

## **Information, Indicators and Accounts: A Regional Sustainability Perspective**

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### **The Regional Sustainability Problem**

Changing regional fortune is an old story. Staple booms, technological waves, backward areas, stagnating regions and politically driven regional cycles are among the sustainability themes explored by regional scientists. Until recently, the socioeconomic and environmental sustainability of northern European and North American regions was discussed within a context of widespread national and international growth. Consequently, regional development problems were viewed as localized phenomena.

Natural resource depletion or unfavourable shifts in technologies or markets have, nonetheless, meant economic distress for the residents of many industrial regions. For other areas, for example the Canadian north or Pacific island economies, population growth and income expectations based on industrialized standards have created situations supportable only by continued injections of subsidies by larger polities. For most regions of the world, developed and undeveloped, residents have noticed with increasing alarm the pressure of lifestyles on their environment's assimilating capacity, resulting in declines in important, often crucial, resources.

These difficulties were anticipated. Twenty years ago the "Club of Rome" report (Meadows, et al. 1972) dramatized the urgent, interdependent nature of the global sustainability problem, to the disdain of other thinkers who argued

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forcefully for the creativity of the "ultimate resource," humankind (Simon 1981). These latter thinkers argued that the marketplace provides the solution in the form of adaptive organizations that possess authority, initiative, motivation and a marvellous information system (based on price signals). Furthermore, many argued that the market mechanism was superior to any human contrived method for conscious management of sustainability.

Unfortunately, environmental signals continue to alarm. The likelihood of global warming, due to massive short term release of carbon dioxide into the atmosphere and an increased cancer threat from ozone depletion, is particularly persuasive to politicians. Global warming represents a dramatic case of the failure of market signals to induce appropriate adaptive behaviour, individually or organizationally. Motivated by general signs of distress, two important works dealing with sustainability have been commissioned: the UN World Commission on Environment and Development ("Brundtland Commission") report *Our Common Future* (World Commission on Environment and Development 1987) and the International Union for the Conservation of Nature's report on world conservation strategies (World Conservation Union 1980). Both reports recognize a global and a regional dimension to the problem. It is recognized that people must make the changes required to cope with sustainability, and that people act regionally.

Brundtland sustainability has economic, social, cultural, political and ecological dimensions. The issues involved are both substantive and process-oriented. The substantive issues involve provision for human needs, ecological integrity, equity and justice, and self determination. The process-oriented issues involve goal seeking, systems orientation, adaptiveness, and an intellectually holistic, multidisciplinary approach to resolving the problem (Jacobs and Sadler 1990).

This paper examines the information required to meet the challenge of Brundtland sustainability in a regional context. The information problem, while more bounded than the general issue, is still very large. The specific focus of this paper is the role of information systems, including accounting frameworks and indicators, in achieving sustainability.

The following discussion uses two groups of terms which may need clarification, given their non-standard usage in various contexts. Terms in the first group are region, sustainable, and development, dealing with geography and process. The second group, macro, micro and agent, deal with organization and scale.

For many, the term region means a classification in a geographical hierarchy, as in continent, nation, province, or region. Viewed in this way, regions are like any other geographical entity; that is, a specific level in an hierarchy having area and characteristics, governing structure and other desirable elements of coalescence. For others, region is used as a way of geographically crystallizing the natural and social elements involved in solving a set of problems. Thus, we find, in the same works, references to regions made

up of nation states and to regions within a nation state; and we also find economic, social and political regions that have overlapping unions and intersections within a larger geographical space. In the following, a region is defined (and may be redefined) by the problem focus, scope of authority and control, and constraints facing persons living in an area as they cope with various aspects of their existence. Centrally, those responsible for places defined as regional do not have available to them the policy tools or police powers of the national state, for example, monetary policy or immigration control. Hence, the concept of region employed here is multidimensional, conceptually and spatially. It has fuzzy edges but is rooted in a subnational space with which residents can identify and for which they develop loyalty.

The term sustainable development has been criticized for its ambiguity for two reasons: first, understanding what is to be sustained and second, confusing development and growth. In the following, sustainability refers to systems stability, meaning that an interacting social, economic and ecological system possesses the capability to meet challenges and seize opportunities and thus adapt to changing conditions without undermining its long run success. Growth within such a system is limited to natural resources capacities, by respecting the reproducibility of renewable resources, and by substituting, in production and consumption, for nonrenewable resources. The term development is generally avoided, but when used means differentiation and growth, without qualification.

The second group of terms needing attention deal with gaining human control over regional phenomena and particularly with informational control. Macro usually refers to the gross or aggregate level and micro to the particular and interactive level of some phenomena, (for example, macro-economics based on national income and product accounts and micro-economics based on market interaction of many individuals). Here the terms are used to establish poles for the discussion, one pole being aggregative information tools supporting macro policies, be they economic or otherwise, and the other pole being individuals or their immediate institutions (referred to as "micro-agents") as they interact within a social, economic or political system which works more or less autonomously. Thus an agent is an individual or institution operating within a more or less autonomous system, for example, the economic market.

