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Information for decision-making and participation

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I. Introduction

1. Information and participation cut across all the other issues highlighted in Agenda 21. Without adequate and timely information and effective public participation, decision-making can be both haphazard and unconnected to people's needs. Chapter 40 of Agenda 21, on information for decision-making, highlighted two main issues: bridging the data gap within and between countries and improving the availability of and access to information. These issues are still highly relevant today, but the context within which they need to be addressed has changed considerably since 1992.

2. An international expert meeting on information for decision-making and participation was held in Ottawa from 25 to 28 September 2000, sponsored by the Government of Canada, the Department of Economic and Social Affairs and the United Nations Environment Programme (UNEP). This meeting considered many of the issues to be discussed by the Commission on Sustainable Development in its review of this topic. Some of the issues considered at that meeting are reflected in the present report. The full report of the meeting is before the Commission as a background document.

II. Changes since the United Nations Conference on Environment and Development

3. As the revolution in information technology has exploded into the "new knowledge economy", the importance of information has grown accordingly. The media often refer to a new information century. Although investments in information technology have sky-rocketed, there is often confusion about the value of information and knowledge. Unlike most goods, whose value depends on their relative scarcity, the real value of information for society grows the more it is shared and used. Restricting its distribution in an attempt to increase its value could be counterproductive from a societal point of view. As noted by the high-level panel of experts on information and communication technology, knowledge differs from other factors of production in that it expands when applied (see A/55/75-E/2000/55, para. 12). For instance, the more widely and freely information on soil erosion control is shared with local land users, the more erosion will be effectively controlled, with cumulative benefits for society. Information is a tool that makes other kinds of benefits and wealth generation possible. As stated by the panel the challenge of a knowledge-based economy is not a scarcity of knowledge but inadequacies in the means of diffusing and using it (see A/55/75-E/2000/55, para. 12). The issues of communication and access to information and of the content and use of information are different although interrelated. This distinction is important when it comes to considering information for decision-making and participation.

4. New information technologies are changing the ground rules for information flow in society. Previously, the holders of information decided how it should be distributed and to whom, and this control gave them power. Top-down systems of management and governance functioned on this basis. Information has traditionally been limited by the capabilities of the technologies available (printed word, telephone etc.) for its distribution. The mass media broadcasts information in an untargeted way for those who happen to be listening or watching, but this is still

limited in range and ephemeral in time. The Internet and computer-mediated information systems shift the balance of control from suppliers to consumers. Information holders simply make their information available on the Internet, and users can come searching for what interests them in a very flexible way. The pool of electronic information worldwide is growing exponentially, and information flow has become more horizontal. Anyone can become both a user and supplier. The potential being opened up by these new patterns of communication is revolutionary and still far from being appreciated adequately. For instance, such information systems empower users to make their own decisions, permitting more decentralized and locally adapted forms of management. One result is the rapid growth in non-governmental organizations and other new structures in civil society that expand the scope of public participation in decision-making.

5. Access to information is essential in the planning, design and monitoring of policies to support sustainable development at the regional, national and international levels. At the government level, a growing number of countries are carrying out national data inventories, organizing the collection and dissemination of data and developing information systems.

Box 1

Country initiatives

In Ghana, the objectives of the new environmental information network are to strengthen information-handling capacity in networking between participating institutions, and to improve on the delivery of information to the users of environmental information. Its activities include the creation of an information centre, where information is to be collected, databases established and information centres linked. Creating promotional print media on environmental issues and an electronic networking system in the environmental institutions has made information-gathering faster and enhanced capacity for data collection, storage, processing and dissemination. In Latin America, the Costa Rica Foundation for Sustainable Development has introduced small deployable information centres through a project entitled "Little intelligent communities". The centres comprise a high band-width satellite link, a space for telemedicine, an environmental monitoring capability, a computer lab and a walk-up information booth.

6. Another change is the continuing technical progress in environmental observing and monitoring systems. Satellite remote sensing with ever-more refined instruments and improved resolution and coverage, drifting buoys with autonomous instrument packages transmitting their measurements in real time, and more powerful computers allowing the increasing integration of data into complex models and decision-support systems, such as geographic information systems, are putting the world at our fingertips. The institutional capacity to coordinate all this is also growing through such initiatives as the Integrated Global Observing Strategy Partnership, global observing systems and global research programmes.

