BEYOND GDP—NEW APPROACHES TO APPLIED STATISTICS

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New social concerns and priorities—beyond the economic growth paradigm—pose a challenge to the established statistical systems. The initial response of developing overall welfare measures and social indicators of the human quality of life had little impact on official statistics. Environment statistics, on the other hand, has become accepted as a new branch of applied statistics, maturing from exclusive pollution monitoring to cover various aspects of natural resources and the man-made environment. Still, a rather artificial separation between ecological monitoring and modeling and anthropocentric environmental statistics and accounting persists. The assessment of complex and interrelated socioeconomic and environmental concerns requires comparable inter-disciplinary information. The provision of such information should be facilitated by a flexible framework approach to statistical coordination and integration.

1. INTRODUCTION

Governmental policy concerns and priorities determine primarily the scope and coverage of national statistical programs. Beyond the classic concern of any government with "its" population, which has been counted since ancient times, policy concerns in modern history have focused on the allocation of scarce human and natural resources for the production of goods and services, i.e. on economic activities. Consequently, those resources that were considered "free" such as water, landscape and wildlife have been typically neglected, both in policy making and statistical data collection.

This narrow perception of the targets of applied statistics has changed rapidly since the 1960s when conspicuous pollution incidents and new scarcities of formerly free or inexpensive natural resources could be observed worldwide. Initial reactions were emphatic, predicting doom in a revival of Malthusian ideas that were promulgated in particular by the "Limits to Growth" study of the Club of Rome (Meadows *et al.*, 1972). Yet, these reactions did succeed in attracting governmental attention to problems of environmental degradation and the depletion of natural resources and to the need for reassessing the sustainability of accelerated economic growth.

The growth concept of economic development and policy has not only been shaken by the environmental discussion in industrialized countries but also by the persistent failure of growth-oriented policies to alleviate poverty in most developing nations. "Alternative development" paradigms focused on the improved distribution of the results of economic growth and also questioned the significance of a one-dimensional development concept epitomized by national product or income *per capita.* Calls for "alternative patterns of development and lifestyles", the "satisfaction of basic human needs", the "integrated approach to

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environment and development", "ecodevelopment" or the "improvement of the quality of life" reflect a multi-dimensional concept of societal development as well as the need to integrate the various dimensions in a coherent framework of planning and policy making (Bartelmus, 1986, p. 14).

The consequences of these developments for established official statistics could be dramatic. In the field of economic statistics, the Nobel prize-winning accounting system might well lose some of its supersystem aura as new statistical systems in the environmental and sociodemographic fields emerge. Traditional social and demographic statistics might have to recast many of their established series to meet the new demands for cross-disciplinary and integrated information. This applies also to environmental data collection that seems to have matured from simple pollution monitoring to include statistics on resource use and depletion and various aspects of the man-made environment. The validity of these general observations is examined below by confronting the three main statistical systems with emerging data demands.

2. Economics: Accounting for Welfare

The great depression of the 1930s and war-supportive as well as post-war development efforts are among the major reasons for abandoning whatever was left of micro-oriented laissez-faire economics in favour of macroeconomic policies. Statistics followed suit deriving from Keynesian theories a system that was based on the circular flows of the macro-aggregates of national product, its cost or factor income, and its components. Circularity of flows and the availability of a common (monetary) numéraire enabled economists and statisticians to describe these flows within a framework of accounting relationships. National accounting was formalized at the international level for the first time by the League of Nations in 1947, culminating in the widely applied System of National Accounting (SNA) of the United Nations (1968). It has been maintained that "the national accounts have given empirical content to the economic concepts needed for measuring economic performance and for modeling the operation of the economic system" (Ruggles, 1982, p. 10).

The most widely used indicator of economic performance is the gross domestic product (GDP). As long as economic performance is interpreted as the long-term growth or medium-term fluctuation of the total of net (deducting intermediate consumption) market transactions, GDP describes adequately the aggregate result of economic activities. However, when the concern is with the ultimate objective of economic performance, i.e. the creation of welfare, the adequacy of GDP is lost. Nevertheless, GDP has and continues to be used as a convenient "proxy measure of welfare" (Merriam, 1968), considering each monetary unit of income as a potential claim on the supply of goods and services.