The following discussion arises out of concern for the largely unexamined macro-policy bias of the national economic accounts inspired approach, as applied to the sustainability information problem, regional or national. The essence of the argument is that the inclusion of environmental, ecological and social considerations intrinsically involves locational specificity and incommensurability, so that accounting adjustments or additions using national environmental or ecological aggregates are quite problematic. This assumes, of course, that essential features of environmental and ecological phenomena cannot be valued in money terms and thereby made spaceless and featureless, nor can they be added up in terms of one standard physical measure. Hence,

a relatively simple system of national accounts modeled on the macro-economic model is not likely to be successful.

These arguments apply to any sizable national or regional unit, with greater or lesser force depending on the homogeneity of the unit and its conformance with self contained ecological units. As we consider a particular spatial scale, we will find the quality of the informational content (regarding a given environmental, ecological or social problem) will vary, as a description of reality or as an index for policy. At the national scale, macro-economic policy indexes are possible and useful, but environmental and ecological ones, with rare exceptions such as ozone, are not. At a regional scale, climate, soils, and watershed indicators may or may not be useful, given the homogeneity of the unit and the nature of the policy concern. At the local scale, culturally unique places may have an importance for which aggregate indices have no meaning at all.

The system of national accounts is not the only information model that might be considered when seeking an effective information framework for regional sustainability management. As just suggested, conventional information models fall into two categories based on their policy/management orientation: macro-policy and micro-agent. The macro-policy model deals with information methodologies that are useful for broad government policy formulation; the micro-agent deals with the project, program or business efforts of individual organizations. Both rely on the market as a central institution for accomplishing the goals toward which their policies are directed. An additional model, the regional development model, is also important but has received little attention within the context of sustainability information models.

In the following, several approaches are considered as candidates for resolving regional sustainability information problems. Section 2 deals with macro-policy models as they relate to micro-agents, including accounts and indicators. Section 3 considers the regional information problem from the point of view of micro-agents operating in the context of their institutions. Section 4 reviews the informational relevance of various approaches to regional development policy. Section 5 provides some concluding comments.

### Macro-policy Information Models

The term "information system" is of relatively recent origin. At the micro-agent level, information systems answer a number of problems. Financial control and economic, political and military "intelligence" have motivated specialized information systems. From a macro-policy point of view, the system of national accounts is the dominant information system of this century. The national accounts system originated in the United States in the 1930s, generated by the work of the U.S. National Bureau of Economic Research and Simon Kuznets. This system provides macroeconomic information for govern-

mental and private economic agents. Its influence has become so pervasive that it is viewed by many as dominating public and private decision making, to the detriment of broader values and particularly natural values. In response to these concerns, the United Nations has undertaken a substantial effort to revise the framework (United Nations 1990), and an active international debate on valuing and accounting for the environment is taking place (Ahmad, et al. 1989, Constanza 1991, Repetto et al. 1989).

### The National Accounts Framework

As the major example of a macro-information system, the national accounts framework deserves more comment. The framework is an accounting system in the true sense of the term. It demonstrates the following features, often considered accounting fundamentals (Gambling 1975), (item 8 added by the author):

1. a single measurement metric (money values);
2. an information system based on data gathered in the normal course of affairs;
3. a "chart of accounts";
4. a "manual of procedures";
5. aggregation rules;
6. a limited number of summary benefit/disbenefit indices (for example, income or inflation);
7. a dual entry character, and
8. constraints (income, resources) requiring allocation and budgeting.

From a policy perspective, the national accounts also demonstrate seven policy fundamentals; that is, they:

1. operate within a well defined institutional context;
2. support policy that addresses a real world system, in this case an autonomously functioning economic system, a system that has organic mechanisms for aggregating in space (transportation costs and rents) and over time (intertemporal discounting);
3. are useful in monitoring the state of the system;
4. allow analysis; that is, development of models of relationships;
5. assist in formulation of goals;
6. aid in identification of policy instruments to address the goals;
7. serve to justify the application of those instruments within a management regime.

These features are critical to the success of the national accounts. The experience raises the question of their importance in achieving an accounting framework capable of dealing with regional socioeconomic and environmental sustainability.

### Social Indicators and Social Accounts

In the 1960s and 1970s, discontent with the social content of macro-policy led to exploration of accounts based on social indicators. Indicators can be utilized for monitoring and policy formulation at any spatial level, within a centralized or decentralized management system. Here, we are interested in the macro scale. Serious discussion of the problem of social indicators construction may be dated by the publication of *Social Indicators* (Bauer 1966). As noted by Andrews (1981), social indicators can be "subjective" or "objective," a distinction based on whether the indicators are based on perceptual statements by those characterizing themselves or their attitudes, or whether they are based on "counting".

