, and included the previous programme (SNICT) under the coordination of CNPq/SNDCT, the National System of Scientific and Technological Development. It mentioned also that information would be available at both CNPq (mainly IBICT) and the decentralised subject agencies (30). Unfortunately the network did not ever come to be effective. Among the problems can be mentioned:

- conflict between the vertical structure of Brazilian government hierarchy, reflected all through the administrative system, and the crossdisciplinary structure of SNICT (SNDCT) (31);
- internal politics among the members of the potential network, competing for power, areas of action, and resources;
- politico-administrative problems within IBBD (now IBICT), which lost quite a lot of its previous prestige as the leading organisation in Brazilian information scene and one of most distinguished in Latin America. Since 1976 IBBD has been reorganised as IBICT; it received a new structure, new objectives and better governmental support. However the frequent changes in direction suggest that IBICT has not reestablished yet the necessary stability to provide an
effective leadership of the information services in Brazil, leadership which is urgently needed and expected;

- problems of transport and communication technology, derived from the large territory to be covered by the network and the stage of technological development of the country;

- inadequate availability of resources, even though II PBDCT had reserved US$ 36,000,000.00 to be spent solely in some prioritary projects of the network.

As far as environmental information is concerned, II PBDCT includes some specific projects. The main project was the development of a computerised system on statistical data and information about natural resources and environment to be set up by the Fundação Instituto Brasileiro de Geografia e Estatística (Foundation Brazilian Institute of Geography and Statistics) - FIBGE. Some others are of fringe interest, such as:

- an agricultural information system (including information on soil conservation);

- the biomedical information system. It included the implementation of MEDLINE, which has partially failed because communication technology problems;

- information on fishery resources;

- information on non-conventional sources of energy;

- information on industrial technology;

- information on the semi-arid and humid tropics.
Notwithstanding its inclusion in the development programme of the previous government, environmental information in Brazil is still in its infancy, and its development will probably depend on some extrinsic factors, the object of previous discussion in Chapter 4, about the design of environmental system, and in Chapter 5, about Brazilian environment. These factors can be summarized in four main points:

- the political and economic destiny of the country in the coming years;
- the policy adopted by government in the management of the environment;
- internal politics amongst Brazilian environmental agencies;
- the development of information and communication technology in the country.

In spite of all conscious efforts and although the socioeconomic conditions have improved tremendously, most of the country is still underdeveloped. As a consequence, resources are directed basically to assist emergency needs and to development programmes; only as a last option to information programmes. On the other hand, the newest and best technology is usually inaccessible to a poor country, which sometimes leads government to take pessimistic position in relation to familiarise itself with new developments through information.
As the country is very large and different regions have developed very unevenly, regional needs vary quite a lot, as does the kind of information they would use. Also the size of the country along with the complexity of prioritary problems make it difficult for the central government (represented by SEMA) to assess the information needs of all agencies involved in the management of the environment. A first survey about the environmental administrative structure, its potential and needs has been under way since 1978, but the results have not been published yet. It is hoped that SEMA will take some action as a result, and does not merely deposit the final report with the thousands of other surveys, evaluation and projects prepared by the government itself or on its behalf by consultants. This negative tradition of making plans which will never executed may be one manifestation of generic bureaucracy in government organisations.

On the political scene the country has still a military government of right-wing ideology, and the environmental information panorama reflects some of the attributes usually linked to that political frame, as discussed in Chapter 2, 4 and 5. A particular example of this syndrome is the recent creation of a Secretaria Especial de Informática (Special Secretariat of Informatics), which has been attached to the Conselho de Segurança Nacional (National Security Council of the Military Cabinet of the Presidency of the Republic. The new Secretariat will be responsible for
policy-making and execution of the national plans related to data processing and communication, in all its aspects, such as development and transfer of technology, systems use, and educational programmes. Regarding the foreign policy of the country, its decision makers see with reservation SEMA's free participation in the international network of environmental information, and reserve to the Ministério das Relações Exteriores all decisions concerned with that sector. As an example, only recently during the UNEP's meeting held in Moscow from 18 April to 4 May 1979, Brazilian diplomats communicated they had agree to Brazil participation in the international information network: SEMA were allowed to join Infoterra, as a focal point and there is an indication that cooperation with IRPTC may be allowed to develop in the near future. But its participation in GEMS is entirely vetoed by the Ministério das Relações Exteriores which sees this system as a threat to Brazil's national sovereignty.

By adopting a technocratic policy in the management of the environment, the government is willing to give preferential support to scientific and technological information systems, devoted to the industrial development of the nation. Monitoring systems to control environmental pollution are few and were only recently introduced in critical areas. A cynical observation might suggest that government support to the agencies
for the introduction of such a control is rooted in
the policy of dispersing evenly the pollution around
the country with the hope that development will also
follow the same path.

As far as the internal politics amongst the agencies
is concerned, the fact that responsibilities for envi-
ronmental matters is very dispersed leads to overt
political manoeuvering for power in this field; SEMA,
the head of the system is too poor and too politically
weak to exercise an effective control over the situa-
tion. The establishment of an actual network of envi-
ronmental information will not be feasible while the
present structure of the administrative system attains,
and while the criteria of resources allocation by the
government, and pattern of relationship among agencies
is maintained in the current style.

The future of environmental information in Brazil will
still depend in part on the way technology progresses
in the country as regards data processing and communi-
cation, and digital transmission.

L. Tarouco and J. Mattos point out that up to the pres-
ent time the country has been investing in analog tech-
nology for communication systems, while its data pro-
cessing industry (digital technology) is still
in the early stages of development.

In 1972 the Coordinating Commission of Data
Processing Activities - CAPRE, was created (It has now been replaced by the Special Secretary of Informatics). CAPRE's policy gave incentive to the development of national technology in data processing, and thus promoted the production of minicomputers and peripherals. However the policy related to the transmission of data, as it relates to the establishment of a network open to public access has not been yet decided. Foreign companies compete for the market, endangering the achievement of a national technology so far (32).

A parallel problem is access to environmental information produced in the West and stored in commercial data bases. Besides the above-mentioned technological problem related to on-line access, there is also the barrier of the high cost of computerised information. Outside the environmental system, many organisations of government and private companies have access to some data bases, either through telex searches or by purchasing the tapes. CNPq is the organisation in charge of coordinating their acquisition, in order to avoid duplication within government system. But, in so far as the facts are known, duplication has already occurred mainly because of political struggle among institutions and ambition to control a slice of the potential information market. This is the choice presented now to the environmental agencies. Should
they join the technological orgy and buy their own data bases, or should they submit themselves to the non-environmental organisations and pay as users?

Regarding a comprehensive approach to Brazilian natural environment (problems and actions towards solutions), the publicly available bibliography is still very poor, as one can deduce from the items stored in the data basis of SIJUR, the information system managed by the Processamento de Dados do Senado (Processing Unit of Brazilian Senate) - PROCASEN. This service covers legislation, books and periodical articles. However, the main sources actually are: governmental reports and development programmes; studies performed by consultants for the government; files of government organisations; and periodicals (magazines and newspapers).

Baseline data are collected and processed in data banks by some of the environmental agencies and their accessibility is discussed later in this chapter.

As has been mentioned in Chapter 5, the administrative structure established to control pollution in the country is quite new and has been based in organisations directly managed by government, which have a tradition of being either bureaucratic or devoted just to administrative work and not to research. This fact may also help to explain the slow development of environmental information and the implementation of information systems by the agencies.
If one considers that the generation and processing of environmental data depends usually on sophisticated equipment, it is easier to understand the paucity of information available to managers, since the agencies are poorly equipped as shown by Table 13. This table refers to equipment availability, and includes agencies' own property, equipment shared with other government organization, and equipment rented from a private enterprise.

Analysis laboratories (chemical, physical, bacteriological) and computers are the main pieces of equipment found in the agencies, and these are frequently shared by affiliated institutions. The data do not discriminate among the levels of complexity of either facility.

Only 12.9% of the agencies have equipment to monitor environmental pollution, and this is concentrated in South-Southeast Brazil, where most of industrial pollution actually is.

In this same Table 13, telecommunications — available in 11.3% of the agencies — should be understood to include either telex or computer terminal. Telex is the most frequent because all major organisations of the federal government are interlinked in a network. Other auxiliary tools for information transfer, such as micrographic and
### TABLE 13: EQUIPMENT AVAILABLE

<table>
<thead>
<tr>
<th>TYPE OF EQUIPMENT</th>
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<th>NE</th>
<th>SE</th>
<th>S</th>
<th>TOTAL</th>
</tr>
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<td>1</td>
<td>4</td>
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<td>3</td>
</tr>
<tr>
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<td>-</td>
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<td>2</td>
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<td>2</td>
</tr>
<tr>
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<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>PHOTOGRAPHIC LABORATORY</td>
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<td>-</td>
<td>-</td>
<td>3</td>
<td>-</td>
<td>2</td>
</tr>
<tr>
<td>MICROFILMING EQUIPMENT</td>
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<td>-</td>
<td>-</td>
<td>-</td>
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<td>1</td>
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<td>MONITORING EQUIPMENT</td>
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<td>-</td>
<td>1</td>
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<td>PRINTING-PRESS</td>
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<td>1</td>
<td>3</td>
<td>-</td>
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</tr>
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<td>TELECOMMUNICATIONS</td>
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<td>3</td>
<td>-</td>
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<tr>
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<td>-</td>
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<td>1</td>
</tr>
<tr>
<td>REMOTE SENSING EQUIPMENT</td>
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<td>-</td>
<td>-</td>
<td>1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>SPECTROPHOTOMETER FOR ATOMIC ABSorption</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>MILITARY APPARATUS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

**TOTAL** (62)
photographic equipment, printing-press and others are limited facilities.

It will be noticed that Table 13 includes an item 'military apparatus'. It was necessary to make a separate entry for this item after conducting interviews with senior managers in the Navy, which is charged by law with specific responsibility for looking after marine pollution. These managers also represent Brazil on the international environmental committees related to the sea, though at the same time they declare that they do not share the same information sources used by other agencies, they do not make decisions; for their work this leading group has declared that they only use 'the legislation, the court transcript and military apparatus'.

It has been found through visits, observation and interviews that there are three basic types of information service in the environmental agencies: technical files or records; libraries and computers data banks (Table 14). Of the sixty-two existing agencies, 83.9% have manual files to keep technical documents and data (both engineering and financial-economic subjects). 69.4% also have a collection of bibliographical material, though sometimes this is so poor that it can hardly be called a library, and often does not have a librarian. Computer data banks exist in 32.3% of the agencies, and their content varies both in nature and in complexity. Half of these data
<table>
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<th>TYPE OF SERVICE</th>
<th>ENV</th>
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<th>FRI</th>
<th>TOT</th>
<th>ENV</th>
<th>SAN</th>
<th>FRI</th>
<th>TOT</th>
<th>ENV</th>
<th>SAN</th>
<th>FRI</th>
<th>TOT</th>
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<th>FRI</th>
<th>TOT</th>
<th>ENV</th>
<th>SAN</th>
<th>FRI</th>
<th>TOT</th>
<th>TOTAL</th>
</tr>
</thead>
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<td>5</td>
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<td>9</td>
<td>6</td>
<td>1</td>
<td>17</td>
<td>4</td>
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<td>1</td>
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<td>52</td>
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<td>LIBRARY</td>
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<td>43</td>
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<tr>
<td>COMPUTER DATA BANKS</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

TABLE 14: INFORMATION SUPPORT

NUMBER OF AGENCIES HAVING INFORMATION SERVICE
banks are not yet fully operational. More details will be given under specific agencies running an information system.

Different pieces of software have been used to operate the twenty data systems existing in the environmental agencies:

- **NAQUADAT**: Canadian software designed to manage water data. It can be seen both in the original and in modified versions. It has been used to manage numerical files containing data related to water quality and to monitoring;

- **PROSIG**: Canadian software appropriate to deal with geological data and the like. It deals with both numerical and non-numerical data, including bibliographical information;

- **TOTAL**: a general SYCOM system designed for the management of data, which has been used to treat numerical data about regional socioeconomics, natural resources and internal administration of the agencies;

- **EIS/P & R**: American software imported from the US Environmental Protection Agency - EPA, to manage numerical data on air pollution monitoring;

- **EIS/AGA**: an adaptation of EIS/P & R to suit water pollution data management;
- AQDHS/2: American software to manage air pollution monitoring data;
- VENTY: American software used in controlling levels of polluting effluents;
- SIH: Software designed by Brazilian National Department of Water and Energy – DNAEE for processing water quantity.

There is some other software of less importance, designed and used by some of the agencies.

One may observe a tendency to generalise the use of AOQUADATA, the modified version of NAQUADAT, because the agency that owns it has demonstrated a special enthusiasm for advertising and commercializing its knowledge, services and information products, even when they are a result of the support from either Brazilian federal government or international organisations. Many complaints were heard during the interviews about this aggressively commercial agency. Besides of problems like the above mentioned, which cannot be solved by SEMA, since it has neither political or administrative power nor money to intervene, the development of information systems in the poorer agencies has been difficult.

Table 15 discriminates among the kind of data contained in files. The agencies collect a huge amount of raw data about various aspects of the Brazilian environment,
<table>
<thead>
<tr>
<th>SOFTWARE</th>
<th>FILES</th>
<th>SUBJECT COVERAGE</th>
<th>NUMBER OF AGENCIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>NAQUADAT (original)</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>NAQUADAT (modified)</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>PROSIG</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>EIS/P &amp; R</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>EIS/AGA</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>AQDHS/2</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>VENTY</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>SIH/DNAEE</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>SPECIFIC</td>
<td>8</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>UNDEFINED</td>
<td>9</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>4</td>
<td>20</td>
</tr>
</tbody>
</table>

TABLE 15: COMPUTER DATA BANKS

NUMBER OF DATA BASES PER TYPE OF DATA
but only a small proportion of this is ever processed. This is done either manually or by computer. In either case it is quite impossible to retrieve the non-processed data.

The agencies related to pollution control have been the most active in data collection. However the areas of action are not properly delimited and, as a consequence, there is a big overlap, mainly concerning water data. That is because most of the institutions related both to pollution control and sanitation are concerned with water quantity of quality. They collect the same data, but mostly for different purposes (even though in practice there are cases of different agencies collecting the same data for the same purpose).

Table 16 presents the data collected by the agencies. As can be seen, the number of parameters used to evaluate fresh water quality vary quite a lot from one region to another, from less than six to over 20 parameters. The control is tighter in both Southeast and South regions, because of the massive industrialisation and high demographic concentration. Conversely it is almost non-existent in both North and Centrewest regions, because they have an abundance of pure water, and because it is an extensive, underpopulated and non-industrialised area. The lack of classification
<table>
<thead>
<tr>
<th>TYPE OF AGENCIES</th>
<th>QUANTITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>FRESH WATER QUALITY INDEXES</td>
<td>Standards of receptor watercourses</td>
</tr>
<tr>
<td>To 6 parameters</td>
<td>Standards of atmospheric receptor</td>
</tr>
<tr>
<td>7 - 10 parameters</td>
<td>To 4 parameters</td>
</tr>
<tr>
<td>11-20 parameters</td>
<td>More than 4 param.</td>
</tr>
<tr>
<td>more than 20 param.</td>
<td>Undefined number</td>
</tr>
<tr>
<td>undefined number</td>
<td></td>
</tr>
</tbody>
</table>
of the watercourses has been an obstacle to the actual water pollution control, and just three agencies collect data on the standards of receptor watercourses (carrying capacity). Data on the quantity of fresh water receives more attention in the Northeast and Southeast regions, where there are areas at risk of becoming a desert. Monitoring of marine pollution is usually restricted to the coastline, aiming at recreational use. Air pollution data are collected by 15.9% of the agencies, and in almost all of these the technological conditions for exerting control are very poor. Just 4.8% of the agencies control noise pollution and collect data on this matter. This low percentage is due to two reasons: it has been the duty of the municipal government to control noise, and it is culturally considered an acceptable kind of pollution, if it does not reach a critical level.

Besides those already mentioned, some other data are also collected about meteorological conditions, soil quality and use, natural resources, potentially polluting economic activities, pollution sources, and socioeconomic data about each region. Like noise pollution, the control of solid waste belongs also to the municipal government. Most of the data are collected just for routine use and for immediate pollution control activities, but do not ever get either analysed
or published. In critical places (some metropoles and industrial sites) population is everyday informed through the newspapers about the meteorological conditions and levels of pollution. In the sea resorts the condition of the beaches is also indicated in the news bulletin supplied by the agencies to media.

Table 17 shows the accessibility of the data collected and processed by the agencies; 59.7% make most of their data available to both governmental and private institutions, though in the latter case the institution must state its reasons for applying for the information and declare what use they are going to make of it. There are restrictions on data produced by other agencies and these are only accessible to federal government, or to federal and regional government. Out of the total, 4.8% agencies referred to the existence of classified data which are only held for the use of the producer.

As showed in Table 18, when the data are accessible, outside institutions can get them free of charge from 69.5% of the holding agencies, but have to pay in 11.3% of the agencies. It is important to observe that the rich agencies (in Southeast and South regions) charge, but the others do not. Some of the agencies (19.4%) have not yet defined their information charging policy.
<table>
<thead>
<tr>
<th>TYPE OF ACCESSIBILITY</th>
<th>AGENCIES GIVING ACCESS</th>
<th>ENV</th>
<th>SAN</th>
<th>FRI</th>
<th>TOT</th>
<th>NE</th>
<th>SE</th>
<th>S</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Private use of the owner agency</td>
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<td>1</td>
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<td></td>
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<td></td>
<td>3</td>
<td>4.8</td>
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<td>2. Open to (1) and federal government institutions</td>
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<td>3</td>
<td>3</td>
<td></td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>15</td>
</tr>
<tr>
<td>3. Open to (1), (2) and regional governmental institutions</td>
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<td>1</td>
<td>2</td>
<td>3</td>
<td></td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>13</td>
</tr>
<tr>
<td>4. Open to any government and private institutions</td>
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<td>2</td>
<td>1</td>
<td>4</td>
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<td>4</td>
<td>1</td>
<td>7</td>
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<td>NE</td>
<td>SE</td>
<td>S</td>
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<td>FRI</td>
<td>TOT</td>
<td>ENV</td>
<td>SAN</td>
<td>FRI</td>
<td>TOT</td>
<td>ENV</td>
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<td>1</td>
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<td>9</td>
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<td></td>
<td>4</td>
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<td>5</td>
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<tr>
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<td>2</td>
<td>2</td>
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<td>5</td>
<td>4</td>
<td>3</td>
<td>12</td>
<td>7</td>
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</tbody>
</table>
With regard to the means used by the agencies to reveal their plans, actions and employees' ideas, 47 periodicals and serials have been identified, as shown by Table 19, which discriminate among the different types. The highest concentration is in the Southeast region, where every agency has some kind of publication; and the lowest concentration is in the North region where only one agency has its own technical news bulletin.