Environmental impacts, most social responses to these impacts and various social services and non-market transactions that affect human welfare are not adequately dealt with by GDP. It has been suggested, therefore, to correct GDP so that it would better reflect at least the economic counterpart of welfare. The pioneering work of Nordhaus and Tobin (1973) was made popular by Samuelson's textbook as "NEW," the net economic welfare (Samuelson, 1980, pp. 183-185).

NEW attempts to correct two major distortions of national accounting, namely the misclassification of certain intermediate outputs as final and the neglect of important non-market activities. To calculate NEW, "defensive" consumption and investment, consisting in particular of excessive expenditures for defense and police, the counteraction of environmental degradation and of various external effects, are deducted; on the other hand, the value of non-market activities such as leisure and certain subsistence activities is added.

Despite some discussion at the international level (United Nations 1977), NEW and similar measures of welfare did not have a major impact on statistical development; nor did they succeed in replacing GDP as the main economic indicator. The reasons are twofold. Replacing the national accounting list of final outputs by a list of final *and useful* (welfare creating market and non-market) outcomes introduces a subjective and thus arbitrary element into the NEW calculation. Perhaps more significant is the valuation problem of both market and non-market activities for purposes of welfare measurement. The basic assumption is that the price of a good is proportional to its marginal utility. However, different intensities of preferences of consumers at different income levels, the occurrence of consumer surplus, market imperfections and external effects of consumption represent major factors of disturbance to the basic assumption of price-utility proportionality.

One response to these difficulties in defining an aggregate welfare measure is to abandon the concept altogether and to collect disaggregated data, rather, on selected high-priority issues outside the established national accounting system. Some approaches cling closely to the original accounting system while others have been developed fairly independently. The disaggregation and restructuring of national accounts into "satellite accounts"[1] (Institut national de la statistique 1976) or "social accounting matrices" (Pyatt and Round, 1977) are examples of the close-links approach. On the other hand, the search for social indicators to assess various aspects of the quality of life and the development of statistics of the state and trend of the environment has been undertaken largely within independent frameworks and systems (see below, sections 3 and 4).

More recently, an international workshop on environmental accounting has resumed discussing the adjustment of national product and income. Rather than attempting to develop measures of overall economic welfare, the workshop focused on measures of sustainable income and product by accounting for environmental degradation and the depletion of natural resources only. Sustainable product is estimated by deducting the consumption of "natural capital" or of "user costs" of natural resources and of "defensive environmental expenditures" from, and adding "discoveries" and other increases of natural resources and "net environmental benefits" to, gross or net national product.[2]

[1]Detailing expenditures and resources in major policy areas such as health, education, income distribution or housing.

[2]The workshop has been sponsored jointly by the United Nations Environment Programme (UNEP) and the World Bank. The different approaches to environmental accounting have been reviewed by Bartelmus (1987) for further discussion in the current revision of SNA.

3. Population: Quality of Life Measurement

The drawbacks of national accounts-related welfare measurement shifted the focus of data collection from aggregate welfare measurement to the assessment of people-oriented "social concerns." Attempts at measuring the human "quality" of life rather than "quantitative" economic growth in the 1970s were based on the belief that the objective conditions and subjective perception of human welfare can be measured by a set of appropriate "social indicators."

Social concerns that represent operational aspects of the quality of life are usually determined first, before defining representative indicators. The specification of such concerns is a difficult task that can be tackled either through an analysis of individual preferences or more pragmatically in a top-down approach by "expertocratic" decision. The pragmatic approach is prevailing in the development of indicators by international organizations such as the Organisation for Economic Co-operation and Development (1973 and 1976) or the United Nations (1978). The analytic approaches are founded on the neoclassical utility concept and derived welfare economics and have been revived by the "new microeconomics" which focus on non-material aspects of human life such as "time, love, marriage, parenthood, crime and justice" (Samuelson, 1980, pp. 750–759).