Social indicators are interesting in their own right and as precursors of attempts to develop environmental indicators. Despite the existence of a World Bank series of social indicators (World Bank 1989) as well as other indicators of institutionalization, the policy impact of social indicators is disappointing. Functionally, social indicators are *ad hoc* and multi-faceted, lack a metric for aggregation over categories, space or time, and serve a relatively undefined policy environment. Empirically, social indicators have been based on ongoing (usually other purpose) government statistical programs and surveys. Attempts to overcome the eclectic nature of these indicators face great difficulty because of the lack of a convincing common measurement scheme, preventing development of an accounting system based on the eight fundamentals noted above.

There are three noteworthy approaches to social accounting. The first relies on time budgeting, based on the human constraint of 24 hour days; time-use surveys are a major tool. The second uses a demographic foundation; people and their characteristics are the framework for a host of indices of social welfare. In the words of Juster and Land (1981: 2):

"...the emphasis is on quantifying changes in the institutional structure of society in terms of sequences of transition regimes and state-occupancy distributions of the population".

A third arena of social accounting effort, quality of life indicators, is varied in content but by now well established in practice. The analytical unit for these indicators typically is a political entity, for example, cost of living indicators for a city. A recent set of quality of life indicators at the regional level of particular interest are the *Oregon Benchmarks*. A state board, working

with a public process has developed 158 benchmarks indicators classified into three major categories, "exceptional people," quality of life and economy. The development of these indicators is part of an ongoing process involving preparation of a state sponsored strategic vision for Oregon's next twenty years (Oregon Progress Board 1991).

The social indicator approaches have major flaws if considered as an accounting framework to support socioeconomic policy formulation. From the point of view of the eight accounting fundamentals, they are deficient in terms of the single metric criteria. They utilize metrics (time, demographics) that are not capable of evaluation, either currently or intertemporally. They do not provide a method of standardization over space. Consequently, they have limited aggregation utility. They lack an agreed upon "chart of accounts" and provide no summary indices of benefit. For demographics based accounts, the constraints that provide the basis for valuation and for systemization are unclear. These are serious difficulties if social indicators are to be organized in terms of social accounts. They are indicative of the measurement difficulties faced in the construction of environmental indicators.

From a policy perspective, the effort to create social indicators and accounts suffers from lack of a well defined institutional framework. There is a very large social services institutional structure in economically advanced nations. Despite the size of the sector, social services are typically not organized as a system that is capable of creating, maintaining and utilizing a system of social accounts; the structures are typically organizationally fragmented and eclectic in the social issues they address. Put another way, it is not clear that the second policy criteria, that is, appropriate definition of the real world system to be addressed by a potential social accounting system, can be met. Social systems are far more diverse and far less understood than economic systems. Furthermore, they are often changing very rapidly precisely at the time that the need for social accounting frameworks is most likely to be recognized.

Given these difficulties, it is not surprising that social indicators are not well developed as a tool to support goal formulation, or for the identification and use of policy instruments, or as a framework whereby the development and application of policy instruments can be justified. While social indicators can make many contributions to understanding and promoting social sustainability, they are unlikely to be useful for macro-policy formulation unless a more convincing accounting framework can be developed and applied.

### Environmental Indicators and Accounts

It appears that those concerned with the development of environmental indicators and accounts have not paid much attention to the social indicators experience. The two information problems share many issues, for example, the lack

of a single measurement scale plagues both. Viewed from a macro perspective both suffer from a multiplicity of interacting real world systems, a multiplicity that does not add up to a system around which accounts might be built. They also both suffer from institutional and policy fragmentation, overlap and from duplication of effort. Analytically, the social indicators experience may have at least as much to teach us when considering environmental indicators and accounts as the economic accounting experience.

Those concerned with creating environmental indicators and accounts have considerable experience with which to work. The major sources of experience are:

1. sectoral specific scientific and business studies (forestry, mining, etc.), reflecting sectoral stresses;
2. a vast amount of work on environmental impact analysis;
3. academic ecological and niche studies;
4. extension or corrections of economic accounting frameworks (national accounts and input-output, patrimonial);
5. watershed and land use studies;
6. studies specifically directed at development of environmental indicators.

Space does not allow exploration of all these dimensions. The following section will briefly comment on three macro-policy approaches, "green" accounts, the patrimonial approach, and the stress-response approach.

### Green Accounts

Suggestions to "green" the dominant system of national accounts are a major aspect of recent work on environmental information. The bias in the national accounts system (NAS) is well known. The lack of success of various green adjustment schemes centres on two difficulties. The first is the resistance of those who do not wish to see relatively robust and well defined economic indicators adulterated by the introduction of factors based on questionable valuation methodologies (see, for example, the discussion in United Nations 1990). The second is the inability of proponents of greening to settle on either an appropriate methodological scope or on proper adjustments to the existing framework, an inability that is, itself, an indication that the necessary institutional context is not yet in place. Many of the difficulties faced by proponents are the same as those just considered in commenting on social indicators and social accounts: valuation difficulties, differing metrics, no agreed chart of accounts and lack of precision in the scope of the real world system(s) under consideration.