7. This rapid progress has increased concern for the widening gap, the so-called digital divide between the “haves” and “have nots” in the information revolution. The most obvious gap is due to the deficiencies in the coverage of technological and communications systems for transmitting information. Those parts of the world without the telecommunications infrastructure to connect into the new global systems, those parts of the population too poor to be able to afford the equipment necessary to connect to these systems, and those generations educated in the pre-computer era are being left behind despite efforts to reach out to them. However, the boundaries between the haves and the have-nots are shifting rapidly. Countries that have recognized the importance of being connected are giving priority to investments in the necessary infrastructure. Younger generations are adapting rapidly, taking naturally to technologies that still mystify their elders, while women in several countries are quickly closing the gender gap.

Box 2

Millennium Declaration and related actions

At the Millennium Summit, heads of State and Government resolved, inter alia, to ensure that the benefits of new technologies, especially information and communication technologies, in conformity with recommendations contained in the Ministerial Declaration adopted by the Economic and Social Council at the high-level segment of its substantive session of 2000, are available to all (see General Assembly resolution 55/2). In direct follow-up, the Secretary-General formed an advisory group of 21 experts from the private and public sectors to help bridge the digital divide by harnessing the potential of information and communications technologies for development.

8. The importance of closing the information gap is heightened by the potential of these new systems to give information access to and empower civil society groups and thus enhance their participation. They represent a potential breakthrough in the provision of public services, education and employment opportunities, particularly for women, young people and other groups. One can imagine new information-based occupations springing up through the combination of new technologies, microcredit and the educated unemployed. Developing this potential will require more robust and adapted technologies, improved information packaging and new marketing strategies. Specific policies are also needed to address the eradication of poverty in terms of the role that information and information technologies can play.

9. A second but continuing information gap since the United Nations Conference on Environment and Development (UNCED) concerns basic data about our environment and the pressures from human activities. Even in the industrialized countries, data are often too limited or too disparate to be usable. In developing countries, even the most basic statistics are often lacking. No assessment or decision-support system can deliver results better than the quality of the inputs. Even where new technologies are generating masses of data, the capacity to analyse and use it is often lagging behind.

10. Another change since UNCED has been the rapid shift in responsibilities and resources resulting from globalization, made possible by the ability to disperse economic activity geographically while linking it electronically.¹ Governments find themselves falling behind as the private sector and civil society organize and operate in new, more innovative ways. Major new issues concerning the control of the Internet and the privatization of information are being debated. The outcome of these debates for the use of information for decision-making will be significant.

11. It is within the context of these changes that specific information issues and proposed solutions need to be explored and developed during the Commission's discussion of these issues during its ninth session. The following sections review specific issues that have emerged or evolved since 1992.

III. Issues for discussion and policy recommendations

A. Bridging the data gap

12. Great differences exist between geographical regions and countries at different stages of development, as to the availability of relevant primary data (e.g., in the area of sustainable development), the quality, comparability and frequency of data compilation, and the quality of information systems. Even in the most developed regions, problems of non-uniform standards and methods for collecting data, dispersion of data among different agencies and the handling of information can make use of that information for management and regional comparisons difficult. The data gap exists even where data seem to be abundant, because so little of it is in forms that can be used for assessment and management purposes.

1. Development of indicators of sustainable development and their use

13. Significant progress has been made both internationally and nationally in the development of indicators as tools to support national decision-making processes. One example is the Commission's work programme on indicators of sustainable development, which represents the largest United Nations system-wide and country collaboration to date in the development of an indicator framework and methodology based on a consensus among the more than 30 participating agencies, other international organizations and Governments. To date, 22 countries have been involved in testing the indicators as the basis for an overall revision of the framework and methodologies in preparation for the Commission's ninth session.

14. Paragraph 40.7 of Agenda 21 calls for recommendations for a harmonized development of sustainable development indicators at the national, regional and global levels, and for incorporation of a suitable set of these indicators in common, regularly updated, and widely accessible reports and databases, for use at the international level, subject to national sovereignty considerations.

15. The goal of the Commission's work programme, which was approved by the Commission at its third session in 1995, is to make the indicators for sustainable development accessible to decision makers at the national level by defining them, elucidating their methodologies and providing training and other capacity-building activities, as relevant. Indicators, as used in national policies, may also be used in the national reports to the Commission and other intergovernmental bodies.

16. The outcome of the Commission's work programme on indicators of sustainable development is reviewed in an addendum to the present report (E/CN.17/2001/4/Add.1).² Two additional reports are being made available to the Commission as background documents, entitled: "Indicators of sustainable development: framework and methodologies" and "Initiatives for the aggregation of sustainable development indicators"; the present report and its addendum should be read in conjunction with these two background documents.