There appears to be some consensus on the major groups of social concerns which generally cover the subjects of health, education, time and leisure, consumption of goods and services, environment, safety/security and social participation (United Nations 1978, pp. 43 *et seq.*). However, the difficulties and dissent begin when breaking down major concerns into subconcerns and actually selecting appropriate indicators that are representative of these subconcerns. An attempt was made, therefore, to describe more systematically both concerns and indicators, in a "System of Social and Demographic Statistics" (SSDS) (United Nations 1975). In analogy to SNA, SSDS proposes to present stocks and flows of individuals and groups of individuals and related economic and social activities in an accounting system of life sequences, time budgets and cost-benefit distribution. In this manner, most of the above concerns are covered. The production of social indicators is explicitly stated as one of the main reasons for SSDS, defining these indicators as "a subset of the data series and constructs actually or potentially available . . . distinguished from other statistics only by their suitability and relevance" (United Nations 1975, pp. 32 and 28).

However, the absence of a natural numéraire which permits aggregation and the lack of a comprehensive theory (such as Keynesian macroeconomics in the case of SNA) soon led to the abandonment of the system approach in favor of a Framework for developing and integrating Social and Demographic Statistics (FSDS) (United Nations 1979, pp. 30 *et seq.*). Considering SSDS's view of social indicators as just a set of most relevant statistics, it is not surprising that FSDS is just this: a list of tentative indicators presented under the headings of the topics of social concerns of the original SSDS. In this sense, social indicators are no more than a set of statistics in a loosely connected field which it is hoped will eventually "shade imperceptibly into complete coverage of social and demographic statistics" (United Nations 1979, p. 31). This characterization of social

indicators is quite different from the original objective of the indicator movement, namely to appraise the qualitative non-economic aspects of social well-being. On the other hand, shunting aside the original objective might not be a great loss, since there seems to be evidence that both objective and subjective (attitudinal) indicators cannot assess, even in theory, the human quality of life (Hankiss 1983).

Recent efforts thus appear to dodge the controversial issue of social concerns and indicators by focusing the development of indicators on the social situation of "special population groups" such as women, children, youth, the elderly and disabled persons" (United Nations 1985, p. 31) on one hand and on "microstatistics" (Ruggles, 1982, pp. 49-51) that can be readily manipulated for *ad hoc* requirements on the other hand. In the absence of a widely agreed upon system or framework of social statistics, the microstatistics approach seems to lean again on SNA for a more systematic organization of its data bases and for integration with established macrostatistics.

4. Environment: Assessing the Support System

As pointed out in the introduction, one reason for politicians and statisticians to look beyond GDP has been the conspicuous breakdowns in nature's support system which has always been taken for granted, that is for free. However, large-scale pollution and depletion of natural resources created social costs that could not be internalized into the existing price-cost structure of the economy. Puzzled economists had to realize that the traditional tools of economic policy failed to cope with these new phenomena (Bartelmus, 1986, p. 10). Statisticians attempted to include the costs and benefits of environmental measures in their system of national accounts or described physical impacts by sets of selected social indicators. The above discussion showed that both a monetary approach to largely non-market phenomena and an eclectic non-monetary approach met with limited success in assessing society's new concerns.

Initially, international efforts aimed therefore at developing a system of environment statistics parallel to those in the economic and socio-demographic fields. It was hoped to cover in this manner the whole of the "real world," i.e. economic and non-economic activities and the material support system of the man-made and natural environment. It soon became apparent, however, that, as in the case of SSDS, a generally accepted theory and a common numéraire were lacking. Consequently, a Framework (rather than a system) for the Development of Environment Statistics (FDES) was developed by the United Nations (1984).