### Patrimonial Approaches

Recognizing the difficulties just mentioned, patrimonial accounts have been suggested. The term patrimonial refers to the "patrimony" or inherited wealth of the nation, measured in all dimensions: economic, social and natural. The application in macro-accounting is due to the French system of environmental accounting. This system utilizes 1. a system of central accounts, drawing on whatever measures are available to characterize a particular patrimony, 2. peripheral accounts describing important inter-ecosystem relationships between patrimonial elements, 3. satellite agent's activity accounts, comprising accounts reflecting the activity of individuals and organizations, 4. satellite environmental relationship accounts (for example, materials/energy balances) dealing with the effect of agents acting on or within patrimonial elements (including materialist aspects of economic, social and cultural activity) and 5. territorial accounts to provide an organization of information spatially (Weber 1983; Theys 1989).

Patrimonial accounts attempt to solve a number of the problems usually raised in environmental accounting, problems of incompatible measurements, differing systemic structure (economic, ecological, social), varying natural and human agencies and inconsistent categorial and spatial conceptualizations. This is done by advancing a proposal for what is, in effect, an information system consisting of accounts of various kinds, models of relationship, and agents who possess differing powers, responsibilities and conceptual frameworks. This ambitious approach is correspondingly difficult to implement. No standard structure has emerged. Nor is it likely that one will emerge, given the scope of the proposed system and the great variability of conditions faced by the organizations that would be responsible for implementation, especially at the regional level. For our purposes, however, the patrimonial approach is useful in raising the issue of a third factor in the state of the environment indicators/accounts discussion: the role of information systems (Friend and Rapport 1989).

### Stress/Response

The development of indicators within a stress-response framework has been a feature of the Canadian government's efforts to develop environmental information (Environment Canada 1991a; Environment Canada 1991b; Friend and Rapport 1979; Victor 1991). A feature of this work is a proactive attitude regarding information users. Whereas macro-accounting systems are often developed as a compromise between stylized description of a system and the strategic or purposeful need of users, the stress/response framework begins by asking three questions:

1. what is happening to the state of the environment (environmental responses)?;
2. why is it happening (stresses)?;
3. what can be done about it (managerial responses)?

In selecting indicators to answer these questions, community leaders, subject area experts and data experts are consulted. The selection process allows for concerns that the indicators reflect social goals, are rooted in a framework, are relevant to information generators and users, valid to experts and can communicate the needed message. Despite this effort, Environment Canada's published indicators share, with the OECD's (1991) report and the *Oregon Benchmarks* (Oregon Progress Report 1991) study, a strong sense of compromise with availability of data and of predefined areas of scientific work and expertise, in contrast with the careful development advocated by Friend and Rapport (1979: 80) discussion. Similar to the social indicators effort, the environmental indicators effort is bedeviled by lack of an agreed upon information model, which is compounded by the difficulties of obtaining aspatial indicators for large national units.

### Regional Sustainability and Macro-Information Models

The above discussion has revealed several issues of critical importance to the development of a regional information model. First, no persuasive macro-policy conceptualization of information exists to guide the development of regional sustainability information. Second, because of multiple metrics and the multiple criterion problem, it is difficult to apply a standard accounting framework including, for example, a chart of accounts and a limited number of performance measures. Third, the problem of aggregation, especially over regionally specific environmental phenomena, is a major challenge to the attempt to develop sustainability indicators for supra-regional political units, so far not successfully resolved. Fourth, unlike the relationship of the national economic accounting framework to economic institutions and economic policy formulation, no well developed institutional or policy framework exists that can consistently support information development and systematically work out difficulties of definition and implementation. This is the case despite the efforts of the UN Environment Program, the Statistical Office of the United Nations, the OECD Secretariat/Environmental Ministers and the growing influence of national environmental ministries. We are in a period of academic debate and institutional experimentation that may lead to creation of the necessary framework. Just as the national accounts were developed and promoted by the United States National Bureau of Economic Research, a national or international bureau of environmental research would be a useful vehicle for the necessary work.

## The Micro-Agents and the Nature of the Regional Information Problem

If macro-policy approaches to regional information are problematic, what can micro-agent approaches offer? In this case the focus is on classes of human agents influencing regional sustainability and the nature of information needs, considered in three categories: business information, nongovernmental organizations (NGO) and government.