The agencies related to pollution control are the most dynamic in publishing, and they hold over 50% of the existing titles. It should also be observed that while these agencies are more concerned with the publication of technical news, law, bibliography and environmental education, the sanitation agencies are more keen on the publication of statistical bulletins related to the public services they offer.

Publications tend to be limited to coverage of local issues, as is usually the case in environmental control field.

Reflecting the decision of the Brazilian government in restraining the growth of the number of official publications, two of the pollution control agencies publish their articles and news in the technical journal of the relevant Ministry or Secretariat.
### TABLE 19: AGENCIES' PUBLICATIONS

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<tr>
<th>TYPE</th>
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<th>SE</th>
<th>S</th>
<th>TOTAL</th>
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<tr>
<td>Own Newsletters (Technical)</td>
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<td>2</td>
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<td>Own Statistic Data Bulletins</td>
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<td>8</td>
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<tr>
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<td>Own Legislation and Related Acts</td>
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<td>1</td>
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<td>Own Educational Series</td>
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<td>Technical Journal of the Ministry or Sec.</td>
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<td>2</td>
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</table>

* Two published in the Technical Journal of the relevant Ministry or Secretary

**Note:** Even though the total number of publications is 47, it does not reflect the number of publishers, as some few agencies publish several types.
6.2.1 Information Systems

This section discusses information systems dealing with any subject related to environmental pollution control, others than only those run by the agencies. Few agencies have formal information systems, which deals with both data and documents, and it was decided to focus mainly on the systems concerned with processing environmental data, irrespective of their actual operational state. The information system will be presented under the name of the institution, and they have been grouped by region, starting from the Centrewest region, where the central government (including SEMA) is.

Centrewest Region

a. Secretaria Especial de Meio Ambiente - SEMA

SEMA's authorities are not in favour of the establishment of a decentralised network, where the Secretariat would coordinate and the agencies would process the data. They opted for the development of their own system, because of:

- the belief that possessing the data in their own premises would give SEMA power and better control over the environmental system. It is felt that decentralisation (by either agencies, or subject sectors, or regional subsystems) would reinforce the present disadvantaged position of SEMA;
the fear that business interests would lead some stronger agencies denying information to SEIM and boycotting exchange through the network.

Thus, SEIM is working on two fronts: coordinating efforts throughout the country towards the organisation of local information, and designing its own system. Some efforts have been made in developing both fronts, and the main results, still in the planning stage, are the following projects:

National System of Environmental Control - SINACAM.

SINACAM is a program set up by the federal government under the coordination of an Interministerial Group composed of representatives of the Secretaria de Planejamento da Presidência da República, Ministério da Indústria e Comércio, and Ministério do Interior. It was designed as a broad instrument to coordinate the activities of environmental management at federal, state and local levels, and to evaluate the impact of these management activities on both social and natural environment. Within this comprehensive programme, a topic specified that potential information needs of SINACAM should be anticipated by the design a computerised system to process mainly baseline data, resulting from monitoring activities.
Carrying on with the programme, two specific projects are in progress at SEU:

. National System of Environmental Monitoring (SEMA);
. Environmental Information System - SEL.

Seen as the main operational means to be used by the agencies in order to control environmental quality, the National System of Environmental Monitoring was designed in 1976. It has been developed and implemented by SEMA in cooperation with different organisations of the government environmental system. Decision has been made to monitor only some essential parameters at the beginning, progressing later according to needs. The standards to be used at first stage have already been developed by SEMA. A preliminary step planned was the survey of existing monitoring activities in the country and a detailed analysis of both techniques and criteria used and data collected. The proposed system was intended to integrate and standardise all existing activities. Along with this analysis related to the production of data, another survey was proposed to identify the actual and potential users of environmental data. The last subproject of the system referred to the design of a data bank, for which SEMA, in 1976, invited external consultancy from the Universidade Federal de Minas Gerais (Federal University of Minas Gerais) - UFMG and
the Universidade de Brasília (University of Brasilia) - UnB, under the coordination of an information expert, member of the UFMG. The deadline for the implementation of the National System of Monitoring as a whole was February 1978, but internal problems and some others of both political and financial nature derived from SEMA's position in the governmental system interfered with the project of the data bank and have been delaying the realization of the whole programme of monitoring.

In January 1978, another proposal for the design of an information system was presented to SEMA, this time by an expert in systems engineering from TELEBRÁS, the telecommunications national company. The proposed system will supply both bibliographical information (including an index to the microfiches received from EPA) and management information (models and hard data, including monitoring). No users' study has been mentioned in the proposal.

b. Departamento Nacional de Águas e Energia Elétrica - DNAEE

DNAEE, a department of the Ministério das Minas e Energia monitors quality and quantity of fresh water in the federal rivers, that is rivers which cross two or more states, or those acting as natural frontier with other countries. The resulting data are processed by DNAEE
in cooperation with CAEEL, the data processing unit of Auxiliary Company of Brazilian Enterprises of Electricity, as part of the National System of Hydrologic Information, which includes:

- a data bank, run by DNEE in Brasília;
- files of all regional districts of DNEE;
- files and data system of the Companhia de Pesquisas em Recursos Minerais (Company of Research on Mineral Resources) - CPRM.

As far as water quality is concerned, among DANAEE's activities, only four parameters are monitored at present: temperature, conductivity, dissolved oxygen, and pH. Future plans include the increase of number of parameters, and the implementation of a subsystem to process data on water quality.

The data bank on water quantity is already operational, and stores data about both rainfall and stream flow, as collected by the hydrologic stations all around the country. The software used to process the data is NAQUADAT.

c. Departamento Nacional de Produção Mineral (National Department of Mineral Production) - DNPM

DNPM runs currently two information systems: PROSIG and RADAEBRASIL. Even though DNPM headquarter is locat-
ed in Brasília, RADAMBRASIL main office is in Salvador. PROSIG is a comprehensive information system which includes both bibliographic information and hard data. Its subject scope is Brazilian geology and mining activities, from both research and economic standpoints. The software is the Canadian PROSIG. Data processing is centred in Brasília, but there is a regional coordination in each district of DNPM. The user - a governmental institution - can receive either a printed report or a map, or a magnetic tape.

In parallel DNPM runs RADAMBRASIL which carries on the pilot activities of RADAM, which started in 1971, covering the Amazon region. RADAMBRASIL covers all other areas of the country concerning: geology, geomorphology, pedology, flora, and soil use (actual and potential). There are five regional centres: Natal, Salvador, Rio de Janeiro, Florianópolis and Goiânia. Data resulting from RADAMBRASIL are published through two series: Relatório Interno do RADAMBRASIL, and Levantamento de Recursos Naturais. It is expected that by 1985 RADAMBRASIL mission will be completed.

d. Instituto Nacional de Meteorologia (National Institute of Meteorology) - INEMET

INEMET manages one of the largest networks for data
collection ever established in the country:

263 main climatological stations (115 of them are part of World Weather Watch System - W.W.W.);
126 auxiliary climatological stations;
29 agroclimatological stations;
9 soundings stations (radiosounds);
13 meteorological balloons.

Meteorological data about Brazilian conditions are analysed and organised for immediate use (mainly related to weather forecasting) and stored in the original forms (tables, reports or maps). Lack of processing and organisation makes retrieval a serious practical problem.

INMET works also as a regional centre for South America in order to retransmit the data to W.W.W. processing centre in Washington, and for this programme there is quite a lot of equipment in use.

e. G E I P O T

GEIPOT is a permanent Working Group within the Ministério dos Transportes. Its 'data bank' on communication and transport includes regional data on: demography, socioeconomics, agricultural production, number of vehicles in both rural and urban areas, volume of traffic in towns and motorways, and consumption and price of fuel. Input comes from different organisa-
tions, such as the Banco Central do Brasil (Central Bank of Brazil), FIEGE, Departamento Nacional de Estradas de Rodagem (National Department of Motorways) - DNMR, and Conselho Nacional do Petróleo (National Council of Petrol). In 1978 there was a plan to use computer to process the data. Although the product of GEIPOT's data bank is available to outside organisations, and the environmental agencies could use the information for their own purposes, the organisers of the 'data bank' explain they do not have any ecological concern in their selection of the data to be included.

f. Superintendência de Desenvolvimento do Centro Oeste (Superintendency of the Development of Centreatwest Region) - SUDECO

This is an organisation subordinated to the Ministério do Interior which promotes and gives incentives to other organisations to carry development programmes in the Centrewest region. Its main information support is a data bank on socioeconomics, and demography of municipalities of the region. It is run in cooperation with both the Ministério do Interior and the FIEGE. The software used is TOTAL.

Northeast Region

a. Superintendência do Desenvolvimento do Nordeste (Superintendency of the Development of Northeast Region) - SUDENE
This is the organisation of the Ministério do Interior which promotes and coordinates development programmes concerned with the Northeast region. Its present database is on hydrometeorologic information. In 1973, SUDENE prepared a project for an information system of Regional Sanitation (35), which was intended as a subsystem of Ministério do Interior's Information System for Planning, Control and Coordination. The short-range objective was the rationalisation of activities related to collection, processing and dissemination of information by sanitation agencies, in order to improve their overall performance. The first product of this effort was a survey on the water supply services of all Northeast states, and then twice a year SUDENE publishes updating information about both water and sewage works in the region.

Southeast Region

a. Superintendência de Recursos Naturais (Superintendency of Natural Resources) - SUPREN

This is the department of IBGE in charge of processing, analysing, evaluating and disseminating environmental information (mainly statistical data). Its data bank covers natural resources, ecosystems, and pollution. Two subsystems are already operative: natural resources and an inventory of industries. Total is the software used.
b. Comissão Nacional de Energia Nuclear (National Committee of Nuclear Energy) - CNEN

CNEN is subordinated to the Ministry of Energy. It has two different information supports:

- CIN: its internal information system which processes IMIS tapes to disseminate bibliographic information on nuclear energy to users all around Brazil;
- a data bank on meteorology, nuclear instrumentation and other data necessary to implement and run the nuclear power stations now being built in Brazil. The data bank is run by Furnas, a company of the Ministério das Minas e Energia.

c. Diretoria de Hidrografia e Navegação (Directorate of Hydrography and Navigation) - DHN

Subordinated to the Ministério da Marinha, this organisation runs the National Data Bank of Oceanographic Data, which covers meteorology, oceanography, and marine pollution. Different software has been designed for each subsystem. Information resulting from the subsystem on marine pollution is periodically sent to UNESCO/COI. Some of the meteorological data come from INPE/NET, but DHN goes beyond INPE/NET level as its scope is broader.

d. Fundação Estadual de Engenharia e Meio Ambiente (State Foundation of Engineering and Environment) - FEEMA
FEEHIA, the environmental agency of Rio de Janeiro, is implementing a data bank made up of the following sub-systems:

- **Ambiodata**: water quality control. The software used is a modified version of the Canadian NAQUADAT;

- **Emission Inventory System/Permits & Registration Subsystem**: control of polluting emissions in the atmosphere. The software used is the EIS/P & R from the United States Environmental Protection Agency - EPA;

- **Emission Inventory System for Water Courses**: control of polluting emissions in watercourses. The software used is a modified version of EIS/P & R;

- **Air Quality Data Handling Subsystem**: monitoring of specific substances which might be polluting the air in a given area. The software used is AQAHS/2 from EPA.

Besides the activities related to environmental control, FEEHIA is preparing the inventory of Brazilian sources of information on sanitary engineering and the environment, as part of the Pan-American inventory promoted by the Pan-American Health Organisation and World Health Organisation.
e. Companhia Estadual de Saneamento Básico e Tecnologia Ambiental (State Company of Basic Sanitation and Environmental Technology) - CETESB

CETESB is the environmental agency of São Paulo. It has adopted the Canadian software NAQUADAT and, since 1974, runs a data bank on sanitation and environmental control through the resulting AQUADATA. It includes data on streams, beaches and coastline water, reservoirs, water supplied to urban areas, and industrial effluents. Having started from the production of data on water quality, the system progressed towards air quality, and now includes also: pollutants emission, noise level and meteorological data. Other subsystems being either implemented or planned are:

- public health information;
- bibliographic data base quality control of materials and equipment used in sanitary engineering.

f. Instituto de Pesquisa Espacial (Institute of Space Research) - IMPE

IMPE, located in São José dos Campos - SP, is an organisation subordinated to CNPq. It processes images obtained from satellites (LANDSAT, NOAA, TIROS-N, SMS/Meteorosat, SKYLAB, and HIMBUS). Some of IMPE's programmes concerned with the application of these data are of high interest for the management of the environment, such as:
Applied Meteorology Programme: mainly used for agricultural research;

Production of Images Programme: used in studies about mineral resources, agricultural and florestal resources, sea resources, hydrology, geography, cartography, urban planning and pollution;

Remote Sensing of Mineral Resources Programme: used for geologic mapping of special sites;

Remote Sensing of Agricultural and Forestal Resources Programme: used to detect areas of reforestation or deforestation, and to evaluate soil and flora as well;

Remote Sensing of Sea Resources Programme: used to survey marine life and spillage of pollutants in the sea;

Remote Sensing Programme of Land Use: used in surveying land use forms and impact, silting of rivers and dams, and soil erosion.

Both images and information resulting from researches are available to outside users, when unclassified. It should be added that INPE's library catalog is now on computer.

South Region

Fundação de Amparo à Tecnologia e Meio Ambiente (Foundation of Support to State Technology and Environment) - FATIMA
A new unit, the embryo of a computerised information centre, is being developed by FATHA to support its programmes. At present, it processes only bibliographic references concerning its own library material.
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Manager, most of the information is lacking. It cannot be expressed. You have to supply it on your own, from friends and allies (1).

The above warning is suggested by C. Churchman to be affixed to the console of a management information system, and it clearly describes the situation: since management is a very complex activity, it demands a great variety of input, from objective data to background knowledge and values (moral, aesthetic, political, etc.). Most of this information, even though very relevant to decision-making, eludes expression in any known form of language, computer or otherwise, and so it will never be supplied by an information system. This limitation is even stronger in the area of environmental management because of some specific characteristics of the subject, such as its crossdisciplinarity, sociopolitical implications, and ethical arguments. It explains somehow why information systems devoted to assisting managers - environment and otherwise - quite usually emphasise hard data: they are straightforward, non-polemic and easily processable. They certainly get another dimension when combined with the variables for decision making in an actual management information system - MIS.

Another characteristic of management - mainly as concerned with the environment - is that most important decisions
involve far-reaching consequences and potential risks, demanding both accuracy and promptness. Thus, the information support required by managers at this point must be easily accessible, precise and fast. As a result, in such situations, decision-makers would be primarily helped either by a computerized information system which contained 'emergency' instructions and hard data, or by personal advice and assistance from experts in the specific problem-area.

In their everyday work, information needs of managers are closely related to managerial functions, within a particular context, and can be met by a variety of sources both formal and informal. However, the sources a manager approaches and the way he interprets the information carried by them are determined by his background knowledge, and professional training and experience.

Much research has been done on managerial functions (in both government and business organisations) and associated information needs. Innumerable other investigations have also focused on the information needs of scientists and technologists. But the analysis of information needs of people working in government agencies in charge of managing the overall environment has hardly been explored yet. Notwithstanding the scarcity of study in the specific area, some understanding about the
information seeking behaviour and need of environmental managers could probably be inferred from previous findings, if the following analogies with some of the subjects already studied are considered:

- the essence of managerial functions is common, even though the area of action varies;
- the environmental agencies are governmental bodies, and so coexist with the same constraints and resources as the other governmental organisations, and have the same functional pattern;
- the great majority of environmental managers are technologists.

The validity of such inference is supported by V. Rosenberg, who found that research and nonresearch professional personnel in industry or government do not differ to any appreciable extent in their evaluation of information gathering methods (2).

7.1 INFORMATION NEEDS AND USES

S. Faibisoff and D. Ely consider information as symbolic representations of reality, capable of reducing uncertainty. In this context, they review the literature on information needs, starting from the analysis of the concept:
If information needs can be considered a generic concept, then there are subsets which address information demands (or requirements) and information wants (or desires). There are those individuals who can articulate demands and there are those who have a desire for information but are not able to specify what it is that they 'need' (3).

Basically the same idea is discussed by J. Tocatlian, when introducing UNESCO's programme of user education. He considers the image of scientific and technological information users and non-users, by analysing the uncertainty which leads users to information sources, and the reasons that keep a person away from the information services (4). By and large the reasons both for being and for not being a user coincide in that they express either ignorance of impotence. On the other hand, the inability to express a felt need falls in between the two mentioned groups, once the individual in this circumstance can be either a potential user or a user having trouble in communicating a latent idea.

When considering environmental managers as a group, an information professional will face the three facets of the information needs issue:

- specific information demanded by users;
- vague information wanted by users;
- a potential user's desire for information and ignorance of available services.
Nevertheless in this present work the different categories of needs will not be discriminated among, but considered broadly. At the same time, the information seeking behaviour of some professional groups will also be analysed, according to the relevance to the subject: decision makers, government officers and technologists.