17. Other major initiatives include the work of the World Bank on genuine savings and measures of wealth indicators, the Organization for Economic Cooperation and Development/Development Assistance Committee/World Bank/United Nations programme on indicators for shaping the twenty-first century and the United Nations Development Programme (UNDP) work on the human development index, the United Nations Development Assistance Framework (UNDAF) common country assessment indicator framework, and the basic social services for all indicators, among others. These indicator efforts are providing important tools to support national decision-making processes.

2. Improved data collection and use

18. Major initiatives have been launched to improve environmental observations and data collection, ranging from ozone monitoring under the Montreal Protocol and implementation of the three global observing systems to non-governmental organizations monitoring forests and coral reefs. There have also been efforts to improve coordination and cost-effectiveness, such as through the integrated global observing strategy. However, these efforts are badly under-funded relative to the need for improved data in response to global data needs, such as the requirements of multilateral environmental agreements. Several other problems are also evident and need further attention.

Harmonization and rationalization

19. Growing recognition of the need for information-based decision-making is driving a steady increase in reporting requirements at all levels. As Governments struggle to meet their reporting obligations, for example, under international conventions, they recognize the need for harmonization and rationalization of reporting requirements. Efforts are under way in the Economic and Social Council and elsewhere to standardize development data and indicators in an attempt to address the growing number of data requirements of United Nations-system programme activities. The United Nations Statistics Division has undertaken a major study on the needs for harmonization and rationalization in the context of integrated and coordinated implementation and follow-up of major United Nations conferences and summits (E/1999/11). The report notes, inter alia, that among international organizations there is ample room for improvement in the coordination of data collection. Such coordination can promote efficient use of resources and contribute to easing the burden on countries' statistical programmes. It also documents many inconsistencies among data disseminated at the international level. At the same time, there is a lack of basic statistical data at the country level and an urgent need to build and enhance national statistical capacity. Improved coordination at the international level regarding data collection and standardization of concepts and methods with regard to indicators will go a long way towards addressing some of the inconsistencies. The UNEP Global Environment Monitoring System water

operations manual, used by many countries, is an example of how multinational standardization can assist in the development of monitoring programmes, although these protocols need further expansion and development to become truly effective tools.

Integration of information

20. Even where the data exist, there are often difficulties in obtaining and combining data from different ministries for an integrated view of sustainable development. There is first an institutional problem with data holders (ministries, companies in the private sector, scientists etc.) not wanting to share their data with other users for various reasons. This type of problem may be amenable to improvement through policy changes and institutional reform. Then there are technical problems in combining economic, social, and environmental data and indicators measured in different units that are not easily compared, as well as problems in combining data at different geographic scales (local, national, regional, global). Research on solutions to these problems has made some progress but needs further encouragement and support.

Box 3

Institutional initiatives

Countries are addressing institutional problems through a variety of means. Towards the end of 1994, Tunisia established a national observatory for environment and sustainable development with the purpose of collecting and providing public officials with continuous data and information regarding the environment, including through the use of such tools as indicators of sustainable development. Tunisia also established a national network on sustainable development that allows users and suppliers of relevant sustainable development information to communicate electronically. Belgium passed national legislation in May 1997 that established an interdepartmental commission on sustainable development that is charged with preparing a federal level sustainable development plan every four years. The Commission facilitates the exchange and coordination of sustainable development information among its members at various administrative levels, including regional and local levels.

21. While technological progress has driven improvements in remote sensing and information access over the Internet, the ability to analyse and assess data and to assemble information in a comprehensive integrated framework has lagged behind. There is an ongoing need to consider weaknesses in the whole data collection, analysis, assessment and reporting process and recommend necessary improvements to eliminate bottlenecks in the information system. Even in the most developed and data-rich regions, such as Europe, the regional integration and assessment of data has been hampered by inconsistent methodologies and inadequate harmonization.

Innovative data collection

22. While scientific research has been the customary supplier of sustainable development information, its coverage is too thin and the scientific infrastructure too weak in many countries to meet the essential needs for environmental management. There have been some successes in bottom-up approaches to data collection, using school children, non-governmental organizations, major groups and amateur volunteers, that can help to fill in data gaps. This may be a partial solution to the particular problems of data collection in developing countries but cannot substitute for efforts to strengthen the scientific research capability to produce better data.