### Business Agents

Business information is obtained from four major sources; markets, government, nongovernmental information organizations (business information services, research units, trade associations), and internally. The market is the central information coordination institution and the failure of the market to deliver much of the information required to achieve regional sustainability is by now well known and amply commented upon elsewhere. Information organizations (governmental and nongovernmental) have attempted to fill the gap between information of strictly business utility and information of social utility, in response to public pressure and government regulatory requirements. This response has had a piecemeal character, aside from the organized efforts of governmental statistical services. These efforts have built upon a core demographic accounts structure (the Census being central), driven by client needs and by the nature of pre-existing information created by historical evolution (or accident). These programs were and continue to be largely driven by the interests and immediate needs of established industrial sectors and the governmental institutional structure. Not surprisingly, this research exhibits sectoral or disciplinary compartmentalization.

A major factor in the business agent information model is experience, embedded in the organization and its staff. The importance of institutional experience reinforces the role of institutional design in dealing with any information problem. To reinforce this mechanism and to provide some institutional "memory", information systems are used: financial, managerial and (most recently and experimentally) decision support. These systems meet certain business needs, in particular financial and ownership needs, operations control, and planning and policy formulation. Financial information systems, meeting the earliest and most fundamental need, have influenced our basic concepts as to the nature of accounts, as illustrated by the above discussion. Management information systems have demonstrated the capacity for achieving great efficiencies in dealing with relatively routine matters such as personnel management or airline reservations. They have accelerated interest in information system development and have enhanced expectations as to the potential of

modern information technology. Their principal focus has been systems performance: monitoring, the allocation of resources and judging outcomes. Decision support information systems are at an early stage of development, associated with large business (and government) units and the movement toward corporate strategic management and planning.

Achieving regional sustainability will require information at each of the levels addressed by business information systems: financial/environmental auditing, managing system performance, and strategic management and planning. It will also require interrelated structures of information that will serve the full spectrum of actors: business, citizen-consumer, nongovernmental and government.

### **Nongovernmental Agents and Information**

Excluding organizations undertaking a quasi-governmental general information function such as the World Resources Institute or the Centre for Our Common Future, it would be inaccurate to characterize most NGOs as possessing information systems. A more productive way of viewing the problem is functionally; that is, in terms of the nature of information and of information holding. Regarding the nature of information relevant to regional sustainability, we have sectoral or stakeholder specific information (including sector or problem specific research and environmental impact studies), academic and research institute generated information, and information internal to NGO clients and operations. Effective utilization and coordination of this information are a major challenge, rarely met. For example, in a major region of Thailand studied by the author, there are over fifty NGOs operating development programs, with no effective information coordination despite the explicit goal of many of programs to help resolve the area's socio-economic and environmental problems by dissemination of research on sustainable economic practices (Walter and Sriboonchitta 1991). A similar situation exists in British Columbia (Sustainable Communities Initiative 1992). Inasmuch as the information held by NGOs is often among the most relevant to solving regional sustainability problems, institutional development allowing access and utilization of this information is urgently needed.

The form of NGO information holding is best described as "loosely structured." *Ad hoc* reports, library systems, working papers and special purpose databases are typical. The information is not produced in a form useful to those attempting an accounting system. Occasionally, specific studies prove important for understanding or developing indicators, but organization of the data within a loosely structured information system is the most straightforward way to build it into a tool for regional sustainability.

### **Government Information**

The last micro-agent category is government, here viewed as a system of agencies responsible for the spectrum of government activity rather than as a macro-policy/program and delivery unit. So viewed, there is a vast array of governmental units, all producing and requiring information. From the point of view of regional sustainability, two aspects of agency activity are most important: socio-economic-environmental programs and sectoral management. The former includes programs aimed at the social and economic viability of communities such as youth programs or employment programs, environmental projects and environmental regulation. The latter include sectoral programs dealing with agriculture, mining, forestry, fisheries and so on. The situation here is a combination of the business and NGO situation. On the one hand the information problem is little different from the NGOs, in that it is often a "loosely structured," multi-dimensional one, centred on legislatively mandated responsibilities and the associated need for data, for example public health regulation and demographically driven entitlement programs. In this case *ad hoc* reports, management information systems elements, and specialized data bases have evolved. On the other hand, government units responsible for sectoral management often function as proprietors or landlords and require information similar to that required by business enterprises. The response has been the development of information systems that are evolving toward decision support systems. Examples are the sectoral ministries of British Columbia, which are attempting coordination of their information systems through their Corporate Land Information Strategic Plan (CLISP), a program of inter-agency cooperation.

### **Regional Information Needs and Micro-Agents**

This brief comment on micro-agent information practice and needs has revealed less structure than the macro-model review, as might be expected from the more diverse and closer-to-reality nature of the micro-information problem. What does emerge is the lack of an integrating concept for information development, in contrast with the national accounts core macro-accounts concept. The nature of the more detailed and operational micro-agent information problem is such that a looser concept than accounts is required, for example, the concept of an information system. Since regional sustainability relies on the effectiveness of the units considered in this section, the question emerges as to the usefulness of accounting and indicators systems at the regional level. The question also arises as to the usefulness of pursuing an enlarged regional macro-policy accounting framework in the absence of a great deal of development work on regional information systems. The roots of the problem are the difficulties of categorial and spatial aggregation when natural and environmental

resources are involved, and the locationally specific nature of environmental problems and human/environmental interactions.