7.1.1 Environmental Managers as Decision Makers.

From the various ways managers' activities are grouped in the management literature, one could say that they perform five main functions: planning, organising, staffing, directing and controlling. Two other tasks - decision making and communicating - cut across all functions, as they are very basic in all human activities, and especially in management. These functions and tasks are explained by J. Hassie:

- planning is the process by which a manager anticipates the future and discovers alternative courses of action open to him;
- organising is the process by which the structure and allocation of jobs is determined;
- staffing is the process by which managers select, train, promote and retire subordinates;
- directing is the process by which actual performance of subordinates is guided toward common goals;
controlling is the process that measures current performance and guides it toward some predetermined goal;

decision making is the process by which a course of action is consciously chosen from available alternatives for the purpose of achieving a desired result;

communicating is the process by which ideas are transmitted to others for the purpose of affecting a desired result (5).

There are various authority levels within the management structure - top, middle, and lower or operating management - which are linked by the macro-objectives of the organisation and the information flow within it. Top management is concerned with strategic, non-programmable, judgemental decisions, usually related to the functions of planning and directing. Middle management is responsible for tactical, programmable decisions frequently related to the functions of organising, controlling and staffing. Lower management deals with operational, routine, recurring decisions, usually part of the function of organising. In practice, middle management participates also in higher decisions, which usually result from a group consensus (6).

The literature on the information needs of managers emphasises information for decision-making. Two reasons
might explain this bias:

1. The uncertainty which initiates the decision-making process is common to any information need, and is the main factor in motivating an information demand;

2. Decision-making is possibly a core task of management. Actually, H. Simon treats it as synonymous with the whole process of management (7).

J. San Miguel's investigation results about information processing in managerial decision making suggest that the diversity of users' background, objectives and psychological characteristics may lead to different wants and preferences for information (8). Even though this idea is largely accepted, most authors generalise about managers' information needs and uses.

S. Trull analyses some variables involved in determining total decision success and, as far as information is concerned, he focuses on two aspects:

1. The need to supply decision makers with the correct amount of data: scarcity of information is likely to lead to poor decisions; but any information acquired beyond the capacity for assimilation by the decision making centre brings about dysfunctional consequences and overloads the cost of the expected product. The determination of the correct amount of data is, or should be, contingent upon the probable
total decision reward;

the importance of efficient communication within the organisation and between the organisation and the community, in order to inform people about the decisions which will affect them and thus get them involved in the decisions (9).

W. Keegan focuses on the process and sources used by executives to acquire business information, and concludes that they prefer to use oral communication (10). This is also the conclusion of B. C. Vickery who points out the preference of managers for either informal communication (personal, oral channels) or textbooks for specific substantive data (11). T. Holland says that managers in human service organisations make decisions based either on their own knowledge and experience, or on familiar information gathered through informal channels. Political and value factors are the main determinants of their decisions (12).

M. Mazis's research, based on the cognitive tuning theory, groups people as decision makers (or receivers) and non-decision makers (or transmitters) according to their behaviour towards information. His conclusions present decision makers as having more flexible cognitive structures, and likely to accept more discrepant information, emphasising new information even through
considering familiar ideas as well. On the other hand, the non-decision makers would have a more rigid cognitive structure, and prefer one-sided, familiar information (13).

A. Rowe (14) and E. Afanas'ev (15) take a practical side of managerial information. A. Rowe recommends the automation of routine decisions entrusted to either lower or middle management and involving a large quantity of data; he also suggests the use of computer to digest information, evaluate alternatives, and test key parameters as aids in making complex decisions involving judgment and analysis by top management. A. Rowe sees an organisation as an information and decision-processing medium. In this context and regarding the information requirements for the decisions, he points out two main sources:

1. internal sources which supply the three levels:
   - operating data for lower management; organisation's reports as the basic source of information for middle management; and summaries of the reports for top management;

2. external information (not pertinent to the direct operation of the organisation) gathered through informal channels. He considers this as one of the most important services of information for top management, along with a manager's own intuition, experience and emotion.
E. Afanas'ev focuses on the industrial context of Russia to consider the specific information needs of managers fulfilling strategic, tactical and operational tasks. The subjects used information mainly for:

- the evaluation of internal achievements, in comparison with foreign technological developments;
- the increase of professional knowledge;
- the development of long-range plans and forecasts;
- the technological improvement of the factory.

A shortcoming of information support was identified. Nevertheless, the main channel of information for managers appeared to be the internal network, and the main sources were the industrial center materials. Top management valued very highly analytical comparative reviews and analytical references on a complex of problems, as the best information support to decision-making.

Some generalisation can be made from the above-mentioned researches, concerning the information support needed by managers:

- there are specific information needs connected to each managerial function and hierarchical level, which in broad terms have already been identified;
- an effective communication network to ensure the
flow of information within the organisation, and
between it and the outside world is a key to decision
success;

- computer should be used to replace managers in routine
decisions and to help them in programmable tasks;
- decision makers should be given the correct amount
of information.

Regarding the information input for decision making,
managers seem to use:

- at top management level: their own intuition, experi-
ence and emotion, along with oral communication with
peers; eventually some formal information that the
decision maker prefers - either analytical/compara-
tive reviews or summaries on specific innovations;

- at lower management level: operational data and
familiar information. When the decision maker uses
formal channels to find specific data, he prefers
to use a textbook;

- middle management, according to the situation,
sends either top or lower management information
seeking behaviour. Internal reports are often used.

On the whole managers tend to prefer informal (personal,
oral) channels of communication, and information (raw
data, reports, etc.) from their own organisation or
from similar ones, besides relying heavily on their own
background knowledge and experience.
7.1.2 Environmental Managers as Government Officers

There are few researches about the information needs of people working in government organisations. They present a complex hierarchical structure, contrasting usually with a weak relationship between authorities and information workers.

R. Tagliocozzo et al. found in a research carried out with decision makers in public service organisations that they base decisions on oral and written information, the latter being informal documents generated by their own organisation.

Another aspect is pointed out by Janda and mentioned by S. Faibisoff and D. Ely (3): government decision makers would be better off being supplied with the right amount of information in a 'digested' form. Instead, some government offices, like Congress, are deluged with official publications and data. The quantity of information received exceeds their capability to use it. A facet of the same problem - weakness in processing and assimilating the information available - is discussed by E. Loehman and R. McElroy II in the area of regional planning decisions. Legislation passed to control problems such as land use implies the need for complex information by decision makers to implement it, but the information support of government has not been developed at the same
pace as the legislative system. They suggest the use of a model which would take into consideration both the information to be processed by the system and the processing rules and criteria to transform the input into decision (17).

B. White investigating the information needs and uses of planners found out they use three different groups of information sources, according to the specific situation:

- for routine work they use the data, maps and plans prepared by their organisation and government publications;
- to satisfy fringe interests and keep themselves updated they use periodicals and other library material and services, including current awareness;
- to keep abreast of the main practical developments they use informal channels, talking to colleagues in the organisation or at professional meetings (18).

Research conducted with social workers of the Wiltshire Social Services Department, as part of the DISISS project of Bath University, shed light upon their information seeking behaviour. It was found that their main sources of information are personal contacts (oral communication) and internal files. It also became apparent that they were unable to get useful information from the chaotic quantity of data existing
in the area of social services (19).

The conference promoted by the Library Association on the sources of information for social planning focused, among several aspects on some characteristics of information needs of the personnel working in that field:

- survey data about the community;
- records of enquiries made by the public;
- records of all council planning matters;
- social indicators;
- government publications, especially social research reports.

Seldom mentioned were the traditional library sources, such as periodical, directories and guides. A common problem mentioned is the variety of subjects the social planner has to deal with (20).

L. Grayson (21) reporting his research results on the information support of local government in the United Kingdom, starts the document with a statement attributed to J. M. Keynes:

> There is nothing a government hates more than to be well informed, for it makes the process of arriving at decisions much more complicated and difficult.

He goes on by analysing the failure of both local authorities and librarians in approaching and satisfying
information needs of government officers. Some of his conclusions are:

- information seems to have little real effect on local government decisions or policy making; outside pressure and internal 'politics' are often more influential;
- various information sources are used in a confusing way: computer data banks, archives, filing systems, personal files, libraries, informal contacts, and individual's own memory.

It has been noted that the most important factors determining a local government officer's preference for an information source are:

- his level of knowledge about the existing sources and their relevance to particular problems;
- the importance he attaches to being 'well informed';
- his professional and educational background;
- ease of access and use of the source.

Summing up it can be said that in general information is somehow seen as troublesome by government officers, because its volume and variety make it difficult to be used and increase the complexity of the decision-making process. To minimise the problem, officers tend to prefer: informal communication (mainly oral),
internal documents and data, government reports, survey data and their own knowledge and experience. Their preference for a specific source is determined by its ease of access and use, their awareness of the existence and the relevance of that source, and some personal characteristics.

7.1.3 Environmental Managers as Technologists

The information needs and seeking pattern of scientists and technologists have been the object of innumerable researches, since it was the first group of users to demand librarians' special attention. The Annual Review of Information Science and Technology, which has been covering the topic since 1967, testifies to the early approach it received in the literature and the achievements so far. Looking through those reviews and the study conducted by S. Taiblesoff and D. Ely (3) one may conclude that some characteristics seem to be common to the technologists as a group and to their working environment:

- preference for oral communication;
- great value given to numerical data;
- seeking behaviour determined by principle of least effort;
- resistance to change;
little importance given to scientific literature and research reports;

preference for a brief, highly readable, and specific document, when a written source has to be used;

'curiosity' about projects their peers are doing and methods they use, but it is difficult to be satisfied because communication flow among organisations is not free in order to protect innovative information.

Some particular researches either confirm the above generalisations or present new facets of technologists' behaviour. P. Gerstberger and T. Allen analyse the four basic criteria used by R & D engineers in the selection of information sources: accessibility, ease of use, the quality of information, and the familiarity with the source. They concluded that accessibility was the main criterion used (22).

R. Rosenbloom and F. Wollek made two important remarks about information transfer to and among technologists:

- technologists use about 50% to 75% of their time in professional communication with their peers;

- both engineers and scientists are unaware of most of their information needs and potential sources to help them (23).

A. Dish, reporting on research about Norwegian engineers' information needs, describes the picture in such a way
that it may be applied generally to the whole professional group, outside Norway:

- they feel swamped in information they do not want, do not need, do not ask for;
- they have neither time nor training to make use of traditional information sources or channels;
- they prefer familiar easily accessible sources, such as a supplier, a colleague, or the old textbook they used at school;
- their requirements are dictated by the need for information to enable them to make an immediate decision than by the need for thoroughly reliable and authoritatively approved information (24).

F. Jenish presents a slightly different picture in Russia, through the results of a survey of over 20,000 specialists, out of whom one third were technologists:

- 27.7% of subjects use channels through which technologists get 20% of their information, and scientists get 22.3%. However, the use of friends as source of reference is appreciated mainly by the least trained specialists;
- subjects use heavily the traditional library material for professional updating, and 43.9% of these specialists use bibliographic support for production purposes. Books are highly assessed by technologists as
a 'conveyor of the very necessary information', which they admit need not necessarily be new (25).

A. Grelowska-Vickery surveyed the communication and information needs of Earth Science engineers to find out that:

- their information requirements will depend on the time available to make a decision, the diversity of fields involved and the number of decisions to be made at a time. Crossdisciplinarity leads the engineer to look for all available sources; urgency will make him seek an oral source; and many decisions to be taken at a time will be a reason for him to use his own past knowledge and experience;

- overall, the sources of information are used in the following ratio: 6% were private (own head and personal files), 30% were organisation sources (colleagues and internal documents), and 64% were external sources (both formal and informal);

- 80% of the interviewees indicated organisational colleagues as the main source of information for day-to-day work and for keeping abreast of new development, and 49% cited peers outside the organisation;

- as for written media, the preferred sources are organisation reports, journals and conference reprints;
when approaching a problem, the engineer-practitioner will consider his own knowledge and the practical solutions that have 'worked' in the past; the engineer-manager will either transfer the task to his subordinates or call upon a consultant. As a whole, all interviewees agreed that in problem-solving situation they use first of all their own knowledge, and next contact orally people who have had previous experience (friend, colleague, supervisor or consultant (26).

It is worth observing that the work in Earth Science presents some direct similarities to the professional circumstances of environmental pollution control:

- subject contents of these fields overlap in some aspects;
- both areas are interdisciplinary;
- various technologies are used at work;
- engineers are the predominant professional group.

A vast literature has been dedicated to the analysis of the informal communication network established within and among scientific and technological organisations. Examples are T. Allen (27) (31), A. Chakrabarti (28), A. Wilkin (29) and R. Taylor (30), all emphasising some common points, such as:

- personal communication is the main source of information in R & D context;
contacts are first of all looked for within the organisation, and then outside through formal working relationship;

there are some key communicators in the organisations who do most of the information transfer to their peers. T. Allen (27) (31) and R. Taylor (30) refer to these communicators as technological gatekeepers. A. Wilkin (29) discusses the roles of innovators, link-pins, technological gatekeepers, information brokers, and team librarians. A Chakrabarti (28) investigates the roles a communicator can play either as referral/connector, or as information/source, or idea salesman, or as idea facilitator, or as idea supporter.

As far as Brazil is concerned, only a few researches have been performed to assess information needs and uses as related to technologists:

a. the Departamento Nacional de Estradas de Rodagem - DNER promoted a research on the users of its Instituto de Pesquisas Rodoviárias (Institute of Road Research) information services. For this purpose, DNER approached 124 specialists about their needs and preferences; the results showed that 24.5% prefer the informal channels of communication. Among those 75.5% who prefer formal written sources, textbooks, handbooks and reports were most popular (32);
b. a study conducted by V. Araújo, under the support of CNPq, in R & D laboratories showed that 30% prefer informal channels. Author’s hypotheses about this preference for informal channels being much lower than among similar groups reported in the literature were: the subjects were very young, had little professional experience, had not worked for many years in the organisation, and their working environment was very competitive (32);

c. M. Santos studied the information needs of technologists working in organisations concerned with metrology, and how the information services of the Instituto Nacional de Pesos e Medidas (National Institute of Weights and Measures) - INPME could be more effective. The results were:

- 51% of people working in the area of legal metrology preferred oral sources of information, as did 33% of those working in scientific and industrial metrology;
- higher preference for oral channels was related either to longer experience in the job, and non-research tasks, or to low-level job and education;
- subjects use first of all sources available at their own organisation (own notes, colleague, document, or files);
- when using formal written sources, they use their own sources (40% of people in the field of scientific
and industrial metrology) and then a library.

The most often used documents are in the following order of preference: standards, specifications, and textbooks; specific tables and graphs related to a particular activity; supplier's catalogue of equipment; legislation; organisation documents (procedures, reports, etc.); reference material (33);

d. M. Bastos surveyed the information needs of geologists working for organisations located in the state of Minas Gerais, and concluded that: the preferred channel of communication is personal within the organisation (97.3%); handbooks are the preferred written source (96%); the most used semi-formal source is own private files; patents, congress papers, and visits are the least considered sources of information. The overall ranking of preferred channels showed that ease of access (mainly the least effort) is the first criterion to choose as source since geologists ranked then is the following order:

1. colleagues within the organisation
2. organisation library
3. own private library
4. peer outside the organisation
5. library of other organisations (35).

The results are similar to those of A. Grolew ska-Vickery (26).
Environmental Decision Makers Themselves

Any emergent field presents problems, such as those related to concepts and determination of boundaries. Conscious of this, H. Strong, when still the director of UNEP, proposed a new concept for the management of the environment, as

the arrangement of the decision-making process; the organisation of the necessary research and analysis and monitoring functions, formulating alternative courses of action, and evolving procedures through which conscious choices can be made in the fullest possible knowledge of their consequences. These are essential, and largely missing, service and support functions for decision-making at the highest political level (35).

He goes on to comment on the traditional human experience in sectoral management of resources, and the tendency in government administration to centralisation, hierarchisation and bureaucracy. All these characteristic are unsuitable for environmental management, and thus he proposes:

this means that lines of communication and decision-making must be given much greater horizontal and trans-sectoral dimensions than are provided for in existing structures. It means evaluation of important activities in terms of their economic consequences. It means allocating the real costs of activities to those who benefit from them, assigning real value to such traditionally free goods as water and air, and radically revising our concepts and methods of valuing the future. And it means a much broader and more extensive participation in decision-making by those who will be directly affected by the decisions made (35).
One may conclude from M. Strong's ideas what kind of environmental system of management he regarded as ideal, and which functions he understood an environmental manager would perform in the new suggested approach to the environment. Managerial functions would include:

- decision making: getting informed, identifying and evaluating the alternatives, and choosing the socially best alternative;
- organising: the establishment and the maintenance of a dynamic, flexible structure for the system; and the promotion of research, analysis, and monitoring functions within the system;
- planning: formulation of alternative courses of action, and evolving procedures;
- controlling: guiding the system towards the objectives within the new concept; revising the concept; performing cost/benefit studies in which real value should be assigned to environmental goods;
- communicating: making the information flow in both horizontal and trans-sectoral directions; allowing and motivating public participation in management;
- directing and evaluating system according to the qualitative goal of the system.
The manager would be concerned with a system of which the main attributes were:

- flexible network structure;
- decentralisation of control, allowing for diversity in size and orientation of the network components;
- responsibility shared among different authorities, and between government and people;
- integrative approach to society-wide problems, looking forward to a better quality of life.

Regarding the information requirements for the management of this new environmental system, M. Strong suggested the establishment of a decentralised network, where a multitude of centres of information, energy and power would be linked together in easy interaction (35). UNEP's information programme is based on this new concept of management of the global environment. On the micro-level, that is the management of national environment, it seems that this integrative view of the environment would also be feasible and so would the new concept of its management.

Notwithstanding the definition of a conceptual framework for the environmental management, and the huge amount of data and publications available, there is still lack of study of the needs and preferences of the users of environmental information. Some active environmental
agencies have surveyed their users' preference for peripheries, such as a new technology to be adopted by the system, as in the case of EPA, in 1973 (36).