23. Progress can be reported in the production of more integrated and forward-looking assessments of environment and sustainable development, including the *Critical Trends* report prepared for the five-year review of UNCED in 1997, the UNEP *Global Environment Outlook* reports and the UNEP/World Resources Institute/United Nations/World Bank *World Resources Reports*, which provide data for 157 countries on environmental resources, consumption and waste, as well as new information on poverty and food security. However, these reports suffer from the lack of adequate core data sets at the international level for many topics, limiting the conclusions that can be drawn from the available information.

Problems in methods of data assessment and analysis

24. This shift in demand from sustainable development data to more explicit and policy-oriented assessments is exemplified in the development of UNEP's global environment outlook network and reports. As noted, the shift towards assessments does not remove problems with the underlying data. In fact, the work on global assessments has revealed weaknesses in the data foundation, particularly when it comes to monitoring progress over time.

25. One continuing problem is that many of the data sets are needed by not one but many different organizations. Consequently, responsibilities for this largely common basis of data are often unclear. Other problems include the fact that primary data collection is costly and time-consuming to organize or modify and the pathway from the source to the user is often long, with the effect that by the time data are used in global or regional assessments, national experts view them as obsolete.

26. Data work for global environment outlook assessments, for example, has been a reminder that up to three quarters of the data required are non-environmental data. In addition, a straight compilation of country data for 150 key variables from the customary international sources proved to be unusable because of inconsistencies, errors and incompatibility between global sets and nationally acknowledged data. Finally, as impacts on specific groups and ecosystems are getting more attention, requiring analysis at various scales, spatially defined information is becoming more in demand.

3. Strengthening the capacity for traditional information

27. Chapter 40 of Agenda 21 addresses the need to consider traditional knowledge — knowledge that reflects the long practical experience of indigenous and local cultures in the conservation and sustainable use of resources. The knowledge and wisdom of indigenous and local communities is critical to the

conservation and management of much of the world's biological diversity and natural resources and can add value to contemporary, scientific ways of thinking. Current understandings may be incomplete if traditional knowledge is not taken into account.³ Documenting and preserving the use of traditional knowledge at the community level and using this knowledge to address resource management issues are particularly important undertakings in the implementation of both the United Nations Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, particularly in Africa, and the Convention on Biological Diversity, as well as Agenda 21 itself.

28. The Conference of the Parties to the Convention on Biological Diversity have taken a number of decisions and adopted a programme of work which, inter alia, examines the application and development of legal and other appropriate forms of protection for the knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles. A major step forward in the process of increasing indigenous and local community participation in the work of the Convention is the establishment of the Ad Hoc Open-ended Inter-sessional Working Group on the Implementation of Article 8 (j) and Related Provisions. The Conference of the Parties to the Convention has requested the Working Group to develop guidelines for the increased participation of indigenous and local communities in the work of the Convention.

29. The secretariat of the Convention to Combat Desertification has compiled regional and subregional reports on the most important and widely applied examples of traditional knowledge. An ad hoc panel of experts was appointed by the Conference of the Parties to the Convention to identify successful experiences in traditional knowledge, to review specific case histories for integrating traditional and local knowledge into modern knowledge, and to propose mechanisms for promoting and exchanging successful approaches. The report of the panel was presented to the Conference of the Parties to the Convention at its third session, in November 1999 (see ICCD/COP(3)/CST/3 and CST/3/Add.2). Given the importance placed on traditional knowledge by the Conference of the Parties to the Convention, the ad hoc panel was reappointed and requested to develop further appropriate criteria in line with future work on benchmarks and indicators, to be used by national focal points.

B. Improving the availability of and access to information

1. Making information useful for decision-making

30. New avenues are opening for preparing and presenting information in formats more easily understood by decision makers and the general public. Multimedia technologies, software packages, and such tools as indicators and animated graphical presentations can assist decision makers in their sustainable development efforts. The development and use of geographic information systems (GIS) and map-based information tools have expanded rapidly in recent years. They provide helpful planning tools allowing for visual assessment of impacts and of resources available to address problems and environmental emergencies. One example of the expansion of such information tools for practical applications are the products of the Global Resource Information Database, part of UNEP's environmental information network. Another example is the International Centre for Tropical Agriculture/World

Bank/UNEP *Spatial Planning Atlas* available on CD-ROM for the Latin American and Caribbean region. The Food and Agriculture Organization of the United Nations (FAO) Advanced Real Time Environmental Monitoring Information System, supports the operational monitoring of seasonal growing conditions and vegetation development worldwide.