### **Regional Information Frameworks, Development and Sustainability**

This discussion has employed the concept of an information model, with attention given to three major classes: macro-accounts, indicators and micro-agent oriented information systems. All have relevance to regional sustainability policy. An additional class is associated with regional development policy and planning. Regional policy attempts to coordinate a large number of individuals and institutions who may be capable of influencing regional development. These agents include politicians, bureaucrats, business persons, non-governmental organizations, and agencies of public opinion. They operate at a number of overlapping regional levels, with various arrangements of networking and connectivity. They have operated within a number of regional policy planning frameworks, including: 1. comprehensive planning, 2. consultative governmental guidance using conservation strategies, 3. regulated development (locally and nationally) using markets as a central autonomous vehicle, and 4. strategic management.

#### **Comprehensive Planning**

As an informational framework for regional development policy, comprehensive planning arose from two sources. First, in the past, society has often turned to architects and transportation engineers for guidance when coping with the difficulties of urban, and by extension, regional development. This approach often led to spatially inconsistent styles, monumentalism and an engineering functionalism, successful under only the best of conditions. The information model used was particularist in that it was organized on a project or plan basis and dealt with demographics, land use and related issues, usually on the basis of subproject studies, engineering project and plan formulation.

The second source was social science and particularly economic development planning. Recognition of the fundamental economic forces governing community development and the apparent success of macro-economic analysis in developing policy tools for economic management led to a presumption that similar methods are workable in regional development management. This presumption faces many difficulties. A fundamental difficulty is that the information model necessary to implement the framework requires a sophisticated scientific program. The program must include model building, testing, evaluation, and the extraction of useful policy implications and, unfortunately, it

often embodies a desire for very extensive if not complete description of phenomena before determining a plan of action. The conceptual influence of systems analysis reinforces the information problem. Nearly all information efforts of this kind begin with an "existing information" report, and for a number of cases little more gets done. Another difficulty is that most development regions are open to migration, quick shifts of capital, corporate policy changes and a host of other influences difficult to capture in precise conceptual frameworks.

Nevertheless, the comprehensive planning framework provides a conceptual basis for systematic review of the information relevant to regional sustainability. The framework can provide a very useful organization for studies needed to deal with regional sustainability, especially if little is actually known of an existing region's characteristics. In exceptional circumstances, such as the city/region building of today's oil rich nations (Walter 1984), comprehensive planning may still play a role as an operational directive plan, specifying in detail projects, budgets, building and infrastructure. Unfortunately, the information model associated with comprehensive planning is very much a bureaucratic one, often directed at an indicative plan for government programs, including projects and market sector instruments such as taxes and subsidies. In regions with many decentralized actors, many stakeholders and highly developed and dynamic interactions, the framework is not likely to be very successful as a directive planning technique.

#### **Conservation Strategies**

Recently, consultative governmental guidance using conservation strategies has become a part of regional policy development. The impetus for this approach is the "World Conservation Strategy" (World Conservation Union (IUCN) 1980 and 1990). A number of national and regional (sub-national) strategies have been developed.

Conservation strategies do not deal with regional sustainability comprehensively. Regional sustainability enters the process as an associated element in the process of coping with conservation values. In practice, conservation strategies have often turned out to be policy documents dealing with many if not all of the essential elements for regional and community stability.

The conservation strategy process provides a focus for community consultation, education and policy formulation, usually within a government sponsored framework. Once a strategy is formulated and approved, the document becomes one source of guidance to those involved in development decisions, at the legislative, bureaucratic, project, business and community levels. Thus, the development of the strategy is only the first part of the challenge of achieving regional sustainability. The second is to achieve community articulation and implementation of the principles. How this is achieved is not clear, especially

as compared to the World Conservation Union's well articulated conservation strategy formulation process.

Viewed as a regional information model, the topics dealt with in formulating a conservation strategy are a subset of those considered in comprehensive planning. The purpose is to select the strategic issues as perceived by a number of participants: community leaders, the public, local and international experts, and various levels of government officials. Selectivity is preferred in order to conserve resources: financial, human and (perhaps most critically) time. Simultaneously, the systems ecology nature of the community and regional development process is kept in mind. The conservation strategy information model is selective and strategic, implemented in terms of a number of targeted studies aimed at aiding task forces or similar vehicles of participatory strategy formulation.