FDES integrates the most common approaches to the organization and presentation of environment statistics.[3] The result is a two-way table which relates the major components of the natural and man-made environment to a sequence of activities and events, environmental impacts resulting therefrom, and social responses to these impacts. A reference category is added, which provides for stock and background information, linking dynamic features of action, impact and reaction with static aspects of the natural and man-made assets. The framework contents are "statistical topics" which are operational aspects of

[3]A critical review of the various approaches to the development and publication of environment statistics is given in United Nations (1982).

general environmental concerns and thus lend themselves more easily to quantification by statistical variables. The Statistical Office of the United Nations is currently developing detailed proposals for such variables in a Manual of Environment Statistics that is conceived as a direct expansion of the original framework.

One aspect of environmental concerns and its implications for data collection deserves further exploration. Many environmental impacts occur and spread within ecosystems. They can thus be fully assessed in the ecosystem context only where their repercussions on material and energy flows and on the biological and physical components of the system become evident. Yet, most environmental impacts are caused by economic (production and consumption) activities that are usually surveyed nationwide and only to a limited extent at the subnational level. Moreover, ecosystem boundaries do not usually coincide with the political and administrative limits of a country and its provinces and districts.

The result of this discrepancy has been distinctly separate approaches in measuring ecological impacts on one side and human activities that cause, mitigate or prevent these impacts on the other side. The relatively new field of "statistical ecology" concentrates on biological variables of ecological models, typically neglecting socio-economic parameters. "Forest, fish, fur and fowl" are the targets of measurement (Hennemuth and Patil, 1983, p. 374) while human activities are generally neglected. On the other hand, no routine compilation of ecological variables has been envisaged by most statistical offices in their environment statistics programs. Only crude aggregate estimates of some overall environmental impacts of species depletion, deforestation or desertification are generally presented, rather eclectically, in environment statistics compendia.[4] Both approaches are therefore inadequate. Environment statistics provide insufficient information for managers of particular ecosystems, such as a watershed or a mangrove swamp, and statistical ecology models usually fail to address politicians, planners and administrators who cannot see the welfare implications of the depletion of selected species in remote ecosystems.

The question is how to combine meaningfully the two approaches so that the ecological implications of socio-economic activities and the welfare implications of imbalances and changes of ecosystems become visible to politicians and environmental (ecosystem) managers. The question is also if there is a real need for this visibility. Perhaps the current attitude of most politicians who appear to be content with a few overall indicators for a general assessment of the environmental situation can be justified, and so might be the ecologists' model-building around their favorite species. Probably, no definite answer can be given to this question as yet. There are, however, some new approaches to regional development planning which point at a possible conceptual underpinning for integrated socio-economic and ecological data collection at local levels. One such approach is "ecodevelopment" which aims to integrate socio-economic and environmental planning and administration for an "ecoregion."[5] The new microstatistics

[4]One noteworthy exception is the latest Canadian compendium which presents a wide range of statistics for drainage basins and ecozones (Statistics Canada 1986).

[5]The ecoregion concept attempts to combine ecological criteria with administrative ones. Its objective is to determine a geographical planning unit whose administration can communicate with central powers while maintaining a certain independence for the realization of local aspirations and activities (Bartelmus, 1986).

approach described above could be an opportunity to construct data bases that relate to regional micro-administrative units and that can be aggregated into ecoregional as well as national information systems.