E. Kverel's research reflects the common concern and declared need of environmental managers: the development of a model to help decision making and the control of pollution. The basic idea is that information needed by regulatory authorities is better known by those to be regulated, who would either supply or deny the information, depending on the incentive policy adopted by government. This policy should take into account both the damage resulting from pollution and the costs of reducing pollution. E. Kverel's model focuses on the policy implication of an asymmetry between the regulatory authority and pollutors concerning information about clean-up costs (37). The 'disturbing' element in pollution control, dealt with by the present model, is the ambition of organisations, which look for maximum profit in their business, with detriment of society's well being.

As far as the use of models is concerned, managers are warned about two points:

- a model is often designed for a specific situation and its adoption should be preceded by careful evaluation of its suitability to local environment;
quantitatively based estimate of the environment must be submitted to experts, who will analyse it face the qualitative factors involved in the decision.

R. Noll's paper focuses on decision making and energy policy. He discusses some uncertainties and possibilities a policy maker has to deal with, and shows information as a means to help him though not to eliminate the uncertainty. Three sources of information have been used by government:

- information purchased by government through its various activities that support research and development;
- information generated and processed by the agencies themselves;
- information coming from the public in hearings, court actions, lobbying, etc.

The main implication of such a variety and heterogeneity of sources is often an increase of uncertainty for decision makers. They then either transfer their responsibility to external consultants or delay the decision by gathering more and more information without a cost/benefit study relating the investment to the expected outcome. The author is pessimistic about the future and, as far as information is concerned, he recommends government to diversify the organisational
suppliers of information, and break the information monopoly (secrecy) of corporations (38). Even though the paper does not contribute to the understanding of the information needs of government environmental agencies, it presents an aspect of the chaotic situation of environmental decision makers faced with the uncertainties of the wide range and heterogeneity of available information sources. From Noll's report one could deduce that information professionals would have to infer the information needs of environmental managers through, for instance, the analysis of the output of their work, and participant observation.

Some of the points discussed by R. Noll are present in R. Carpenter's analysis of the information needs of congressmen in making decisions in environmental policy. Their channels of information are: public committee hearing, executive agencies, lobbies, committee staffs, industries, technical societies, civic groups, individuals, and the literature. Their information needs are related to: the national goals and the necessary resources allocation to achieve them; and the technological facts involved in the decision. Two special characteristics are connected to congressmen:

1. they need both 'pro and con' information on the topic of the search, besides the unresolved controversies in the field;
2. information gathering, evaluating and packing is usually performed by the research staff, and not by the user.
Users' requirements are:

- timeliness: information must be supplied within the time available;
- objectivity: all relevant facts ('pro and con') must be found out and presented in a logical, straightforward way;
- quality: analytical, consolidated information based on reliable sources (39).

E. Willis is critical about the adequacy of data supplied to some complex projects, and his survey on the needs relative to environmental data conclude that research should be conducted in the following areas:

- guidelines to determine the optimum point beyond which the investment in data does not give the expected return as far as decision making is concerned;
- data collection techniques;
- coordination, use, and dissemination of data among user groups;
- problems associated with examining data and impacts within the context of an entire region rather than for a specific site (40).

M. Darker investigates the conceptualisation of air pollution by five different specialist groups - lawyers, doctors, engineers, economists, and geogra-
phers - represented by students completing their specialised training. The author's hypothesis is that the existing fragmented approach to environmental management by government is largely a function of different professional perspectives gained during specialised training, and from association with peers. This hypothesis was confirmed in the way specialists differed significantly in:

1. the amount of knowledge about air pollution;
2. the conceptual organisation of environmental information;
3. the perceived professional roles in the control of pollution.

Lack of communication and cooperation between the specialists seems to deepen the conflicts which lead to a divisive form of decision making (41).

H. Ingram discusses the information channels used in making environmental decisions. In practice, decision makers focus upon a quite limited number of alternatives in making choices, and not all consequences of any alternatives are, in fact, taken into account. This restricts their information needs to the main facts and data, relative to the direct and immediate effects of a decision. Information becomes relevant to the decision maker when he is convinced that it will help him, or that he cannot afford to ignore it. As a result of
this predisposition of decision makers, information overload is a likely problem. Environmental decision makers are presented by H. Ingram as being resistant to change, closely related to their past experience, and reluctant to take conflict-generating information which may complicate the decision. The author suggests that the factors affecting decision makers' choice of information are:

- the issue context, i.e., information is only considered on the basis of the familiar (or fashionable) issue;
- the source of information supplied: the decision maker is more willing to use sources which are not controversial, and are likely to lead him to a successful decision, in political terms;
- content of information: decision makers are particularly receptive to categories of information which justify and legitimise their decision making process;
- characteristics of the decision maker's background and experience influence his ability to collect and assimilate data;
- rules and regulations give legitimacy to information used by the decision maker;
learning capacity: intellectual and emotional capacity of decision maker to adjust himself to new sources of information and to feedback from decisions taken;

timing: decision makers will be most receptive to new information during the sorting out phase of an emerging issue.

The author mentions the communication between national, and local levels as one of the main obstacles to a timely information flow for decision making (42).

Summing up the description of information-related characteristics of the above-mentioned professional groups, one may infer some generic attributes of the environmental decision makers, such as:

a. General characteristics:
   . resistant to change;
   . political character.

b. Origin of information generally used:
   . by-product of government purchased R & D projects;
   . product of the agencies monitoring, research and project activities;
   . pressure groups;
   . industries;
   . technical societies;
   . consultancy from experts;
   . advice from colleagues;
   . literature.
c. Information needs:

- models;
- qualitative information to complement quantitative assessments;
- research on data collection techniques;
- legislation;
- surveys to apprehend public perception of problems and desired solutions;
- projects under way in similar organisations;
- in relation to each specific decision: goals of government programmes related to it, resources to be allocated and their availability, and technology associated with the decision.

d. Basic requirements:

- timeliness;
- objectivity;
- correct amount of information;
- cost effectiveness;
- familiarity with the content and with the source of information;
- accessibility;
- ease of use;
- quality
e. Preferences:

- own knowledge and experience;
- informal, oral communication;
- survey and monitoring data;
- internal information;
- government reports;
- technical literature (textbooks, handbooks, standards, and legislation).

Overall, the environmental manager seeks information which endorses his own ideas and gives legal support for his decisions. Regarding information presentation he prefers either internally prepared analytical reviews, or tables, or a brief, specific published document.

The design of an information system likely to support managers of the environmental agencies should take into account two groups of factors:

1. the above-mentioned attributes of environmental decision makers, as an indication of the character, information seeking behaviour and preferences of the users;

b. some indicators of the environmental quality, which may determine the types of information needed in the management of environmental pollution these indicators are:
urban settlements and developments: population (total, geographic distribution, projections); dwellings (number by types, holdings); vehicles (public transport and private cars); amount of fuel consumed (by industries, commerce, residences, and cars); amount of waste incinerated and disposed of; population supplied with water and sewage works; means of communication available.

industrial sites and production: activities performed, area per plant, location, number of employees, raw material used, fuel consumed, water consumed, processes, daily production, by-products (emissions, effluents and solid waste). Safety installations. Treatment of effluents. Projections regarding the industrial expansion of each region.

agricultural activities: area cultivated; types of crops; yearly production; production and consumption of fertilisers and pesticides; irrigation (area irrigated and water consumed); conditions of the population in rural areas.

natural resources: flora and fauna (species and geographical distribution).

geophysical factors, such as drainage areas, climate, temperature, radiation.

hydrological factors, such as precipitation, evaporation, drainage.
Water quality with respect to both the carrying capacity of watercourses and the relative purity according to different uses. Some of these factors are: biological oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), concentration of hydrogen ions (pH), number of coliform bacteria, suspended solids (SS), metals, temperature, colour, turbidity, odour, and taste.

Air quality indicated by the level of sulphur dioxide, carbon monoxide, nitrogen dioxide, photochemical oxidants, and suspended particulate matter.

Sanitation works supplied to population: sewage system (capacity, kind of treatment given to the sewage and the solid waste, cost and revenue) and water supply system (catchment, treatment, capacity, cost and revenue).

Social opportunities available to the population, such as: public health (number of doctors, dentists, nurses, and hospital vacancies per inhabitants); leisure (gardens and parks, public entertainments, theatres and concert halls, sports facilities); employment (labour market, salaries), public education (courses of both basic and professional education, students enrolled and graduate per course; illiteracy; public libraries).
A third group of factors to be considered by the designers of an environmental information system should be the specific needs and characteristics of the users to be served. This aspect will be considered in the next section regarding Brazilian environmental managers.

7.2 INFORMATION USE AND NEEDS OF BRAZILIAN ENVIRONMENTAL MANAGERS

The analysis of the environmental scenario in Brazil indicates that managers in charge of pollution control throughout the five geographical regions have some information available to them are reflected in the way they mention the sources they use at present, and those they are likely to need when looking towards future development in environmental information system in the country.

To understand their information usage pattern it is necessary to analyse the process by which the environmental managers interviewed make decisions. Table 20 gives the overall picture. The hierarchical level at which decisions are made varies considerably. In Table 20, the 'power levels' (1-4) are considered in relation to the top authority (zero) which is either the President of the Republic or the state Governor; thus level 1 is the position subordinated directly to either of these top authorities, and so on.
<table>
<thead>
<tr>
<th>AREAS OF ACTION</th>
<th>Number of Agencies</th>
<th>Political Decision</th>
<th></th>
<th>Technical Decision</th>
<th></th>
<th>Administrative Decision</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Power level</td>
<td>Freq. Urgency</td>
<td>Power level</td>
<td>Freq. Urgency</td>
<td>Power level</td>
<td>Freq. Urgency</td>
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<td></td>
<td></td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
<td>1° 2° 3° 4° Maj Min Maj Min</td>
</tr>
<tr>
<td>POLLUTION CONTROL</td>
<td>30</td>
<td>12 12 1 1</td>
<td>2 19 7 8 3</td>
<td>13 7</td>
<td>4 18 1 10 6 4</td>
<td>11 9 2 6 6 7 9</td>
<td></td>
</tr>
<tr>
<td>SANITATION</td>
<td>24</td>
<td>2 18 4</td>
<td>1 17 4 6 1</td>
<td>8 10</td>
<td>3 13 4 1 11 8 2 7 5 3 9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FRINGE</td>
<td>8</td>
<td>2 6</td>
<td>1 5 2 1 1 3</td>
<td>3 6 6</td>
<td>2 4 1 2 1 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL</td>
<td>62</td>
<td>16 36 5 1</td>
<td>4 41 14 15 5</td>
<td>24 20</td>
<td>7 37 1 29 10 5 24 21 4 14 13 11 22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SOURCE:** Interviews with Environmental Managers. 
Brazil, 1977-78.
There is a tendency to more centralisation for political decisions, in contrast to more decentralised technical and administrative decisions. As an example, only the President of the Republic can decide upon closing even temporarily a polluting factory. Overall, having decisions made by top managers is a characteristic of the environmental agencies dealing with pollution control, while in the agencies related to sanitation and fringe subjects, decisions are often made at middle and lower management level too.

Regarding the frequency with which decisions are demanded, it seems that technical decisions are made very often as part of the everyday work of pollution control, while the political decisions are taken relatively seldom, and only when planning or in emergencies.

As far as the time available to make decisions is concerned, technical decisions demand more urgency, as they always involve an engineering problem to be solved promptly. In contrast to this, the administrative decisions are considered routine and non-urgent. Somewhere in between, lie the political decisions, as they require 'average urgency'.

The information requirements of managers are directly related to the above-mentioned characteristics of the decision making process:
top and middle management need special information support, as they make most of the decisions;

- technical information must be readily available, as it is connected to urgent decisions, and is often demanded;

- information to support political and administrative decisions bears some delay in supply, and the information workers may be given notice well in advance of managers' deadlines.

Asked about the sources of information they actually use in order to make decisions on the control of environmental pollution, the managers mentioned five institutional and four non-institutional sources. The institutional sources mentioned are, in order of importance, according to Table 21:

a. regional organisations or state government institutions, which were mentioned by 77.4% of the managers representing the sixty-two agencies;

b. federal government institutions, by 75.8%;

c. their own organisation, mainly through research and monitoring activities, by 62.9%;

d. municipal institutions, by 59.7%;

e. foreign institutions, by 33.9%.

This result puts forward two characteristics of the system:
### TABLE 21: INSTITUTIONAL SOURCES OF INFORMATION

**NUMBER OF AGENCIES USING EACH SOURCE, PER REGION**

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>N</th>
<th>CW</th>
<th>NE</th>
<th>SE</th>
<th>S</th>
<th>TOTAL</th>
<th>(62)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENV SAN FRI T</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>6</td>
<td>5</td>
<td>(2)</td>
<td>(3)</td>
<td>1</td>
</tr>
<tr>
<td>SAN FRI T</td>
<td>(1)</td>
<td>(6)</td>
<td>(5)</td>
<td>(4)</td>
<td>(12)</td>
<td>(7)</td>
<td>(9)</td>
<td>2</td>
</tr>
<tr>
<td>ENV SAN FRI T</td>
<td>2</td>
<td>15</td>
<td>6</td>
<td>6</td>
<td>1</td>
<td>13</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>ENV SAN FRI T</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
<td>6</td>
<td>75.8</td>
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<td>TOTAL</td>
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<td></td>
<td>(62)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FEDERAL ORGANISATIONS</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>REGIONAL ORGANISATIONS</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>2</td>
<td>9</td>
<td>5</td>
</tr>
<tr>
<td>MUNICIPAL ORGANISATIONS</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>OWN ORGANISATION</td>
<td>1</td>
<td>2</td>
<td>-</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>FOREIGN ORGANISATIONS</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>2</td>
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</tbody>
</table>

**SOURCE:** Interviews with Environmental Managers.  
Brazil, 1977-78.
the great importance of environmental management as a regional issue, and of the exchange of information among institutions of the same level and area;

the inability of agencies to be self-sufficient in information supply to their managers, which makes the latter rely more upon outside sources, even though they often do not know where the required information is available.

As described in Chapter 6, the overall coordination and infrastructure of the environmental system is still very poor. This is reflected in the field of environmental information by the way the existing low level of resources is underused. Neither are the agencies prepared to collect the data and produce the information for their own use, as they are not mature enough, and most of them have a limited budget and no political power. The great majority of the agencies do not have the necessary equipment to monitor the environmental pollution, and their employees are not qualified enough. As a result of their own disadvantaged situation, the agencies rely on any other governmental institutions, which have the type of data they need. Consequently, the data gathered together sometimes present a lack of precision and homogeneity. The other sources of information mentioned by the managers as used by them were non-institutional (Table 22):
TABLE 22: NON-INSTITUTIONAL SOURCES OF INFORMATION

<table>
<thead>
<tr>
<th>SOURCES</th>
<th>N</th>
<th>CW</th>
<th>NE</th>
<th>SE</th>
<th>S</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>LITERATURE</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>62.9</td>
</tr>
<tr>
<td>CONSULTANCY</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>3</td>
<td>62.9</td>
</tr>
<tr>
<td>MONITORING AND SURVEY ACTIVITIES</td>
<td>-</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>66.1</td>
</tr>
<tr>
<td>MEETINGS</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>4</td>
<td>5</td>
<td>72.6</td>
</tr>
</tbody>
</table>

SOURCE: Interviews with Environmental Managers.
Brazil, 1977-78.
a. meetings: frequent internal gatherings to discuss the organisation's issues, and less frequent external formal meetings to discuss technical subjects of wider interest were mentioned by 72.6% of the managers;

b. consultancy: formal external consultancy from an expert, or opinion from a colleague of their own organisation are used by 71% of the managers;

c. monitoring: raw data from monitoring and survey activities were referred to by 66.1%;

d. literature: technical publications to solve specific problems were mentioned by 62.9%.

These results indicate that Brazilian environmental managers lean towards informal channels of communication, the same tendency which is shown by their foreign peers, as mentioned in 7.1 about previous researches. Notwithstanding these results, it would still require a special study to discover if managers' preference for personal (oral) sources of information is a matter of choice determined by either training or natural preference, or the simple result of the scarcity of formal sources.

Analysing the activities performed by environmental managers, it was found that they exert the traditional management functions mentioned by J. Massie (5) and
E. Harrison (6), and discussed in 7.1. They usually perform the planning, organising, personnel management, directing, and controlling of their institution.

During the interviews the respondents were asked to relate each managerial task in the area of environmental pollution control to the respective information most likely to satisfy their specific needs. That is to say, what kind of information they thought it was necessary for managers to possess in order for them to make decisions and proceed to subsequent actions concerned with the various aspects of environmental pollution under their responsibility. The respondents were allowed to cite what they had available both in their own agency and elsewhere. The objective of this question was to test the first hypothesis:

There is a constant relationship between managerial tasks performed in the area of the control of environmental pollution and information needs.

At the end of the interviews it was realised that the managers knew and mentioned 25 sources of information, as listed:

a. monitoring data;

b. socioeconomic statistical data;

c. internal reports about a specific problem under consideration;
d. opinions of colleagues of their own institutions;

e. opinion or consultancy from external experts;
f. periodical articles;
g. research reports;
h. communications presented at a congress or at any formal meeting;
i. technical books (mainly handbooks, norms and standards);
j. government programmes, policy and goals;
l. financial reports of their own organisation (data related to the financial-economic situation of the institution);
m. data on the availability of credit in financing institutions (either reports, or letter, or telephone conversation);
n. top management reports about the policy of their own institution;
o. national plan of sanitation;
p. data on labour market and available human resources (usually gathered through word of mouth information);
q. data on materials and equipment available in the market (gathered by telephone, letter, or catalogues);
r. opinions from users of materials and equipment;
s. opinions of the users of the pollution control and sanitation services;
t. technological innovation (mainly catalogues concerned with equipment, processes, and materials);
u. legislation;
v. hearsay about industries to be implemented in the region (either oral communication or newspaper);
w. hearsay about the economic activities under way in the region;
x. physiographical data about the area;
y. hydrological and meteorological data;
z. internal reports on personnel working performance.

These items may be grouped into four broad categories of information sources, as follows:

1. informal sources: items c, d, e, p, q, r, s, v, w and z;
2. institutional sources: items j, l, m, n, o and u;
3. formal sources: items f, g, h, i and t;
4. field research: items a, b, x and y.