2. Public access

31. A major new issue since UNCED is the need to facilitate public access to environmental information, as exemplified by the adoption in 1998 of the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters. The Convention aims to provide public and non-governmental organizations in Economic Commission for Europe countries with common tools and standards to monitor performance and engage in environmental decisions on issues ranging from nuclear power to infrastructure development. The Convention has three main components. The first sets rules and requirements for Governments to disclose environmental and other information to the public. The second addresses how public and private interest groups can participate in environmental decision-making. The third deals with the right of public and private interest groups to seek judicial remedy for non-compliance by Governments and corporations.⁴ A key question is whether conventions of this nature are or should be made applicable in other national or regional settings.

32. Recent experience has shown that public awareness of the environment, access to local environmental data and participation in the debate on environmental quality are critical to environmental improvement. The UNEP Global Environmental Information Exchange Network (INFOTERRA), with national focal points in most countries, is being reformed to ensure better public access to environmental information and to advocate the public right to know principle.

3. Reaching the excluded

33. Special efforts are needed to make electronic sustainable development information as widely available as possible and in all segments of society, since decision-making on sustainable development takes place at all levels, from intergovernmental meetings to individual resource users in rural areas.

34. High priority needs to be given to broad-based, grass-roots approaches aimed at involving civil society, particularly women, youth and older persons as a means to secure their input into sustainable development issues. Working with women, youth and other civil society groups active in sustainable development to facilitate investments in innovative information and communications technologies represents an important opportunity for the further empowerment of these non-governmental actors. The ability to communicate their perspectives and concerns is a central empowerment issue, both for publication of their views and for access to information and education that will promote consciousness-raising for women and others. The decentralized, interactive and non-hierarchical nature of new information technologies provides a unique space for women and youth to develop their views, opinions and benefit from the synergy of interactive communications with their counterparts nationally and internationally. In addition, once the initial costs of access and technology are covered, the Internet and other information technologies present a low-cost and relatively simple mode of publishing

newsletters, articles, statements etc. Special attention should be given to involving women and youth in training and support, in partnership with technology providers.

Box 4

Learning networks for African teachers

The United Nations Educational, Scientific and Cultural Organization, through its project on harnessing information technology for development in Africa, is working to improve basic education in Africa through the development of a network connecting African teacher training colleges and educational authorities to the Internet. The programme seeks to upgrade the capacity of teacher trainers, develop educational resources in college libraries and initiate pilot experiences on technology based learning in the surrounding schools.

35. Another dimension of this topic is language. Language continues to be a barrier to the wider dissemination of information and its greater accessibility. The best data-transmission mechanisms will not serve their purposes if the vast majority of information and knowledge circulating in the world is in only a limited number of languages, with English being the most predominant. Even in the context of international governance, multilingualism is often perceived as an additional burden that slows down global negotiations and leads to additional costs for translation and interpretation. In this regard, the Ministerial Declaration on the Role of Information Technology noted that the development of local content on the Internet and the ability of people to freely access it will help to foster a culturally and linguistically diverse cyberspace and encourage broad and sustainable use of the Internet.⁵

4. Training the users

36. As scientific information on the environment and sustainable development has become more widely accessible, it has become apparent that additional efforts are needed to integrate and use available information in decision-making processes, at all levels, in a timely and appropriate fashion. Data may need to be analysed, interpreted and presented in understandable ways, but the capacity to do this has not kept up with space technologies and other means of generating new data. Fortunately, new techniques for generating maps, graphics, animated presentations and other formats can facilitate the communication of information on complex issues. However, even when it is delivered, many decision makers are unaccustomed to using scientific information, emphasizing the need for special training activities on the use of information for decision-making.

5. Making use of commercial information sources and business involvement

37. Chapter 40 of Agenda 21 refers particularly to commercial information sources and information available in the private sector, and this area has seen significant developments since 1992. As more companies around the world adopt standards and systems for environmental management — such as ISO 14001 — and social and accountability standards — such as AA 1000 and SA 8000 — more reliable and comparable environmental, social and economic performance information is being

generated and is often voluntarily published as part of corporate environment and/or sustainability reports. A growing community of users of this information is emerging, including ethical investment firms, benchmarking and rating organizations, NGOs, and environmental and social reporting award schemes launched in a number of countries.