5. Statistical Integration—A Framework Approach

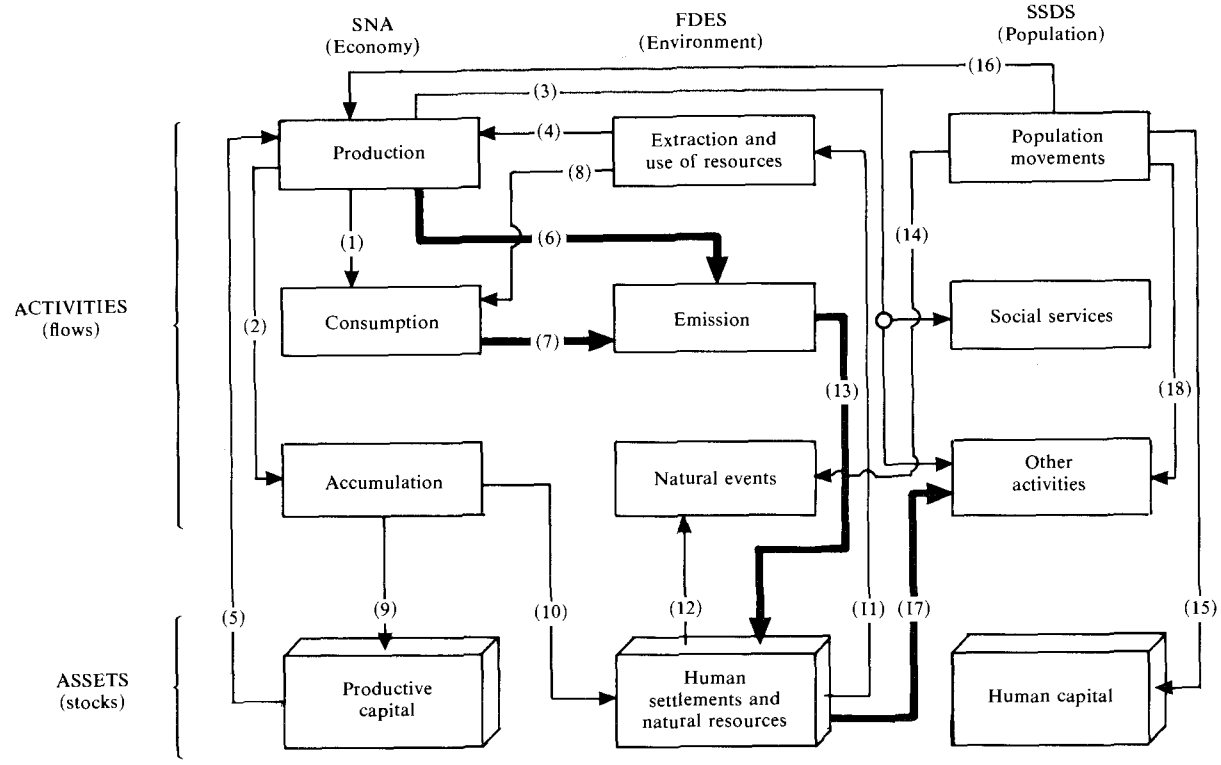
The above description of regional development and its information requirements presents a strong argument for integrating economic, social and demographic data, at least at local levels. "Bottom-up" approaches to socio-economic planning and policy are still in their infancy, however, as central government planning and policy prevail in countries of any level of development. Moreover, even in central policy making, co-ordination of programmes among different sectors and administrative levels has been far from perfect, especially regarding the relatively new concern with the environment. The question is if, under these circumstances, it would not be premature and unrealistic to aim at developing an integrated system of statistics that were usually developed for relatively specialized objectives.

One reason for improving the integration of statistical series is of course the degree of interaction of the various components, agents and processes of the "real world" which are the targets of statistical measurement. Figure 1 illustrates in a rather simplified way some of these interactions in terms of the principal topics of the three major statistical systems. Common to these systems and framework (in the case of environment) is the basic distinction between stocks and flows. Only "real" flows are shown in the figure, omitting their financial counterparts in the case of SNA as well as more qualitative impacts, especially in the environmental and socio-demographic fields.[6]

Although the figure is neither comprehensive nor unambiguous, it does convey an impression of the complex interface among economy, environment, natural resources and population. One example, namely the sequence of emission of pollutants (flows 6 and 7), their concentration in environmental media (13) and their subsequent "consumption" as part of "other activities" (17) is highlighted by bold arrows. A further extension of this sequence into health effects (18) and social response to these effects (3) could also be construed. Even a cursory inspection of real world complexities reveals thus a need for linking statistical data across the traditional boundaries of data collection.