Tables 23 A-E bring into relation the managerial tasks of pollution control and their information needs. The letters (A/Z) represent the source of information used, while the numbers show the total of managers using that type of information to fulfil a specific task. The first column on the left lists the five main
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<th>MANAGERIAL TASKS</th>
<th>NUMBER OF AGENCIES USING EACH SOURCE OF INFORMATION</th>
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**SOURCE:** Interviews with Environmental Managers. Brazil, 1977-78.
### Table 238: Relationship between Managerial Tasks and Information Needs:

**Organising**

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**Source:** Interviews with Environmental Managers

Brazil, 1977-78.
### TABLE 23C RELATIONSHIP BETWEEN MANAGERIAL TASKS AND INFORMATION NEEDS:

**PERSONNEL MANAGEMENT**

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<tr>
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**SOURCE:** Interviews with Environmental Managers

Brazil, 1977-78.
### Table 3: Relationship between managerial tasks and information needs: direction

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<th>MANAGERIAL TASKS</th>
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**Notes:**
- CHN, SAN, FRI represent channels of information.
- TOTAL represents the total number of agencies using each source of information.
TABLE 23E
RELATIONSHIP BETWEEN MANAGERIAL TASKS AND INFORMATION NEEDS: CONTROL

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5.1 Internal Information

5.2 External Information

5.3 Control
managerial functions and related tasks, as follows:

- Table 23 A refers to the planning function;
- Table 23 B refers to the function of organisation;
- Table 23 C refers to the personnel management;
- Table 23 D refers to the function of directing the organisation;
- Table 23 E refers to the function of controlling.

The function of environmental planning includes the tasks of preparation of plans and projects, formulation of policies, setting regulations and standards, and the management of research and development. The decisions and actions in this area are undertaken by top managers. Their generic needs for overall planning comprise all four categories of information at different levels of importance. The most important information, in the managers' opinion was: socioeconomic data (in 64.5% of the agencies), the policy of their own institution (60%) government programmes, policy and goals (60%) and a specific report about the situation under consideration (54.3%). It is important to notice that socioeconomic data have been considered crucial for planning in the pollution control agencies, but not so outstanding in the others. For sanitation agencies, for instance, they are equally important as the National Plan for Sanitation (PLANASA) or the policy of their own institution.
For each specific planning task managers' information needs may vary, so that for policy formulation they should be aware of related government programmes, policies and goals, besides the relevant legislation. To set regulations and standards they first of all need the specific legislation and existing standards; after that they look for the opinion of a specialist within their own institution. For the management of R & D, a comprehensive report on the subject or problem-area under study is considered the most important piece of information, followed by the opinion of both external and internal specialists on the subject of the research.

To perform the tasks related to the function of organising, environmental managers first of all require the legislation, and after that a report about the situation considered for organisation, the opinion of internal colleagues, and the policy of their own institution.

Decision making and task performance in the area of personnel management are supported by information mainly on labour market, and legislation, besides the labour policy and financial-economic situation of their own institution.

The function of directing the organisation includes operations management, finance and accountancy, and maintenance (goods and equipment) of the institution.
The overall needs expressed by managers to exert the function of directing were: data on the financial-economic performance of the institution, a report about the point under consideration, and the opinion of people in the institution. For the specific tasks related to operations management, the following information was considered the most valuable: a report about the operation in question, the opinion of internal colleagues, report about research done elsewhere in the same subject, and monitoring data.

To manage the areas of finance and accountancy they need all data about the financial-economic situation of the institution, information on the availability of credit in financing institutions, the policy of their own institution, and the relevant legislation. The management of goods and equipment demands information on the material available in the market (catalogues, specification, prices, etc.), opinion from users of the material to be bought, data on the financial-economic situation of the institution, and technological innovations.

The function of control includes both internal evaluation of general activities going on within the institution, and the external inspection of potentially polluting activities, besides the monitoring of actual environmental pollution. The overall information needed to exercise control of both the agency and environmental pollution
is principally: monitoring data, technical reports on the specific problems to be controlled, legislation and standards, socioeconomic data, either news or research reports about the solution of identical problem elsewhere, and the opinion from both colleagues in the institution and outside experts.

Specifically for external inspection of environmental pollution conditions, managers need mainly: monitoring data, a technical report on the pollution problem observed, the relevant legislation, socioeconomic data, and the opinion of a colleague. The internal evaluation is made on the basis of an informal report about the performance of both human and material resources involved in the operation.

The data just presented about the functions and tasks performed by the environmental managers, and the related information needs lead to some partial conclusions concerned with the first hypothesis:

- environmental managers have the same basic functions as other managers: planning, organising, personnel managing, directing, and controlling;
- there is no regional variation in managers' functions and main tasks. Only the level of problems and the frequency of their occurrence vary regionally;
- the repertory of information sources of respondents
is very limited: it totals 25 types of information, out of which just a few are needed frequently for all functions;

- information needs for the overall functions and tasks are centred much more on data and opinions than on documents;

- there is just a slight difference in the sources mentioned on the whole, even though the specific information needs, i.e. the type of data expected, might vary from one task to another;

- the majority of the agencies in the three areas of environmental work - pollution control, sanitation and fringe areas - agree about the existence of a basic constant set of information items to satisfy their needs when performing each managerial function.

These results validate the first hypothesis as true.

The second hypothesis to be tested was:

the degree of complexity of managerial tasks is directly related to the socioeconomic level of any given region and, consequently, there are different levels of information needs.

It assumes the point of view discussed in Chapter 2, that environmental pollution has usually been a consequence of uncontrolled socioeconomic development. One aspect
of the question is that the biggest pollution problems of the natural environment exist in the most developed regions, owing mainly to the concentration of population and industries in urban areas.

Starting from this background and having in mind that to each task corresponds a group of basic information needs, it was tested whether managers in more developed regions need more formal, complex, elaborate and varied information than those working in the less developed regions.

Answers to the interview have been grouped in three different ways:

1. Appraisal of every kind of information out of the twenty-five items already mentioned (a-z), considering just if the agency values each of the items. A yes/no answer was expected, and the number of agencies considering a specific item useful was divided by the total number of agencies in the region. The result has been considered as an index of information appraisal in each region, its value ranging from 0 to 1. The average index of appraisal throughout the country is also presented (Table 24).

2. Information needs of managers, by relating the incidence of each information item to both the thirteen areas of action (functions and tasks presented in
<table>
<thead>
<tr>
<th>SOURCES OF INFORMATION</th>
<th>N (4)</th>
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<th>NW (18)</th>
<th>SE (18)</th>
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SOURCE: Interviews with Environmental Managers
Brazil, 1977-78.

* IA = No. times used in each region = 0 - 1
No. agencies in the region
Tables 23 A-E) managers do perform and the total number of agencies in each region. In Table 25 TI represents a partial data meaning the task index. The final result, which can vary from 0 to 1, has been considered an integrated index of the information needs by tasks and region, and is indicated by II.

3. Preference of information sources by managers within each region and comparatively amongst the five regions. As mentioned before, the 25 items of information have been grouped into four broad categories: informal sources, institutional sources, formal sources and field research. After grouping the items into these categories the percentage of choice (or frequency) made by managers in each region about the categories of information sources was calculated in the context of tasks performed (Table 26).

Table 24 shows that the highest index of information appraisal reached by a source was 0.9, which indicates almost total agreement among the agencies, about the relevance of certain information items. It occurred in the South region about the following items: monitoring and socioeconomic data, internal report about a specific problem under consideration, opinion of both internal colleague and external specialist, research report, and government programmes and legislation. The occurrence
### TABLE 25: INTEGRATED INDEX (II) OF INFORMATION NEEDS BY TASKS AND REGION

<table>
<thead>
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<th>SE (18)</th>
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<td>1.4</td>
<td>0.1</td>
<td>4.8</td>
</tr>
</tbody>
</table>

**SOURCE:** Interviews with Environmental Managers.

Brazil, 1977-78.

- **TI** = No. times used per task = O - x, where x = No. of agencies per region
- **II** = Total No. of tasks
- **II** = No. agencies in the region
<table>
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<tr>
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<th>INSTITUTIONAL</th>
<th>FIELD</th>
<th>RESEARCH</th>
<th>FORMAL</th>
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</tr>
</tbody>
</table>

SOURCE: Interviews with Environmental Managers.
Brazil, 1977-78.
of the same index was found four times in the Northeast region, referring to: research reports, government programs, financial-economic data about their own institutions and about the availability of credit in external financing organisations. On the other hand, a zero index was found in the North region, where none of the agencies need data about the labour market.

Ranking the items according to the index of appraisal each one got in each region (Table 24), and comparing the four top items in the five regions, it can be observed that:

a. there was a consensus among the five regions about the greater importance of the following information items: monitoring data, internal report about a technical problem, opinion of an external specialist, research report, technical books (handbooks, norms and standards), government programmes, policy and goals, and legislation;

b. some other items have been considered among the most important in just four regions: socioeconomic data, periodical articles, data related to both policies and the financial-economic situation of their own institution, data on both labour and goods/equipment markets, users' opinion about pollution control and sanitation services, sources on technological innovation. In all cases - except for users' opinion - the disagreement came from the Centrewest region.

The greatest discrepancies in Table 24 are related to the following items: news about industries to be im-
implemented in the region, hearsay on general economic activities in the region, physiographical, hydrological and meteorological data about the region, and internal reports on personnel working performance. These items have not been considered relevant by the more developed regions (South and Southeast). This seems rather peculiar because these data (except those about personnel) are basic for pollution control, which is an increasing problem particularly in the South and Southeast regions, where urban concentration and industrial effluents cause deterioration of the environment and have an adverse effect on the quality of human life.

It should also be noticed that the appraisal indexes in both North and Centrewest regions (the least developed among the five) are the lowest. It suggests that managers over there are poorly informed and ignore the available sources. Paradoxically but quite understandably, by being in such extreme necessity they do not even realise their own needs.

Analysing Table 25 in the same way as the previous one, it was found that managers in all five regions entirely agree with the importance of some information items to satisfy their needs when fulfilling the tasks of environmental pollution control. These are the items which reached the highest integrated index of information needs,
as they were ranked in the first four positions: monitoring and socioeconomic data, an internal report about a technical problem, opinion of both a colleague and an external specialist, research report, technical books (mainly handbooks, norms and standards), governmental plans, programmes and policy, data related to both policies and the financial-economic situation of their own institution, data on goods/equipment market, sources on technological innovations, and legislation. The three following items got one of the highest integrated indexes in just four regions: periodical articles, users' opinion about pollution control and sanitation services, news about industries to be implemented in the region. The one missing is the South region. This is surprising and helps to confirm partially the findings about a discrepant information pattern in the developed regions, as described on page 371 about Table 24.

The highest index in Table 25 was 0.7 and occurred in the South region for the following items: opinion of a colleague, government plans, programmes and policies, and policy of their own institution. The lowest score was 0.03 and occurred both in the North region for users' opinion on goods and equipment, and in the South region for physiographical, hydrological and meteorological data, and internal report on personnel working performance. Table 25 endorses most of the conclusions drawn from Table 24, such as:
a. by comparing the highest indexes in both tables, it can be observed that they coincide in their assessment with regard to many items as the most important in satisfying their information needs. These highly assessed items are: monitoring data, internal report about a technical problem, opinion of an external specialist, research report, technical books (handbooks, norms and standards), government plans, programmes and policies, and legislation. It shows a very limited span and a spur-of-the-moment, practical approach to information;

b. on the whole, in the North and Centrewest regions items got a lower integrated index which could be indicative of both non-availability of varied information sources and managers' ignorance about the potential information sources;

c. Southeast and South regions have not assessed as important the items related to the economic activities in the region, physiographical, hydrological and meteorological data, and internal report on personnel working performance. Disregarding these types of information on the natural environment seems quite inexplicable as these regions have to deal with real pollution problems.

Table 26, correlated with the data of Tables 24 and 25, presents the sources of information grouped into the four
mentioned categories to highlight the regional accords and variances with regard to managers' preference. From this table it is evident that throughout all regions managers have a strong preference for the informal channels of communication. It is the main source of information in the regions North, Centrewest, Northeast and Southeast; the highest percentage belongs to the Centrewest. It validates also identical observations made when testing the first hypothesis.

The second most important information sources are the institutions, mainly the governmental organisations; for the South region this is considered the main source. Nevertheless, in Brazil, institutional sources could be considered a kind of informal source too. This is because the information obtained from them has two unique characteristics: its source depends on the right personnel being in the right place at the right time; but personnel frequently move from one post to another, and as their position in the organisation fluctuates so does their ability to seek out and provide the information. Taking this for granted and considering together informal and institutional sources, it could be observed that in all regions the aggregated result corresponds to more than 50% of the preference among the available sources.

The least popular source of information is field research (monitoring and survey of both national and social
environmental conditions), mainly in the South region, which strengthens the previous observations resulting from the data in tables 24 and 25, about the unexpected pattern of information of developed regions.

The formal or bibliographical sources of information get an equally low preference throughout the five regions. This coincides with the pattern of foreign technologists, as described in 7.1. But it would demand more analysis of the fact that the highest percentage - 21.4\% - of preference for both field research and formal sources has been found in the less developed regions - the North and the Centrewest - while the Southeast region, the most developed, has presented the lowest percentage - 19.9\% - among all regions. One could attempt to explain this unpredictable result through regional conditions.

The scarcity of information resources (and poor infrastructure to generate their own data) in the Centrewest region makes managers give priority to the categories of information sources which are of more difficult access to them, as they are expensive and demand time to be in proper use (e.g. building up a library collection, and setting up monitoring equipment). Besides, there are not many experts in environmental sciences available in the less developed regions, to be used as information sources.
On the other hand, in the most developed region - the Southeast - experts are more easily available, and in most cases, they are seen by managers as a self-contained source of ready-to-use information. However, not considering monitoring and survey data to be necessary is still quite an inexplicable attitude in managers in a polluted region.

It is worth summarising some aspects of the present results, such as:

* in the less developed regions managers are really less concerned about pollution control activities, as discussed in Chapter 5 through tables 8, 9 and 10, because pollution is not their main problem. Although they exercise the same basic functions as the managers in the developed regions;

* the lowest overall indexes of information appraisal were found in the less-developed regions;

* even though they are ill-informed and do not have to perform the more complex tasks related to pollution abatement, managers in the underdeveloped regions value the formal sources of information and data from field research (including monitoring) more than managers in developed regions, which have to cope with actual pollution problems;
managers dealing with actual problems of pollution prevention and abatement do not feel extreme need for regional data on either economic activities or the physiographical, hydrological and meteorological conditions, when considering the establishment of a national information system;

all regions have manifested special preference for the informal channels of communication irrespective of their level of development. Three factors may explain this pattern: most environmental managers are engineers, who are known through previous researches on users' behaviour to have a very practical approach to information, instead of reading formal literature; managers interviewed are ignorant of the existing sources of information and how to use them, which limits their choice; there are not many sources of environmental information available (except in São Paulo) in any single state. As far as individual consultants are concerned, no one particular name has been emphasised, but regarding institutional information support, CETESB has been the most active consultant for the other agencies all over the country.

These findings lead to the conclusion that the second hypothesis is false in the Brazilian context.

The next chapter deals with the above-discussed results, as the reality within which a governmental policy is proposed for the development of an environmental information support to managers in charge of pollution control in Brazil.
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32. Information received informally through M. Andrade Garcia.

33. SANTOS, M. V. R. Estudo das necessidades de informação dos técnicos das áreas afins do Instituto Nacional de Pesos e Medidas e seu comportamento quanto à busca de informação ou da aplicação de um método de análise e avaliação de desempenho de serviços de informação. Rio de Janeiro, IBICT, 1977.


Taking into account the results of present research, a governmental policy for environmental information to support managers in charge of pollution control in Brazil would be a function of factors such as the following:

1. the direct relationship which exists between each managerial function and specific information needs;
2. the uniform pattern of information use and needs which has been observed throughout the country, irrespective of the level of development or the actual pollution problems of the region;
3. the scarcity of information resources and means to generate them at most of the agencies;
4. the clumsiness of managers in locating information and using it;
5. technological, political and economic barriers, some of them raised by Western Capitalism, and others inherent in Brazil's condition of underdevelopment;
6. deficient communication and transportation systems in a country of continental dimensions. Within the environmental system, the traditional bureaucracy and secrecy of a military government hardens even more the problem of communication among the environmental agencies, and between them and other organisations on both national and international levels;
the variety of environmental problems - as a reflection of the dualistic economy of the country - ranging from natural resources conservation and the pollution of poverty to industrial pollution;

conflict between the technocratic policy of central government and the ecological ideals of the environmental agencies.

Overall environmental information policy will be part of the national policy of scientific and technological information of the government, and in this context it will be a concern of both the environmental authorities and CNpq, which is the specific body for formulating and guiding the implementation of scientific and technological information policies.

With the aim of improving the social and natural environment of Brazil, a national policy of environmental information would seek to provide environmental managers and environmentalists in general with both the world's specialised knowledge and factual information about the conditions of Brazilian environment. On the practical plane this governmental policy may be realised through an information network which makes the best of the existing information resources of the country, even though they are very scarce in the area of the environment. Present information infrastructure, systems and services should be taken as a basis. A blueprint for countryside information development might be drawn in order to de-
velop the strong points (or nodes), improve those new or weak, fill the existing gaps, and improve the communication between users and sources.

8.1 NETWORKING THE RESOURCES: STRATEGIES

As described in 6.1, there are many international bodies concerned with organising information about the global environment - actual resources and problems, and potential hazards. Out of these, UNEP tries to ensure the participation of all countries in an effective network.

Brazil's integration into this global network, partially agreed upon by the government, will not be efficient unless some level of coordination is established over existing environmental information systems in the country, which have been described in 6.2. Most of the effective existing information systems (environmental and otherwise) are to be found concentrated in São Paulo, Rio de Janeiro and Brasília. The other states have at least the embryo of an information system. Unfortunately, a full exchange of the information collected by these systems is not possible at present because of defective coordination. This would be feasible through a formal network coordinated by one governmental organisation interested in environmental matters. The coordinating body would have the conditions to direct any query to the relevant source because it would know at any time
who holds what kind of information, and which information is available at each environmental agency and related organisations.