### **Regulated Market Led Development**

Perhaps the most common way of managing regional development is by government regulation, including permits, licenses, tax and subsidy tools and various other economic instruments. The regulatory framework can, of course, be developed based on many considerations, including those arising from a comprehensive plan or a conservation strategy. In this section, however, we are concerned with regulations (local, regional and national) that are developed by political and bureaucratic processes operating over a considerable time. These processes are typically not guided by any consistent analytical effort at understanding the development process or the constraints acting upon development. Regulations more typically develop as responses to crises or milder indications of distress. Within a regulatory framework, economic markets are the central, dominant vehicle guiding development, interplaying with social and cultural institutions and the governmental system. The information model here is the market/agent model. Measures to improve performance by providing indicative information are undertaken as the failure of the market/agent model to promote sustainability becomes apparent. To provide feedback on the effectiveness of the regulatory framework, this approach often supports government sponsored state of the environment and indicators reporting. Since regulated development is the dominant model of society, this information model is, broadly speaking, the macro, micro and agency accounts and indicators model discussed above, with all the difficulties noted.

Major difficulties with this system are: 1. its tendency to be driven by technological changes based on proprietary, closely held information (illustrated historically by the automobile, personal computer or jet travel), 2. its inability to provide information and thus coordinate development when goods, services, and values are involved that do not enter the commercial marketplace, in particular, environmental goods and services, and 3. its failure to

support information regarding inequalities of income and power.

The postwar development of very large corporations has changed the way that market led regional development must be viewed. These corporations, often multinational, possess the power to influence the form of regional or community development, either by constructing a large and perhaps dominant marketing or residential complex (for example a shopping mall or sealed retirement communities), or regional mega-projects. Such corporate initiatives may involve many joint costs, for example congestion and changes in transportation patterns, changes in employment and small business opportunities, and changes in waste disposal impacts and facilities requirements, which the market information model fails to adequately signal. An additional issue is the ability of large corporate units to use financial power, superior information and the market to gain control of basic natural resources, to the disadvantage of other business agents.

### **Strategic Management**

Strategic management is the last regional information framework discussed here. It arises from a quite different perspective than those commented on above. Comprehensive planning assumes the information capacity to accurately assess key situations and processes affecting development (to "model" them), the ability to develop a specific, concrete set of actions to control development, and the ability to effectively implement the actions such that a desired result is obtained. Emphasis is on determinism and controllability. The conservation strategy approach assumes that community consensus and better knowledge of development issues will lead to sustainability. Its emphasis is on goal formation and consensus building. The process by which implementation will be achieved is left to existing institutions. Regulated and market leadership approaches leave development to a more or less autonomous system reflecting competing private interests. The assumption is that a mindless process cannot be influenced by deliberate actions without an inferior result. None of these systems or their associated information models give sufficient attention to all aspects of the regional management process: regionally specific realities, goal formation, institutions and their interactions, the controllability of some aspects of the development process and the autonomous nature of other aspects (both natural and socio-economic).

Strategic management for regional sustainability can be viewed as positioning a community's assets to take maximum advantage of development opportunities as they arise, consistent with maintaining long run quality of life and the communities resource base. It is not comprehensive in that it does not attempt to define and cope with all aspects of development, but only those that have strategic implications. It differs from the conservation strategy approach in that it is a continuous process, not a set of studies and consultations leading

to a statement for others to implement, and it differs from the regulated/market led approaches in that it explicitly recognizes the need to develop a structure of information and learning to allow the institutions influencing development to work more effectively. Emphasis is on process, not a set plan of action. The approach involves frequent reappraisal and reformulation as events, actors, technology, information and other factors change their nature and weight within the process. Strategies are formulated and used in governmental implementation programs and as indicators to guide the action of autonomous micro-agents. In formulating strategies actors face a number of challenges that might be supported by a strategic information model: the external environment, the community environment, environmental imperatives and the political reconciliation of diverse goals.

The strategic approach to regional management uses a loosely structured information system that is evolving toward a decision support system. Given the emphasis on process, adaptability, strategy formulation and reformulation, the associated information model must be dynamic. The categorical and subject content of the strategic approach is not so different from other methodologies, particularly the stress-response and the patrimonial approach. In fact, the reality of the regional problem dictates the content. The significant difference lies in the way that the relation of information to the planning and management process is conceptualized.

### **Regional Information Frameworks: Summary**

This section has underlined the nature of the regional information problem, by means of a review of various approaches to regional policy formulation. It underscores the difference between the macro-economic policy problem and the regional problem. A region, defined in terms of particular people and problems, may be fuzzy in definition and overlap other regions. A sub-national geographical region is typically open to economic, social and environmental influences from other regions. A region usually involves local synergism that cannot be captured in aggregate formulations. Furthermore, the regional scale is such that micro-agents must be directly involved in the policy process, because they hold essential information, because only they know their definition of their region, and because their cooperation is necessary to achieve useful results.

The inference is that regional accounts or regional indicators can only be useful if founded on an information system that is ongoing and includes the important actors in the region. Within the context of a regional information system, accounts and indicators provide useful periodic situational reports in support of public discussion and policy formulation.