The need for better coordination and integration of data compiled independently in different statistical programmes is not a new concern of statisticians. The above-described statistical systems claim to serve integration, beyond their original domain, by extending their scope and coverage into other fields. In the context of SNA, attempts have been made to measure the costs of environmental damage and expenditures for pollution control by government and business and to cover environmental resources and impacts on these resources in balance

[6]Some further simplifications and modifications have been applied to the original systems to better accentuate real-world interrelationships. For example, the system is closed to external flows, the housing complex is shifted from SSDS to FDES (as part of human settlements) and distribution aspects are not made explicit.



(1) Goods and services for private and public consumption; (2) Capital goods; (3) Supply of social services and use of goods and services in "other" activities; (4) Use of natural resources in production processes; (5) Capital consumption (shown in SNA as a corrective item of income in the consumption account); (6) Emission of waste and pollutants by production processes; (7) Emission from consumption processes; (8) Consumption of natural resources (aesthetic, physiological) and of man-made resources (use of housing and infrastructure); (9) Capital formation; (10) Construction of shelter and infrastructure (see also (9)); (11) Depletion of natural resources (see also (4)); (12) Destruction of human settlements and natural resources by natural disasters; (13) Ambient concentrations in the man-made and natural environment; (14) Losses of human life and limb from natural disasters; (15) Net growth of population; (16) Labor; (17) Human consumption of pollutants; (18) Losses of human life and limb through diseases, crime and warfare.

Figure 1. Real World and Statistical Systems

sheets of tangible assets.[7] The further breakdown and reclassification of selected accounts into social accounting matrices (Pyatt and Round, 1977) and the linkage of microstatistics to macro-aggregates within SNA (Ruggles, 1982) have been considered as an adequate means of capturing most of the body of social statistics. On the other hand, SSDS includes housing and its environment, and natural resources and the environment in its scope and coverage though the latter is not further developed in anticipation of a "system of environmental statistics" (United Nations 1975, p. 4). The distribution of income, consumption, accumulation and net worth is also included in SSDS, but most progress on this topic has been made in the province of SNA (United Nations 1977b).

FDES seems to be less aggressive in incorporating other fields despite the all-embracing character of environment. One gray area is the field of human settlements which comprises the three components of shelter, infrastructure and community services according to an international conference on human settlements (United Nations 1976, p. 37). Apart from environmental aspects, human settlements thus exhibit characteristics of SNA's productive capital and production activities as well as of housing which is claimed by SSDS/FSDS as a topic of social concern.

Considering the traditional sectoral and institutional segregation of statistical fields on one hand and the connectedness of the various components of the real world on the other hand, the flexible structure of the multi-disciplinary FDES appeals as a pragmatic approach to the coordination and organization of the different fields of applied statistics. Contrary to a system approach, FDES does not try to relate variables through rigid functional or accounting relationships and does not specify common concepts, definitions, classifications or tabulations. FDES lists "statistical topics" only, which are the quantifiable aspects of general concerns. In this manner, the subjects of diverse fields and disciplines are linked together for the purpose of developing a well-coordinated data collection system. In the field of environment, FDES has proved indeed to be a powerful tool of developing and presenting statistical variables in a Manual of Environment Statistics (see above, section 4).

In Table 1, FDES criteria are also applied to SNA and SSDS in order to outline an overall framework for statistical integration. The framework largely maintains the original concerns, topics or subject areas of SNA, FDES and SSDS. On the other hand, it organizes these concerns and areas around "information categories" of (a) stocks or assets, (b) activities that produce, use or affect otherwise the assets, (c) impacts resulting from the activities and (d) social response to the impacts of activities. These information categories simply reflect the common interest of all statistical systems in describing the state (stock) and trend (change of stock) of the real world as well as the major activities responsible for real world changes.[8] Accounting relationships could be displayed by marking

[7]Impacts on natural resources and human settlements are reflected in reconciliation accounts and balance sheets of SNA as natural growth, depletion and new finds or losses of the breeding stock, forests, plantations, fisheries, subsoil and other resources (United Nations 1977a). Some new approaches to environmental accounting have been referred to above in section 2.