According to B. Mc Gurrin & B. Silcoff information networks have the capacity for eliminating duplication, equalising access to services, minimising effects of distance from information resources, reducing costs through regional sharing of software and hardware for technical process and communication (1).

The planning of an environmental information network for Brazil must start from the formulation of strategies, which would include the definition of objectives, the organisational structure and the information components required to make it operative and effective.

3.1.1 Objectives

The main objectives of formalising the environmental information network are:

- to improve the capacity of agencies for selecting, processing and communicating information;
- to improve the accessibility to information among the agencies;
- to promote the optimum utilisation of the available information sources, services, and resources (mainly technology);
to facilitate international and national cooperation and exchange of both information and expertise;

- to provide environmental managers and decision makers with relevant information to solve present environmental problems and to meet their future needs.

Regarding specific environmental management activities, to be provided through the network would be valuable for the following purposes of the agencies:

- planning: models and data would be supplied to assist in the development of new plans, in the management of projects under way, and in the annual updating;

- setting guidelines for planned activities;

- program control, as for instance, to assist in budgeting, cost control, scheduling, and performance evaluation;

- reports: data would help in the preparation of both follow-up reports regarding a specific programme and annual reports required by the central government, besides bulletins for public information;

- enforcement and follow-up of compliance of the environmental quality standards and regulations;

- permits: control and updating of permits given to potentially polluting enterprises;
surveillance through monitoring data on environmental conditions and on polluting activities;

- assessment of the environmental impact both of economic activities and the agency's clean-up programmes;

- inventory of available environmental resources, and pattern of consumption (present and forecast);

- data, models and document exchange among the agencies, and with other organisations (national and international) outside the system;

- research conducted at the agencies and by outside researchers would be supported by factual information stored at a known place in the network.

It is quite possible that the management of the environment in Brazil would be improved at little increase in costs, as a consequence of sharing the existing resources.

8.1.2 Organisational Structure

As mentioned before in 5.2 the management of Brazilian environment is dispersed under many different authorities, all of which are supposed to refer to SEIHA, the national coordinating body. However, internal problems — political, economical, and technological — of the governmental system interfere in the relationship between SEIHA and the environmental agencies and related organ-
isations of the central government. As a consequence of the weak coordination of the system - at both national and regional levels - there are areas in which the agencies' interests overlap, while in other areas no agencies at all are active. On the other hand, as a result of political misunderstanding among the institutions of the higher administration, and the fight for power and profit among a few agencies, the uniform growth of the system is disturbed. On the operational side there is a scarcity of technology and qualified personnel in the specific environmental areas.

As far as the information scene of Brazil is concerned, there is neither formal coordination nor a national network of libraries, information systems and the like. Regarding environmental information specifically, there are few formal sources available, there is almost no information on the available sources, librarians are not yet trained in the environmental field, and the prospect of user education has not yet been investigated.

Consideration of these factors may determine the basic characteristics of the network structure. Initially, it seems quite clear that such a structure should consider all governmental bodies and scientific and technological institutions of the country as potential information sources. If the set of non-environmental organ-
isations were to be called 'external network'; then the resulting environmental information network would be really the combination of an external network and the network composed of the environmental agencies and related organisations. However, from the administrative standpoint, the coordination of such diverse institutions which are under many different authorities seems to be not feasible at least at the present stage. So, the temporary solution appears to be the composition of a formal network of the environmental agencies, supplemented by informal contacts with the non-environmental institutions, as far as information gathering is concerned.

A network of the latter kind could be either centrally directed (controlled by one national centre, or by some regional centres) or non-directed (decentralised processing and free communication among the nodes). In both cases, as regards document and data processing, and communication within the network, the organisation could be as follows:

a. in a centrally directed network:

  . the centre (or centres) would have a powerful computer system, giving access by terminals to the nodes;

  . a common format and software would be used by all nodes and the centre;
each node would have its own minicomputer in order to process the data of that particular state (or authority's competence) and transmit them to the centre's computer;

the centre would function as a clearinghouse for formal sources. This function would be performed by its library which would have the tasks of acquiring, processing, storing and providing services, such as: specific information supply (question answering, analytical reporting, SDI for individuals or groups, etc.); document lending (both to individual users and to the nodes' libraries), photocopying services, and referral services (mainly on the informal sources of information).

b. in a non-directed network:

- each node would have its own computer and terminal;
- data and documents relating to the individual state (or authority) holding the node would be gathered, processed and stored by the respective node, so that every node would be provided with necessary technology and facilities;
- each node would have its own library responsible for document processing and lending, referral service, and information analysis and dissemina-
tion. Interlibrary loans and information exchange could be based on common norms but would be controlled by each individual library; a common format and software would be adopted by all nodes for ease of communication and interchange.

In both directed and non-directed network nodes, in the initial stage agencies could continue to use the conventional means of communication - telephone, post, and telex - for their information exchange.

Five alternative configurations have been considered for the network, as discussed hereafter.

a. Alternative 1

This would be a directed network with coordination at the top organisation of the environmental administrative structures - SEMA (Fig. 1).

![Fig. 1](image)

SEMA would be not only the head of the politico-administrative system, but also the centre of the information network. This centre would have the tasks of coordinating the network; providing referral service, processing, storing and disseminating the information;
and of being the clearinghouse for the formal sources (periodicals, books, microforms, etc.). The possible advantages of this configuration would be:

- a position at the head of both politico-administrative system and information network should restore SELA's authority and thus strengthen the system;
- better coordination could promote a more intensive interchange of information and resources within the environmental system;
- this 'pool' of data and documents would prevent the monopoly and the commercialisation of information among the agencies, and give each agency access to all the information collected in the whole network;
- standardisation of formats for data input and output and for document and data processing;
- economy as related to facilities for data and document processing.

On the other hand, some problems or disadvantages could also be foreseen, such as:

- some nodes (especially the more powerful ones) may boycott SELA by withholding information relating to their specific area (state or region) or subject;
agencies which have been profiting from selling information to the others may not want to yield up the revenue;

SEMA's lack of money, and prestige both with the central government and among the agencies make the gathering of all agencies' information services and sources under its control difficult to realise;
sensitive information would demand special consideration: it could either be held by the original node or stored by SEMA under a code for limited access.

b. Alternative 2

This would be a non-directed network, where the nodes would informally interchange information among themselves (Fig. 2).

Fig. 2

SEMA, as head of the politico-administrative system, would have the role of policy making. Each node would process and store its own data and documents, and disseminate such information to its users. Through their terminals the nodes would be able to communicate among themselves and have access to the non-classified information stored in each
node's computer. Interlibrary loans would be promoted by the nodes directly. The main advantages presented by this configuration would be:

- Each node would keep its autonomy and make independent decisions about the desired form of association with the other agencies, and about the conditions of information exchange.

In this way, contrasting with the alternative 1, SEMA would not lose face by being unable to solve conflicts between specific agencies about information and technology transfer;

- The adoption of this model would allow the operation of the network with the present structure and personnel of the environmental system. It would however require the supplying of technology and sources where needed, measures to make existing software and hardware compatible, and the training of both the environmental managers as the users and the information personnel.

As problems or disadvantages one could mention:

- Compared to any directed mode where processing is centralised, this non-directed configuration of network is more expensive, as it underutilises the equipment, the personnel and the information sources available within the system;
-399-

some nodes may boycott the others by blocking the access to a great deal of their information (data and other sources). This could be caused either by marketing reasons or by commercial and political secrecy;

the enormous size of Brazil makes distance a barrier for some aspects of the information interchange, as for instance in the case of interlibrary loans.

c. Alternative 3

This would be a centrally directed network, as in alternative 1, but having one of the subordinated agencies as the centre for administrative and operational matters. Policy making would be shared with SEMA, the head of the politico-administrative environmental system (Fig. 3).

Fig. 3

The most probable centre for this role amongst existing institutions would be SUPREN, the body of FIBGE in charge of collecting and processing data on national resources and associated environments. SUPREN would coordinate the information network,
process and store data and documents, provide interlibrary, referral service and various other information services. As the head of the politico-administrative system and the policy making body of the network, SEIA would still keep direct links with the nodes and a limited control over the information network; it could thus be considered a political centre. The other agencies would be considered nodes of the network. Both SEIA and the agencies would have the responsibility for collecting their own data and sending to the processing centre (SUPREN), from which they would obtain the information they need, either through a computer terminal or an off-line printout.

The probable advantages associated with this configuration would be:

- it would be a great economy to use SUPREN's infrastructure. This body (and the whole FIBGE) has powerful and modern data processing equipment, and a well qualified personnel (geographers, biologists, engineers, statisticians and librarians) for data processing and analysis. In addition, it has already established its data collection (survey) 'network' all over the country.
- specific legislation supports FIBGE's statistical surveying activities. This legislation obliges
citizens and organisations to supply the information demanded by FIEGE and its subordinated bodies;

SUPREN would have access to the huge basis of statistical data about Brazil, accumulated during many decades by FIEGE.

Some disadvantages could also be pointed out, such as:

- the diversion of some SEMA's attributions to SUPREN may further fragment SEMA's power as head of the environmental politico-administrative system, and could also increase the friction between SEMA and SUPREN;
- by keeping policy making at SEMA, the network would have to some extent a kind of double control. This could create both functional and political problems;
- the lack of functional objectives between SUPREN and the environmental agencies, since the former is basically only part of the statistical body of the central government.

d. Alternative 4

This would be a centrally directed network, as in alternative 1 and 3, but having the centre at an organisation with no relationship at all with the environmental system (Fig. 4).
The centre would be IDICT, the organisation which, as mentioned in 6.2, was indicated by the I and II PBDCCT as the potential coordinating body of the scientific and technological information network (SNICT - SMICT) planned (and never realised) at the beginning of the Seventies.

SEMI would keep its functions as head of the politico-administrative system, besides being responsible for policy making within the environmental information network. As in the alternative 3, SEMI would then be considered the centre for political decisions. Both SEMI and the agencies (the nodes) would collect and transmit their own data to IDICT for processing, storing, analysing and disseminating. As in alternative 3, IDICT would function as a data and document processing centre, a clearinghouse for all formal sources of information, and as a referral service.

The advantages of this configuration would be:

. environmental information would be dealt with globally as is the entire field of scientific and technological information;

. IDICT's personnel is already trained in the techniques of handling specialised information;

. as an organisation which has functions of information transfer and teaching as well (it holds a mas-
ter's course in Information Science and a refresher course for librarians), it could lead the training of both librarians and users in the handling of environmental information. It could also introduce the subject in its own courses;

- IBICT already has experience of using the international data basis, even though irregularly and through telex;

- the situation of IBICT under CNPq, a body of the Presidência da República, would probably make the environmental information network more prestigious than under any of the organisations presented as other alternatives.

The disadvantages of the model are:

- the diversion of some of SEIA's responsibilities to CNPq, with the result of fragmenting even more SEIA's power as head of the politico-administrative system;

- IBICT has no direct relationship (administrative, political or functional) to the environmental system. It could create problems of communication between IBICT and the agencies (nodes), political problems between SEIA and CNPq (or directly IBICT), and an overall embarrassment within the environmental system because an outside organisation has been invested of a coordinating role over the environmental agencies;
at the present stage IBICT appears not to have the necessary infrastructure to take over such an extra responsibility, especially considering its lack of space, technology, environmental sources and of personnel specialised in environmental information. IBICT has already heavy duties related to the teaching of Information Science and to the transfer of scientific and technological information in general;

in view of the history of IBICT, which has been characterised by an uneven development - as described in 6.2 - placing the administrative and operational responsibilities of the network under this organisation would endanger the continuity of the network.

e. Alternative 5

The present model assumes that the regionalisation of information would be a natural policy line, since management of the environment is also exercised on a regional and local basis. In this alternative, the national network would result from the interconnection of five non-directed regional networks. They are linked together through SEMA and five switching centres (one in each region) (Fig. 5).
The organisations in charge of regional development could be designated as switching centres. Each switching centre would have several functions: as the link among networks and between each network and SEIA; as clearinghouse of formal information sources, and then providing interlibrary loan to the nodes of that particular network; as a referral centre mainly for informal sources of information; and as a photocopying service to the nodes of the particular network, to SEIA and to other switching centres. Data processing at either the nodes or at the switching centres would be a matter of local agreement, according to the availability of equipment; but in any case the compatibility of software and hardware should be a must, in order to allow for information exchange among all participants of the network.

SEIA would be the head of the politico-administrative system and, as far as the information network is concerned, it could have:

- a research and advisory group, which would solve problems beyond the capacity of both the nodes and the switching centres;
- facilities to use the international information data basis on request of the switching centres or the nodes;
- information about informal sources of information available outside Brazil in environmental subjects,
such as consultants, research institutions or groups, universities and other environmental agencies.

The disadvantages of the present alternative would be:

- the creation of regional clearinghouses would provide a solution for the problem of exchange of documents and data among agencies in a very large country where transport and communication systems are still quite inefficient;

- the integration of the agencies situated in the same geographical area into a network favours the exchange of identical experience towards the solution of similar problems;

- compared to the centralised data processing style of the centrally directed network alternatives, the present configuration would present bottlenecks caused by the volume of data;

- the organisation in charge of the programmes of regional development have good budgets, enjoy political prestige in the eyes of the central government and the other organisations. These factors would facilitate measures necessary for the implementation and maintenance of the network, and the day-to-day communication;

- SEIA and the organisations for regional development are all subordinated to the same authority, the Ministério do Interior. It would make their relation-
ship and formal administrative arrangements easier;

- all bodies of the Ministério do Interior - thus SEMA and the organisations for regional development - are linked to the Ministry, and amongst themselves, through telex. They also have a tradition of exchanging information (data and documents), based on the union catalog of the central library of that Ministry. Both the Ministry and the organisations for regional development have computer installations;

- the organisations for regional development have already been supporting the environmental agencies in the conduction of surveys and studies, - for example the initial assessment of environmental conditions in each state.

The disadvantages would be:

- concern for the environment is not a functional objective for the organisations in charge of regional development, especially if one considers that by and large they would probably follow the lines derived from the technocratic policy of central government;

- the surrender by the nodes of their autonomy for direct communication and information exchange could be a difficulty which would have to be solved diplomatically by SEMA and the switching centres;
bureaucratic obstructions may occur because the indi
direct interchange of nodes through the switching
centres and SEnA could delay the process and intro-
duce some 'noise' in the communication;

compared to the directed network alternatives, this
configuration could be considered more expensive,
since it requires duplication of equipment, personnel
and sources of information to supply the five switch-
ing centres.

Each of the above alternatives would be amenable to
slight adaptations without having the original model
distorted. On the other hand, a combination of models
could be also possible, as for instance: to start the
implementation by using alternative 2, moving at a
second stage to alternative 5; or, using alternative 2
for information exchange and the main feature (region-
alisation) of alternative 5 for the clearinghouse of
sources, and interlibrary lending. For referral service,
either centralisation (alternative 1) or regionalisation
(alternative 5) could be used.

3.1.3 Services

For the purpose of this section, the potential informa-
tion services of the network may be focused on under a
specific node and as the generic activities expected
from the organisation as a whole.
As far as local activities are concerned, each node should first of all meet the information needs of the personnel working at the local agency, and secondarily help people in other agencies or in non-environmental organisations. So, the efficiency of services will depend on the quality of understanding between the particular node's system and its users. For this reason, the planning of local services should be preceded by a survey which will help in identifying and characterising the potential users, their information needs, preferences and information seeking pattern.

Nevertheless, a consensus of the writings on this subject encourage some fairly confident predictions about the kind of services required. As regards the broad areas to be covered, the two following authors come to similar conclusions, even though approaching different environments. On the Indian system, A. Lahiri suggests that such an environmental information system should be able to answer questions pertaining to:

1. environmental status and trends;
2. environmental technology;
3. research and education;
4. socioeconomic indicators, policy, planning and legislative measures and judicial decisions (2).
current awareness service;

- retrospective bibliography;

- data bank for rendering data services;

- reprographic services;

- translation service;

- mechanization of information services;

- publication of reports, digests, bulletins, etc.;

- state-of-the-art and trend reports on R & D activities;

- education and training of information personnel (4).

So, taking into account what has been said by A. Lahiri (2), R. Deininger (3) and J. Dave et al. (4), and having in mind the information needs and preferences of Brazilian environmental managers - described in Chapter 7 - five groups of services have been identified. They may be suggested as the basic activities of the Brazilian environmental network, as follows:

Group 1: Information infrastructure

- identification of resources (budget, personnel, equipment, software, and installations) available and needed at the whole network;

- formulation and discussion of the policies and rules concerning the network's way of functioning;

- identification of information availability and needs at each node;
Basically this is the same link followed by R. Deininger, as the editor of a publication which focuses on information systems for the management of the environment in many different countries. He considers that an environmental information system should offer services in the following areas:

- environmental status and trends;
- technology, management, research and education (3).

As regards the way that information can be supplied to the users of the environmental information network, J. Dave et al. list the following services, based on Indian National Environmental Engineering Research Institute:

- building up an exhaustive collection of conventional and non-conventional documents on environmental engineering and allied disciplines;
- compilation of a directory of experts;
- preparation of the union-catalogue of the network;
- catalogues of present and proposed R & D projects;
- reference service;
- referral service;
- bibliographical service;
- selective dissemination of information (SDI);
- indexing and abstracting service;
• compilation of computerised union catalogue of the network;
• preparation of users' (individuals, groups, and organisations) profiles of interest;
• building up of the collection by updating and improving the existing resources;
• development of a computer data bank, starting from the compatibilisation of those already existing in different agencies (future nodes);
• compilation of a directory of experts and organisations;
• compilation of catalogues of the present and proposed R & D projects with an environmental interest at governmental bodies, R & D institutes and universities;
• implementation of a translation service;
• implementation of reprographic service;
• promotion of manpower development.