## **Conclusion**

As noted at the beginning of this paper, this discussion arose out of concern for the largely unexamined macro-policy bias of approaches inspired by the national accounts. This review suggests that the inclusion of environmental, ecological and social considerations raises difficulties of locational specificity and incommensurability and that the coordination problem of many actors operating in many localities requires a decentralized information system. One conclusion is that an accounts approach, modeled on the macro-economic policy issues, is not appropriate for dealing with regional and local information needs.

In response, many practitioners have attempted to develop a macro-policy approach based on indicators. This approach has merit in that it does not necessarily impose aggregation. Indicators can include culturally unique places of macro-policy significance, crucial drainage basin indicators, macro-accounts, or anything else. In practice, the indicators selected are not normally justified by any compelling rationalization, whether a systems model, chart of accounts based on an allocative function, or another policy framework. They are generated with faith that micro-agents and macro-policy makers will adopt a number of the indicators in their decision making, and that, somehow, the resulting decisions will generate improved results. This is by no means assured, as the history of partial, technology based intervention reveals. The lack of a structure constraining the selection and use of indicators undermines their scientific validity because of a lack of a context for testing their suitability.

Despite these difficulties, the indicator's approach has contributed to the debate by underlining the need for categorical and spatial flexibility when facing the comprehensiveness required by sustainability policy. It also directs attention away from a macro-policy focus toward focus on micro-agents. It helps in the recognition that it is the interacting web of organizations and individuals in a given region that is the operational power determining sustainability, within a governmental policy framework.

Central to the effectiveness of micro-agents in achieving a goal is the efficiency of their information systems. The macro-policy approach relies upon market signals to manage the micro-agent system, supplemented by infrastructural projects and by targeted programs to patch up problems. Recent attempts to patch up our macro-accounting tools are motivated by a growing perception of the inadequacy of the market approach, supplemented by macro-policy, as a means of dealing with social, environmental and ecological issues. The position taken here is that the macro approach is an inadequate response to regional information needs, considered in those spatial, categorical and management dimensions required to achieve sustainability. This is not to say that the "greening" of the macro-accounts is not desirable, to the degree that convincing monetary evaluations can be made for the missing attributes. What is required is a means of marshalling, at the appropriate spatial and management

scale, the locally held, spatially specific and often noncommensurate information relevant to the definition of a region, to its quality and sustainability. Based on this means, regional and higher level information systems can be built up, on a national system of patrimonial information and appropriate national indicators might be constructed.

The development of any information system requires close coordination with the purpose it is to serve. The macro-accounts system was developed to serve economic management based on the market and minimalist government intervention in the affairs of micro-agents. Regional development information systems have been developed to deal with localized problems, often spatial, environmental or social, which were either neglected or even created by macro-policy. Postwar experience with regional development has led many to believe that regional policy must be strategic in nature, working with more or less autonomous micro-agents rather than in opposition. The strategic approach, focusing on rapid situational appraisal ("scoping", "visioning"), identification of major opportunities and threats, development of strategic concepts, systems analysis and formulation of scenarios and alternatives, strategy selection, policy formation and implementation -- within an ongoing process that features interaction between experts, politicians, nongovernmental organizations and citizens -- should be viewed as the most hopeful approach to regional sustainability. It will be very difficult to achieve. It is impossible without an effective and ongoing regionally based information system.

Of course, the nature of the problem constrains the information strategy chosen. As social scientists are often reminded by "hard" scientists, there is no convincing national ecology except possibly in cases of nations centred on one drainage basin or confined to one biome (if any exist). Likewise, there is no national economy -- what passes for a national economy is a set of national policy instruments, most notably international trade, fiscal and monetary instruments. And as demonstrated in many places at this moment in history, there is only a veneer of national society over a set of regional and subregional societies. These spatial issues, when considered together with the measurement and multi-criterion issue, makes it difficult to see how we can have a system of accounts for a nation's environment and socioeconomic system as a whole. What we can have is a set of accounts to guide the use of national economic policy, and some similar mechanisms are evolving for environmental and social policy. The information problem is not one of measuring reality, it is one of understanding the observable and reliable characteristics of reality that matter in formulating sustainability policy, regionally and nationally.

The conclusion of this paper is that the way forward is to develop an information system involving databases, information exchange, regional accounts, indicators, and other information tools, as appropriate to the particular scale and policy problems of concern at a given local or regional level. A system of this kind would centre in on-going information as well as periodic benchmarks, operating within an interactive, spatially nested and hierarchical

information system, perhaps drawing conceptually on the French patrimonial and regional development planning information models. Once such a structure is in place, it will provide a basis for national policy oriented information, including accounts and indicators. Without such a structure to draw upon, information purporting to indicate the state of sustainability, regionally or nationally, will be *ad hoc* in nature, opportunistic in construction, and oriented to past rather than future problem identification.

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