[8]For a more detailed discussion of the information categories and other FDES concepts see United Nations (1984).

TABLE 1

FRAMEWORK FOR STATISTICAL INTEGRATION

Statistical System (Subject Area) \ Information Category	Assets	Activities	Impacts on Assets	Responses to Impacts
SNA (economy)	*Financial assets* *Net tangible assets* -reproducible -non-reproducible	*Production* -commodities -activities *Consumption* -expenditure -income and outlay *Accumulation* -stock increase -fixed capital formation *Distribution* -income -consumption -accumulation *Transactions with the rest of the world*	*Saving/net accumulation* *Reconciliation* -price changes -"births" and "deaths" of assets and liabilities -other	*Macro-economic policies* -fiscal -distribution of income and wealth -investment -sectoral programming and budgeting -foreign trade -foreign aid -other
FDES (environment)	*Stocks/reserves of natural resources* -biological -water -land (surface and sub-surface) *Human settlements* -housing stock -other building and infrastructure	*Use of natural resources* *Emissions and discharges* *Natural events* (disasters) *Construction and use of shelter and infrastructure*]	*Resource depletion or increase* -natural resources -human settlements (sprawl and dispersion) *Ambient concentrations of pollutants and waste* in -air -water -land/soil *Biological and ecological impacts* *Human health and welfare effects*	*Environmental policies and programs* -management of natural resources -pollution monitoring and control -human settlements policies and programs -prevention and mitigation of natural disasters
SSDS (population)	*Population* -composition (by demographic and vital characteristics) -regional distribution -social characteristics	*Population movements* -natural growth (births, deaths, fertility) -migration (external, internal) -social stratification *Other activities* -leisure -learning (education) -crime, delinquency -other (travel, housework, natural functions)	*Population increase/decrease* *Changes in the health status of the population* *Other qualitative changes of human capital*	*Population policy* (family planning and population control) *Employment policy* *Social services* -social security and welfare -medical care -public order and safety

the first column of the framework as "opening assets" and adding a last (identical or similar) column of "closing assets."

The category of social "responses" is unusual in traditional statistics. Much of the policy orientation of the social indicator movement reflected a dissatisfaction with prevailing statistical indicators that are quite removed from or even irrelevant to policy formulation and evaluation. It should be a challenge for statistical services to supply planners, administrators and politicians with statistics that relate more closely to the process of decision making and its successes and failures. To some extent, this policy orientation could be achieved by processing and displaying data in the activity-impact-response sequence of the framework with a possible loop back into the impact category for an assessment of the effects of responses. It may not always be easy, however, to distinguish between response and impact activities and between their intended and unintended impacts, especially when an activity combines different objectives (United Nations 1984, p. 12).

Another important use of the framework would be to lend visibility to areas of overlap among the existing statistical fields. These areas represent risks of work duplication and should be the target of coordination and harmonization of statistical work. Even at the relatively aggregate level of the framework proposed in Table 1, such areas are easily identified: human health effects figure in SSDS in an overall assessment of the health situation and in FDES, as far as environmental diseases and accidents are concerned; responses to environmental impacts may include particular fiscal measures described in SNA, pollution control contained in FDES and social services from SSDS; and a further breakdown of SNA's tangible assets reveals categories similar to the stocks of natural resources and human settlements (housing and infrastructure) of FDES.

The above examples show the usefulness of an overall coordinating framework that highlights the interface among separately developed statistical fields. The building-block character of the framework also allows it to reflect new or changing concerns of society and to select relevant topics and related data for cross-disciplinary statistical analyses. Old and new concerns and priorities and related data collection are thus drawn into perspective, prompting a critical evaluation of cherished but under- or misused statistical series. Emerging issues and objectives, beyond GDP maximization, point indeed to a need to reorient applied statistics—away from a preoccupation with monetary accounting towards a more balanced assessment of society's economic, environmental, social and demographic concerns.