Group 2: Environmental status and trends

• Supply of data resulting from monitoring activities performed by the agencies. The system should have the capability to inform by geographical area, by monitoring station, by pollutant substance, by polluter, and by time of occurrence (including historical series of indexes);
preparation of analytical reports for management control use. Examples of these services are: survey reports of the environmental conditions in a determined region, and reports on the environmental impact studies (either forecast studies as the basis for planning decisions or the studies of actual consequences of specific event or activity, for the reasons of control);

- publication of state-of-the-art reports to inform governmental authorities (central and state) of the plans and achievements of the entire environmental system (the information network also included);

- publication of a news bulletin for public information about government actions taken to prevent or solve environmental problems, and on new plans;

- cooperation with foreign and international organisations (mainly as related to UNEP's information system);

- translation service to support international exchange.

Group 3: Environmental technology

Various services based on the published literature, in order to provide information about the available technology (methods, techniques and equipment) for environmental improvement. Those services would be: lending activities, 3DI from external data bases, internal alerting lists on publications available at.
network's libraries and/or clearinghouses, collection of commercial catalogues about equipment on the market literature reviewing, and translation service);

for identical purposes, various services based on informal sources of information, such as referral services, alerting service, and reporting about matters such as: meetings to be held on the subject of interest of specific user, experts on a particular technology, organisations which have developed (or are developing) a certain equipment or technique, organisations where such technology can be observed, or users of this specific technology;

preparation of state-of-the-art reports and technological forecasting surveys for management use;

preparation, for management use, of comparative reports concerning what is available in the market about a specific environmental technology. Whenever possible these reports should be critical and include both the results of tests made elsewhere and the assessment of users of this technology;

publication of digests for large circulation at all nodes;

indexing and abstracting of Brazilian publications on environmental subjects.
Group 4: Research and education

- provision to individuals and groups of information (state-of-the-art and trend reports, or alerting and referral services) on environmental researches of their specific interest under way within and outside the network. It is intended to avoid duplication and promote interchange among researchers of different organisations. This service can be based on the literature, on data basis about research grants, or on the direct approach of experts and specialised institutions;

- supply of the agencies with information on the research and educational capabilities of universities and R&D institutions within and outside the country, looking forward the training of the personnel of the entire environmental system. Directories and direct enquiry will be the main source of information to prepare the list of references to be provided to the user.

Group 5: Management

- supply of brief information (through lending, photocopying, reporting, and reference and referral services) on specific topics of legislation, quality criteria and standards and associated technology, management techniques;

- provision of political information on the relationship within the environmental system, and between it and
outside governmental system, and about the relationship of the national network with the foreign and international organisations;

- supply of information on socioeconomic indicators of environmental conditions. These data may be gathered through the literature or through external data banks, by direct survey conducted by the network, or from FIBGE;

- provision of information on the economic and functional performance of the network (or of a specific system, or organisation, or project). This may be provided through analytical reports based on the data stored at the network;

- publication of news bulletins (daily or weekly) on the main environmental occurrences within and outside the environmental system. The main inputs for this bulletin could be the reports from the agencies, and news cuttings.

Quite certainly it will take some time for the network to develop its full capability, and the services suggested above would accordingly be implemented in stages.

8.1.4 Components

Four main groups of components can be identified in an environmental information network: technology, people,
financial resources, and information sources.

a. Technology

In generic terms, J. Gardner suggests that an environmental information system should have the following capabilities:

- be able to define environments in terms of a composite of their elements (lithosphere, atmosphere, biosphere and hydrosphere);
- be able to monitor changes in these elements over time;
- include measures or indices to characterise the state of environmental elements;
- be able to store and retrieve information about the environment for a range of scales;
- be able to predict the consequences to environmental quality of changing environmental variables (5).

This concept, which is shared by many other authors (6), includes monitoring activities as an integral part of the information system. However, they could also be considered merely an input to the latter, without distorting the output or services expected by the users. The ideal design of I. Gardner's model will probably best be achieved in a management information system - MIS, which is defined by D. Voich Jr. et al. as
a group of information systems that are interconnected in their design, operation, and management to serve operations and facilitate the performance of the process (7).

D. Voich Jr. et al. point out as its advantages three main characteristics of MIS:

- its objective-user orientation in the design of information in the design of information needs;
- the interconnection of individual information processes through an integrated data base;
- its management (or autoregulating) capability for designing, monitoring and integrating (synergic function) the parts and processes (8).

Thus, a MIS could be recommended for adoption in the environmental information network, since it would best allow for the integration of the various data banks and information systems existing at present in the environmental agencies and those likely to be created in the near future. Besides, two other practical advantages of MIS could be added:

- it can manage information in its numerical (monitoring data, socioeconomic indicators and the like), non-numerical (e. g. bibliographical data), and graphical (graphs and drawings) forms;
- it can incorporate decision factors (economic, political and functional) and criteria, to help managers in the decision-making process.
The technology (computer and communication system), and associated software, micrographic and reprographic equipment) required to make the network operational should be provided according to the volume and complexity of the services, and taking into account the needs for compatibility, with already existing resources. The methodology for data collection and processing is an important decision to be taken in advance to ensure homogeneous data. In parallel, all functional forms and institutional procedures should be decided beforehand and be registered, in order to standardise all processes (manual and mechanised) operated at the network.

b. People.

The network would depend on two categories of people: the users and the personnel. Even though the network is designed with special attention to the environmental decision makers, it should welcome enquiries from other people and institutions. So, the category of users may include:

- the managers in charge of decision making on the pollution control, working at the environmental agencies;
- any Brazilian organisation and individual researcher with an interest in environmental information;
- foreign and international organisations.
The requirements concerning the services listed in 8.1.3 will vary with the users. Thus one of the initial tasks in setting up the network will be a basic survey of the potential users. The present study of information needs, preferences and pattern of usage of the environmental managers - described in 7.2 - may be contemplated as a first input and then be updated. A second step in considering the users must include their training in the use of the network facilities and sources of information.

As far as personnel is concerned the network will require a multidisciplinary team, which will include:

- librarians to process the documents, gather and disseminate various types of information, prepare users, files, and look after the internal organisation of the library or information centre;
- computer and communication technologists, and statisticians, who will design and operate the data processing and communication system;
- environmental scientists, sociologists and economists, who will advise librarians on the selection of information sources, help them in the analysis of information, prepare surveys, and analytical and comparative reports on specific subjects, help librarians in the preparation of users' profiles, and advise the users;
translators, to help up the exchange with foreign organisations, to write reports for distribution abroad, and to help the users; staff to look after administrative and routine jobs.

Manpower development through formal courses, internal workshops, training and professional meetings should be a permanent concern of the network management. On the other hand the network should build up its own environmental information expertise with the aim of becoming a training centre for professionals.

c. Financial resources

The main sources of support for the network will be the central and the state governments; secondary sources may be the national and international funding organisations. But how the financial resources and other material facilities are going to be allocated, and the way that acquisition of equipment, publications and other goods will proceed are a matter for discussion among the members of the network.

Sharing of costs regarding routine maintenance of the services and components of the network should be included among the early decisions about the basics of the organisation.
d. Sources of information

Regarding the availability of information and the preferences of the environmental managers - discussed in 6.2 and 7.2 - the survey about information sources mentioned by the interviewees presented the following picture of the environmental system:

- general scarcity of information resources;
- managers' limited repertory of information sources;
- managers' preference for the informal channels (mainly oral sources), even though they are not aware of all available experts and specialised organisations in the country;
- limited use of published information (legislation, standards, handbooks), and then only for routine work; usually not for updating;
- an ignorance of available information resources (at the system or elsewhere) makes managers unable to specify their needs.

This picture suggests that

- managers' declared information needs actually reflected the information known and used by them. It is not therefore a sufficient indicator to build up a system, unless it is complemented by the needs inferred from their tasks and from other environmental systems in more advanced stage, as presented in 7.1.4.
informal channels of information should in some way be institutionalised and used heavily by the network in the transfer of information to the managers, at least in the first stage, while there is not a variety of sources available;

formal sources should be developed in parallel, and the users be alerted to their availability and trained on the use of them.

As far as the user of informal channels of communication is concerned, planning should start from the study of the communication-information process within the agencies (i.e. among their managers and between them and outsiders). This will help in the identification of the key communicators (network leaders or stars) and the specific role played by each of them regarding the information transfer to the environmental decision makers. T. Allen defines gatekeepers as those experienced and well informed people who act as extra-organisation liaisons and digesters of the theoretical knowledge into practical information for their colleagues (9). T. Allen's gatekeepers correspond to E. Rogers' innovators (10) and A. Chakrabarti's referral-connectors (11). The intra-organisation information liaisons have been called early adopters (10), information source (11) or opinion leaders (12).
Actually, A. Chakrabarti suggests five roles of key communicators in R & D laboratories: the referral-connector, the information-source, the idea salesman, the idea-facilitator and the idea supporter (11).

Based on the above-mentioned classifications and concepts, schematic plan may be suggested for the possible use of some of the typical roles played by these communicators. They may be used by the environmental network in two basic ways:

- as a means of filtering to managers and technical personnel the substantive information they need but would not gather or assimilate by themselves;
- as a political or functional link between the research and development groups, or between colleagues and higher management.

Four main roles have been identified: referral, consultant, idea facilitator and opinion leader.

Referral (or gatekeeper)

He is a professional well informed about his own organisation as much as about the extra-organisation environment, and he tends to be the best link between these two worlds. His role in the environmental information network would be that of a personal referral service, informing colleagues about subjects of their interest. This information
supplied to his colleagues may be the name of experts in their areas, courses or other kind opportunities for training, current projects in other organisations, or even a formal written source of information. Besides helping colleagues, he could also be invited to advise the information personnel in the preparation of technical reports.

On the other hand, the information network personnel would support him by providing him with updated conventional literature through an SDI service on the subject of his speciality, information on government plans and policies, information about plans and projects going on in his organisation, information on R & D researchers, and researches under way within his organisation and all over the country in his area of interest, information on the main R & D organisations in the world, information on the main foreign environmental agencies, and information on coming professional meetings.

Consultant

He is an active intra-organisation liaison who acts as a clearinghouse of substantive information for his colleagues. He has important professional contacts and is always well informed about recent
literature and events in his speciality. He has the talent of transforming the content of written, theoretical sources into practical or easy to assimilate information, when approached by his colleagues. He links the different cliques of his organisation and so is the best person to inform others about what is going on in the institution. To be a good consultant he needs basically the same information input given to the communicator who plays the role of a referral service. They both hold the same kind of information, but the difference in the roles played by them is determined by the character of these two people: the referral is much more a social person and then good for contacts or external link; the consultant is a kind of teacher (or 'practical intellectual') who tends to link theory to practice, basing himself on the technical literature, in his own experience, and in other people's experience (through discussions and observations). Exceptionally one only person may play both roles.

Idea facilitator

This is a creative role which constitutes stimulating colleagues in the processes of idea generating and evaluating. He may be used by the information network as a political and functional link between operation and management, in order
to make plans operational. He needs to receive mainly the following information input: technical digests, and summary of R & D projects within and outside his organisation.

Opinion leader (or idea salesman)

He is an influential character who plays a specially political role in persuading people in favour of specific ideas, or in changing group behaviour within an organisation. He may be used to get top support for a project or to prepare the organisation for the implementation of new policy or procedure. He is going to be specially useful in the implementation of the information network in order to motivate both managers and colleagues to join it. He needs to be supplied with information about his own organisation (policies, plans, specific projects, publications, etc.), and with technical digests and bulletins.

Regarding the formal channels of communication, the network should concern itself with the development of two main sources of information:

- bibliography on the basic subjects of interest to pollution control and related areas. Librarians may be helped by the referrals, the consultants and the subject specialist who work at the information team.

The information on the sources available at the network should be accessible through the IIIS;
a data bank with technical and social information about the country, such as: monitoring data (pollutants, polluters, areas affected, performance of stations, parameters, etc.), socioeconomic indicators (health, income, employment, housing, land use, etc.), and data on the environmental elements or resources. These indicators of environmental quality have been specified under 7.1.4, and should be the first to be implemented in the MIS, therefore meeting managerial needs of urgent answer to questions related to their technical tasks. Irrespective of the structure adopted, the most important role to be played by the information network is that of ensuring compatibility of the existing processing system, and standardising data collection.

Taking into account the conclusions arrived at in 7.1 and 7.2, it is advisable that:

- the network services should be characterised by its speed of response, objectivity, ease of use, cost effectiveness, and precision;

- information should be available in different forms: hard data (raw or tabular); either in the full-length of original documents or in the network's version (digests or analytical reviews);
the information network should always be in touch with all groups and institutional sources with an environmental interest, such as: governmental organisations, industries, R & D institutions, universities, technical societies, and pressure groups;

among the kind of documents to be included in the collection, special consideration should be given to governmental reports and programmes; reports on R & D projects; internal reports of the environmental agencies; federal, state and local legislation; technical books containing engineering formulas and tables, norms and environmental quality standards; and reports of international organisations in the area of environment and socioeconomic development.

as far as the dissemination of information is concerned, attention should be paid to the differential needs of each managerial level - top, middle and lower management - and the specific relationship existing between tasks fulfilled and information needs.
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CONCLUSION

The analysis of the environmental discussion, on both national and international levels, shows that there is not a common agreement about the solutions for the problems, and not even about the priority actions to be taken. The arguments have usually been understood to characterise individuals by their social class, and nations according to their economic group. As far as individuals are concerned it has been observed that, as they get their basic needs (housing, food, clothing and education) satisfied, the quality of the environment is also included among their concerns. Going further, the environmental movement has been associated to the middle class as the one which gets the most from governmental measures in favour of cleaning and preserving the environment. This idea is shared by W. Beckerman, who thus suggests that society must intervene in the environmental choice. But the decisions must be taken by bodies that are representative of society as a whole, not solely or even mainly of the middle classes, with their special interests in the matter (2).

Regarding the international disagreements, they are caused basically by the interests of wealthy advanced countries colliding against those of the poor underdeveloped nations. Thanks to the Stockholm Conference, in 1972, some understanding between the two blocks have started and the concept of environmental deterioration
was broadened to include both the pollution caused by chemical agents and the one derived from poverty and related socioeconomic factors. Since then the United Nations - through its specific bodies, mainly the UNEP - has been playing an important role in motivating all countries in favour of both the defence of the environment and the bettering of the quality of life in a more even way throughout the world. However the concept of a transnational organisation being created to manage the global environment is still an idealisation. N. Jacoby, a defender of this idea, sees two dominant drawbacks - nationalism and each country's difference in priorities and needs - and hopes for a future solution of global dimension (2). This solution could probably be found through an ecodevelopmental approach to the management of the environment. As regards to people, it is expected that a more developed and better informed society will be also more concerned about the environment. The information systems play an important part in supporting a better management of the environment, in helping the development of environmentally sound technology, and in educating citizens in the use of natural resources.

9.1 ENVIRONMENTAL INFORMATION NOW

Information professionals find three main problems in covering the environmental sciences:
it is a new field and, as a result, its boundaries are not clearly defined; yet, and the literature is rather scattered;

it is a broadly interdisciplinary field, demanding more from the librarians and requiring a reorganisation of some basic information instruments (catalogues, indexes and bibliographies);

it is a rapidly growing field, which may be related to the increase of interest from the government and of the public (3).

The solutions to cope with these problems have been tried within each country and on the international plane, where UNEP plays the difficult role of coordinator, trying to establish a global network of environmental information. Notwithstanding all these efforts, there are still much needed.

N. Lee puts forward six areas where more research is demanded in order to get a better performance in the control of pollution:

- the pattern of waste creation by society;
- the technical efficiency and cost effectiveness of the available methods of waste control;
- the pattern of waste diffusion through air, water or on land, and how it is diluted or accumulate;
the levels of pollution concentration and its
effect on humans and their environment;
the social costs of pollution;
the most appropriate criteria and organisational
system to control pollution (4).

In parallel, H. Lee uncovers also the information
needs of personnel in the area of pollution control:

- reliable data on wastes created and pollution con-
centration levels. They should be uniformly
collected, synthesised, and supplied on a continuing
(time series) basis;

- a recently written authoritative survey or small
collection of key surveys, these would identify
the main problem areas relevant to the discipline,
establish the technology appropriate to tackle those
problems, and review the state-of-the-art in the
subject area;

- a list of references appropriate to the problem area
under consideration;

- a cheap current awareness service to update these
references;

- a list of research organisations, researches and
workers in the specific environmental area of in-
terest (4).
Unfortunately a straightforward testimony like this is not often found in the literature, and librarians have not yet gone deep into the study of the users of the environmental information. So, this should be included as one more area where research is also needed.

9.2 THE FUTURE OF ENVIRONMENTAL INFORMATION

Two main features call the attention of an analyst who focuses on what lies ahead in the field: the increasing volume of the literature and data, and how the advancement of the technology may affect the area.

As far as the information volume is concerned, J. Gardner considers that it will become overwhelming very soon, as a result of technological development in the area of data collection (e.g. remote sensing and monitoring techniques and equipment), and because of the 'environmental crisis'. Then, he foresees the chaos of the environmental information services, under a gigantic volume of data, and in consequence, the doomsday of the environmental management as well (5).

To avoid this catastrophe, librarians dealing with environmental information should be very critical in assessing the publications to be acquired. Identical measures should be taken when collecting and processing environmental quality data. Finally, regarding both publications and data, the dissemination of information
should emphasise precision and objectivity, in order to offer the right amount of information to the user.

Information and communication technologies may help to solve the above-mentioned problems, but there are also some doubt associated to them. S. Wolpert suggests that, within the next generation, the pattern of information usage by managers and researchers may be dramatically affected by the technological changes in the area of information systems, such as:

- the growth of literature;
- the growth and qualitative change of computer readable data bases;
- the growth of general purpose terminals;
- the development of on-line information retrieval software;
- the integration of information retrieval and computational systems, allowing the user to create his personal working file in the system;
- graphic display system;
- on-line systems on conferences;
- document storage and transmission systems;
- library networking.