References

Bartelmus, P., (1986), *Environment and Development*, Boston, London and Sydney: Allen & Unwin.

——— (1987), Environmental accounting and SNA (in preparation).

Hankiss, E. (1983), Cross-cultural quality of life research: an outline for conceptual framework. In *Quality of life: Problems of assessment and measurement*, UNESCO, Socio-economic studies, **5**, 9-48. Paris: UNESCO.

Hennemuth, R. C. and Patil, G. P. (1983), Implementing statistical ecology initiatives to cope with global resource impacts. In *Renewable resource inventories for monitoring changes and trends*, Proceedings of an International Conference, August 15-19, 1983, Corvallis, Oregon, J. F. Bell and T. Atterbury (eds.), 374-378.

Institut national de la statistique et des étuders économiques (1976), Système élargi de comptabilité nationale. *Les collections de l'inséé*, Ser. C. **44/45**, Paris: inséé.
Meadows, D. H., Meadows, D. L., Randers, J. and Behrens W. W. III, (1972), *The Limits to Growth*, New York: Universe Books.
Merriam, J. C. (1968), Welfare and its measurement. In *Indicators of social change, concepts and measurements*, E. B. Sheldon and W. E. Moore (eds.), 721-804, New York: Russell Sage Foundation.
Nordhaus, W. D. and Tobin, J., (1973), Is Growth Obsolete? *Studies in income and wealth* **38**, 509-564.
Organisation for Economic Co-operation and Development (1973), *List of social concerns common to most OECD countries.* Paris: OECD.
Organisation for Economic Co-operation and Development (1976), *Measuring social well-being, A progress report on the development of social indicators.* Paris: OECD.
Pyatt, G. and Round, J. I., (1977), Social Accounting Matrices for Development Planning, *Rev. income and wealth*, **23**(4), 339-364.
Ruggles, R., (1982), The System of National Accounts: Review of Major Issues and Proposals for Future Work and Short Term Changes, Expert paper for the Conference of European Statisticians, Working Group on National Accounts, Geneva, May 31-June 4, 1982 (ESA/STAT/AC.15/2).
Samuelson, P. A., (1980), *Economics*, 11th ed. New York: McGraw-Hill.
Statistics Canada (1986), *Human Activity and the Environment.* Ottawa: Minister of Supply and Services.
United Nations (1968), *A System of National Accounts*, Ser. F No. 2 Rev. 3, New York: United Nations.
United Nations (1975), *Towards a System of Social and Demographic Statistics*, Ser. F No. 18, New York: United Nations.
United Nations (1976), *Report of Habitat: United Nations Conference on Human Settlements*, A/CONF. 70/15, New York: United Nations.
United Nations (1977), *The Feasibility of Welfare-Oriented Measures to Supplement the National Accounts and Balances: A Technical Report*, Ser. F No. 22, New York: United Nations.
United Nations (1977a), *Provisional International Guidelines on the National and Sectoral Balance-Sheet and Reconciliation Accounts of the System of National Accounts*, Ser. M No. 60, New York: United Nations.
United Nations (1977b), *Provisional Guidelines on Statistics of the Distribution of Income, Consumption and Accumulation of Households*, Ser. M No. 61, New York: United Nations.
United Nations (1978), *Social Indicators: Preliminary Guidelines and Illustrative Series*, Ser. M No. 63, New York: United Nations.
United Nations (1979), *Studies in the Integration of Social Statistics: Technical Report*, Ser. F No. 24, New York: United Nations.
United Nations (1982), *Survey of Environment Statistics: Frameworks, Approaches and Statistical Publications*, Ser. M No. 73, New York: United Nations.
United Nations (1984), *A Framework for the Development of Environment Statistics*, Ser. M No. 78, New York: United Nations.
United Nations (1985), *Statistical Commission, report on the twenty-third session*, E/CN.3/1985/23, New York: United Nations.