Some services of future are also mentioned by S. Wolpert:

- the information query: managers and researchers will
phone the information center and ask for the information they need to make a decision. Soon after they would receive through the terminal next to the desk the information required;

- orientation reports: the specialist librarian shall prepare an orientation report (based on the literature review) to support managers who have to start a new project;

- automated analytic reports: a team of information professionals and experts together will prepare within one day, analytical business studies. These reports will be prepared on-line and present information such as time series, tables, literature abstracts, graphs and regressions, and models;

- conference modeling: use of data bases for checking and making decision among different alternatives;

- selective dissemination of information: managers and researchers will be provided daily with update 3DI reports (6).

Speaking about environmental information specifically, L. Rubin et al. foresee, for the end of the Eighties, that information technology will allow for better public knowledge on environmental problems. The subscriber of the 'Home Information Utility' - as he calls the public information system - will, from his office or residence, select directly and receive the information
by terminal. Examples of resources which will be stored in the Home Information Utility are:

- a complete index of library information on any given environmental subject, with complete texts of books and articles, if the user wishes them;
- a list of pending government decisions, bills and meetings affecting the environment, with the indication of their status;
- background information on any important event;
- the ability to monitor any important public meeting on a home television screen;
- consumer information to permit environmentally informed purchasing decisions;
- the ability to register an opinion instantaneously in a local or national referendum on an environmental subject (7).

H. Davis however is not so optimistic about the future of environmental information, facing a new technological era. She anticipates a great variety of technological and information (formal and informal) resources, which will not be shared equally:

> the information-rich will become richer, and the information-poor will not even suspect what they have missed (3).

This prospect of information starvation foresees by H. Davis is which the developing world fears.
H. East and H. Ekelin have been sensitive to the problem faced by the developing countries regarding the paperless society. They concluded that it is unlikely for the poor nations their equal participation on this new international electronic information network without undergoing internal social conflicts, and substantial economic hardship or political compromise in their international relationships (9).

The role to be played by librarians in this new era have been anticipated by some authors.

A. Meelamgehan and S. Seetharama mention two human capabilities which will still be demanded in tomorrow's electronic system: conceptualisation and imagination. The authors see the information worker as an important element to prevent further alienation of modern man caused by the deepening rupture between the individual and his environment (10).

Concerned with both environmental and technological development, R. Munn suggests librarians of both developed and developing countries that they have many challenges and opportunities ahead represented by the search for new solutions regarding more appropriate technologies (11).

H. Goldhor, summarising the papers of the 18th Allerton Park Institute, calls the librarians for deeper and more
political participation in the environmental issues. Such an attitude would imply a struggle for the free circulation of all existing information, against monopoly and censorship (12).

F. Lancaster concludes his futuristic report Toward Paperless Information Systems with this warning note, which must be taken into consideration by both advanced and underdeveloped nations:

the paperless society is rapidly approaching whether we like it or not. Everyone reading this book will be affected by it in one way or another. We cannot bury our heads in the sand. We may choose to ignore the electronic world, but this will not make it go away. Now is the time for technological changes that are occurring for the operations of publishers, primary and secondary, for the operations of libraries and information. If we do not plan now for the years ahead, we may find the transition to be one of disruption and chaos rather than one of ordered evolutionary progress (13).

9.3 THE CASE OF BRAZIL

As discussed in Chapter 2 and 4 about the relationship of environment and development, and in Chapter 5 specifically about the situation in Brazil, the roots of the environmental deterioration in Brazil lie in the socio-economic conjuncture of the country: its developed Southern regions deal with industrial pollution, while the remainder regions struggle against the depletion of natural resources and a kind of pollution which are
by-products of either poverty or technological underdevelopment.

Even though in such a complex situation, the concern for the environment is a very recent affair in Brazil, and the management of its environment has been characterised by the piecemeal approach. The creation of SEMA at the beginning of the Seventies corresponds to one of the first and most important actions of the central government to integrate sectoral and regional programmes regarding the environment into the central planning through SEMA as the national coordinating body. However, lack of infrastructure, represented mainly by its financial and political problems, has been interfering with SEMA's success in its coordinating and regulating role in relation to other federal organisations and to the state environmental agencies.

The nub of the politico-administrative environmental system is reflected into the status of the environmental information available at the system:

- the information resources available at the agencies are very limited and even so underutilised;
- data collection on the environmental conditions and problems is being collected by various organisations independently;
- the technological and economic status of the agencies is very uneven, and sharing the available resources
is not a popular idea within the system yet;

. the decision makers in-charge-of the management of Brazilian environment seem to be ill informed, and in extreme need for information support through both informal and formal channels of communication.

Overall it seems that some recommendations are suitable to the present picture:

. the government should adopt an ecodevelopmental policy in the management of the environment, which would allow for an environmentally sound development of the country;

. the structure of power within the environmental system should be better defined, starting from moving SEMA from the Ministério do Interior to the Presidência da República, as an independent body, and then giving SEMA more prestige and a stronger budget;

. the environmental agencies should be interlinked through an information network likely to promote a better use of the available resources and meet the information needs of people working at the management of Brazilian environment. The network would be more effective if included the provision of both formal and informal sources of information;

out of the network configurations discussed in Chapter 8, the alternative 5 seems to be more suitable because: the large territorial extension of the coun-
try, the diversity of problems from one region to the next, and the difficulties of transport and communication.

Irrespective of the network configuration adopted, would be desirable that the central government launched an environmental information programme with three lines:

a. the training of the information personnel in the knowledge of the information sources, the processing techniques, the services to be provided, and in the communication with the user;

b. the training of the environmental managers as the users of the environmental information network, alerting them about the available sources of information and how to make the best out of them;

c. the education of the public in the concern for the environment, and the information about its rights for a high quality of life.

Once the environmental crisis has its roots in socio-economic problems, its solution must be looked for beyond technological remedies for the pollution of the natural elements. In Brazil the solution should thus be sought in two directions:

a. previously, in the extinction of poverty, inequalities, oppression and illiteracy among the population. When every Brazilian has the condition to grow and develop
its entire potentiality as a human being, the whole population will respond to the environmental appeal;
b. in the development of non-polluting technology, appropriate to Brazilian social and natural environment.

However the strategy of looking for environmental solutions through development should be understood from E. Schumacher's standpoint:

Development does not start with goods; it starts with people and their education, organisation, and discipline. Without these three, all resources remain latent, untapped, potential.
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APPENDIX 1: INTERVIEW SCHEDULE

Part 1: Institutional Data

1. Name of the organisation.
2. Address of the organisation.
3. Administrative subordination.
5. Legislation: creation of the organisation, internal statute and norms, and local pollution control.
6. Character of the organisation.
7. Area of action, i.e., subject areas covered by the agency.
8. Objectives.
10. Available human resources.
11. Equipment.
12. Information system.
15. Environmental problems of the Region.

Part 2: Managerial decision making process.

16. Level where the decisions are taken.
17. Time allowed for decision.
18. Data collected by the agencies in order to support decision making.
19. Accessibility to data by outside users.
20. Information use and needs of the environmental managers.
APPENDIX 2: LIST OF BRAZILIAN ENVIRONMENTAL AGENCIES

ACRE

SANACRE. Companhia de Saneamento do Acre S.A.
Av. Brasil 349
69.000 Rio Branco, AC
Phone: 29-81

ALAGOAS

Coordenação Geral do Meio Ambiente
Secretaria de Estado de Planejamento
R. Cincinato Pinto 503
57.000 Maceió, AL
Phone: 223-4757, 223-2833

CASAL. Companhia de Abastecimento de Água e Saneamento
R. Barão de Atalaia 200
57.000 Maceió, AL
Phone: 223-3599

AMAZONAS

CODEMA. Conselho Estadual de Meio Ambiente
Av. Sete Setembro s/n
69.000 Manaus, AM
Phone: 232-6679
AMAZONAS

COSAMA. Companhia de Saneamento do Amazonas
R. Miranda Leão 31
69.000 Manaus, AM
Phone: 232-1601

BAHIA

CEPED. Centro de Pesquisas e Desenvolvimento
Km 0 da BA-536
48.240 Camaçari, BA
Phone: 920-0046, 920-0164, 920-0173

or:

CEPED's Office
R. Torquato Bahia, 4, s. 711
40.000 Salvador, BA
Phone: 242-0131

EMBASA. Empresa Bahia de Águas e Saneamento S.A.
Ed. Secretaria de Saneamento e Recursos Hídricos
1º andar
Av. Luiz Viana Filho
Centro Administrativo da Bahia
40.000 Salvador, BA
Phone: 244-0834
BRASÍLIA

SEMA. Secretaria Especial de Meio Ambiente
Ed. MINTER
Esplanada dos Ministérios
70.000 Brasília, DF
Phone: 223-7084, 223-8972

Divisão Nacional de Ecologia Humana e Saúde Ambiental
Ed. Ministério da Saúde - 8º andar
Esplanada dos Ministérios
70.000 Brasília, DF
Phone: 223-9823

DNAEE. Departamento Nacional de Águas e Energia Elétrica
Ed. MME - El J, 3º andar
Esplanada dos Ministérios
70.000 Brasília, DF
Phone: 223-8592

DNPM. Departamento Nacional de Produção Mineral
Ed. DNPM - SAN
70.000 Brasília, DF
Phone: 224-2670

CNPU. Comissão Nacional de Regiões Metropolitanas e Política Urbana
Ed. BNDE - 16ª andar
70.000 Brasília, DF
BRASILIA

Divisão das Nações Unidas
Ministério das Relações Exteriores
Palácio do Itamaraty
Esplanada dos Ministérios
70.000 Brasília, DF
Phone: 225-1305

SUDECO. Superintendência do Desenvolvimento da Região Centro-Oeste
Ed. MINTER - SAS
70.000 Brasília, DF
Phone: 225-4340

CAESB. Companhia de Água e Esgotos de Brasília
SCS, Q 13, N° 67-97
70.000 Brasília, DF
Phone: 224-0405

SLU. Serviço Autônomo de Limpeza Urbana
Av. das Nações s/n
Lago Sul
70.000 Brasília, DF
Phone: 243-3954
CEARÁ

DNOCS. Departamento Nacional de Obras Contra a Seca
Av. Duque de Caxias 1700
60.000 Fortaleza, CE
Phone: 223-2177

SUDEC. Superintendência de Desenvolvimento do Estado do Ceará
R. Barão de Aratanha 1319
60.000 Fortaleza, CE
Phone: 231-8118

CAGECE. Companhia de Águas e Esgotos do Ceará
R. Dr. Lauro Vieira Chaves 1030
60.000 Fortaleza, CE
Phone: 227-2176, 227-2122

ESPIRITO SANTO

Secretaria de Saúde do Estado do Espírito Santo
Av. Beira Mar
Bento Ferreira
29.000 Vitória, ES
ESPIRITO SANTO

Fundação Jonas dos Santos Neves
Conjunto Hilal – Ed. São Jorge
Av. César Hilal 437 – 1º andar
Praia do Suá
29.000 Vitória, ES
Phone: 227-0186

CESAN. Companhia Espírito Santense de Saneamento
Av. Governador Bley 186 – 3º andar
29.000 Vitória, ES
Phone: 223-5399

GOIÁS

SEMAGO. Superintendência Estadual de Meio Ambiente
R. 100 nº 92
74.000 Goiânia, GO

SANEAGO. Saneamento de Goiás S.A.
Av. B nº 750
Jardim Goiás
74.000 Goiânia, GO
Phone: 225-2200
MARANHÃO

CAEMA. Companhia de Água e Esgotos do Maranhão
R. Silva Jardim 307
65.000 São Luiz, MA
Phone: 2-3232

MATO GROSSO

SANEMAT. Companhia de Saneamento do Estado do Mato Grosso
Av. Presidente Vargas 1426
78.000 Cuiabá, MT
Phone: 3513, 4415

MINAS GERAIS

COPAM. Comissão de Política Ambiental
Av. João Pinheiro 146 – 3º andar
30.000 Belo Horizonte, MG
Phone: 222-1285

Superintendência de Ecologia e Engenharia Ambiental
CETEC. Centro Tecnológico de Minas Gerais
Av. José Cândido da Silveira 2000
30.000 Belo Horizonte, MG
Phone: 224-7933

COPASA. Companhia de Saneamento de Minas Gerais
R. Sergipe 580
30.000 Belo Horizonte, MG
Phone: 224-0237
PARÁ

SUDAM. Superintendência do Desenvolvimento da Amazônia
Av. Almirante Barroso 426
66.000 Belém, PA
Phone: 22-2648

Coordenação de Ecologia Humana e Saúde Ambiental
Secretaria de Estado de Saúde Pública
Av. Pernambuco 469
66.000 Belém, PA

COSANPA. Companhia de Saneamento do Pará
Av. Magalhães Barata 1201
66.000 Belém, PA
Phone: 26-0773

PARAÍBA

CAGEPA. Companhia de Águas e Esgotos da Paraíba
R. Feliciano Cirne s/n
Jaguaribe
58.000 João Pessoa, PB
Phone: 4406
PARANÁ

ARH. Administração de Recursos Hídricos
R. Engenheiro Rebouças 1206
80.000 Curitiba, PR
Phone: 34-1211, 23-8684, 24-1864

SANEPAR. Companhia de Saneamento do Paraná
R. Engenheiro Rebouças 1376
80.000 Curitiba, PR
Phone: 23-8711, 22-1318, 23-6524

PERNAMBUCO

SUDENE. Superintendência do Desenvolvimento do Nordeste
Av. Professor Morais Rego
Ed. SUDENE
50.000 Recife, PE
Phone: 27-4011

CPRH. Companhia Pernambucana de Controle da Poluição Ambiental e de Administração de Recursos Hídricos
R. Santana 367
Casa Forte
50.000 Recife, PE
Phone: 268-4071
PERNAMBUCO

COMPESA. Companhia Pernambucana de Saneamento
Av. Cruz Cabugá 1387
50.000 Recife, PE
Phone: 21-3066

PIAÚI

Secretaria de Saúde do Estado do Piauí
R. Alvaro Mendes 1182
64.000 Teresina, PI

AGESPISA. Águas e Esgotos do Piauí S.A.
R. 24 de Janeiro 294-N
64.000 Teresina, PI

RIO GRANDE DO NORTE

Núcleo de Defesa do Meio Ambiente
Av. Rodrigues Alves 538
59.000 Natal, RN
RIO GRANDE DO NORTE

CAERN. Companhia de Águas e Esgotos do Rio Grande do Norte
Rua do Sul 198
59.000 Natal, RN
Phone: 2-2193, 2-2194

RIO GRANDE DO SUL

SUDESUL. Superintendência do Desenvolvimento da Região Sul
R. Caldas Junior 120 - 20 andar
90.000 Porto Alegre, RS
Phone: 24-8988, 24-8049, 25-2357

Coordenadoria de Controle do Equilíbrio Ecológico
Av. Ipiranga 389
90.000 Porto Alegre, RS
Phone: 23-9793, 23-7783

CORSAN. Companhia Riograndense de Saneamento
R. Caldas Junior 120 - 18º andar
90.000 Porto Alegre, RS
RIO DE JANEIRO

SUPREN. Superintendência de Recursos Naturais
R. Visconde de Niterói 1246 - Bl B - 6º andar
Mangueiras
20.000 Rio de Janeiro, RJ
Phone: 234-0979

Diretoria de Portos e Costas
R. 1º de Março 118 - 15º andar
20.000 Rio de Janeiro, RJ
Phone: 253-2134

DAC. Departamento de Aviação Civil
Aeroporto Santos Dumont - 4º andar
20.000 Rio de Janeiro, RJ
Phone: 253-1173

CNEN. Comissão Nacional de Energia Nuclear
R. General Severiano 90
20.000 Rio de Janeiro, RJ
Phone: 286-7002

FSESP. Fundação de Serviços Especiais de Saúde Pública
Av. Rio Branco 251 - 12º andar
20.000 Rio de Janeiro, RJ
Phone: 232-8066
RIO DE JANEIRO

DNOS. Departamento Nacional de Obras de Saneamento
Av. Presidente Vargas 62 - 11º andar
20.000 Rio de Janeiro, RJ
Phone: 223-8411, 223-3415

FEEMA. Fundação Estadual de Engenharia e Meio Ambiente
R. Fonseca Teles 121 - 15º andar
São Cristóvão
20.000 Rio de Janeiro, RJ
Phone: 234-3681, 234-0731, 254-4050

SERLA. Superintendência Estadual de Rios e Lagos
Campo de São Cristóvão 38 - 3º andar
20.000 Rio de Janeiro, RJ
Phone: 234-1260

Capitania dos Portos do Estado do Rio de Janeiro
R. 1º de Março 118
20.000 Rio de Janeiro, RJ
Phone: 253-6733

CEDAE. Companhia Estadual de Águas e Esgotos
R. Sacadura Cabral 103
20.000 Rio de Janeiro, RJ
Phone: 243-1524, 223-9791
SANTA CATARINA

FATMA. Fundação de Amparo à Tecnologia e Meio Ambiente
R. Demétrio Ribeiro 15
88.000 Florianópolis, SC
Phone: 22-6281, 22-8478, 22-2062

CASAN. Companhia Catarinense de Águas e Saneamento
R. Tiradentes 17 - 3ª andar
88.000 Florianópolis, SC
Phone: 22-7444

Departamento Autônomo de Saúde Pública
R. Felipe Schmidt 117 - 5ª andar
88.000 Florianópolis, SC
Phone: 22-9033

SÃO PAULO

CETESB. Companhia de Tecnologia e Saneamento Ambiental
Av. Professor Frederico Hermann Jr. 465
Alto dos Pinheiros
10.000 São Paulo, SP
Phone: 210-1100
SÃO PAULO

SABESP. Companhia de Saneamento Básico do Estado de São Paulo
R. Costa Carvalho 300
Alto Pinheiros
10.000 São Paulo, SP
Phone: 211-8911

SERGIPE

Conselho Executivo de Controle da Poluição
R. José Sotero 394
49.000 Aracaju, SE
Phone: 222-7424

DESO. Companhia de Saneamento de Sergipe
R. Campo de Brito 331
49.000 Aracaju, SE
Phone: 222-2313, 222-2314