Box 5

Government/private-sector initiatives

The microlevel information generated by companies needs to be linked to macrolevel policy concerns and targets set by Governments. This is beginning to happen, as demonstrated in recent initiatives, including: (a) the work of the Division for Sustainable Development of the United Nations Secretariat and an expert working group on improving the role of Governments in the promotion of environmental management accounting; (b) the UNEP global reporting initiative to establish a common framework for enterprise-level reporting on the linked aspects of environmental, economic and social sustainability; (c) the United Nations Conference on Trade and Development Intergovernmental Working Group of Experts on International Standards of Accounting and Reporting; and (d) the “Engaging stakeholders programme” of UNEP, in cooperation with SustainAbility Ltd. These initiatives provide an opportunity for Governments to work closely with the private sector to ensure that the sustainability performance information generated by the private sector is utilized for useful planning and monitoring tools.

38. Due to changing budget priorities, changes in perceptions about the role of government and rapid advances in information technology, there is a growing trend towards the commercialization of information previously held in the public domain and/or the migration of such information from the public domain to commercial systems whose costs may make information unaffordable for many users. For example:

(a) In response to growing commercialization of meteorological information, in 1999 the World Meteorological Organization adopted a resolution distinguishing between “basic” and “special” (commercial) information. Basic information is defined here as information that should remain in the public domain, while special information can be commercialized;

(b) The European Union (EU) recently passed legislation on intellectual property rights that permits the commercialization or transfer to limited access of information that was until recently held in the public domain;

(c) The United States Congress is discussing incentives for commercialization of information. It is expected that such incentives may put all satellite information in the private sector;

(d) Also in the United States, policy changes have already resulted in the commercialization of information and data previously held by federal or national agencies. For instance, the former Office of Technical Assessment, which served the

United States Congress, has been eliminated and is now functioning as a consulting company;

(e) The former research and information arm of the Federal Environmental Agency in Austria has been privatized and is shifting to a commercial mode of operation.

39. This trend has two immediate impacts: (a) it affects access to information by the public in the countries where these trends occur, and (b) it limits access of other countries and the global community to information relevant to sustainable development or the livelihoods of groups in other countries or for the global good. Policy guidance is needed to distinguish between information uses that can effectively be commercialized and those that should be freely available in the public interest.

6. Financial support for information infrastructure and critical data-collection efforts

40. At the same time that new possibilities are being opened up by new technologies, there is a decline in essential observations due to reductions in government support and spending. There is also a need to shift from data collection in research programmes to operational systematic observing programmes and institutions able to provide both the long-term time series needed to monitor and assess global change, and information delivered rapidly for immediate use in decision-making. The particular problems of data collection in developing countries, which cannot afford the considerable costs when faced with other urgent priorities, may require innovative solutions, such as international support for the incremental costs of collecting data primarily for international assessments. The Commission should aim to enhance awareness in Governments of the need to increase financial support for critical data-collection efforts, both nationally and internationally. It is particularly important that the needs of policy makers for information and data are clearly understood by them and linked with the data-collection efforts of statistical offices so that the resources invested in information and data programmes clearly support policy objectives.

41. Adequate funding is also needed to support gender-sensitive research and information on decision-making on sustainable development. Efforts need to be made to provide funding for creative partnerships between government, women's groups and universities active on gender and sustainable development for comprehensive strategies for research development and dissemination. Additional gender-sensitive research at the international level needs to be enhanced. For example, comprehensive international analysis of policies for women's access to information about land and efforts to reform land legislation would be particularly useful, including innovative methods of improving information and understanding of related legal texts and provisions.

C. New information technologies

42. New information technologies are opening up exciting possibilities for innovative integrated environmental information systems using data globally from a variety of sensors and systems, transmitting it rapidly to assessment centres and generating targeted information products for delivery to decision makers, much as

the world weather forecasting system works today. However, the new flood of information from remote-sensing and other instruments is not being matched by a similar investment in the on-site collection of corroborating data and in the capacity to assess and add value to that information. Despite all the wonders of automation and artificial intelligence, there is still an important role for well trained minds and mature experience, requiring an investment in people as well as technologies as an integral part of an effective information system.

1. Space-based and remote sensing technologies

43. Earth observation from space is one of the most cost-effective means for understanding the Earth and its various scientific uncertainties. Such observations can provide the long-term consistent measurements of key physical variables needed to study the shifts in the state and variability of Earth's eco-system as a basis for rational action at the local level. Satellite remote sensing provides vital information on environmental impacts, natural resources and inputs for integrated development plans for both rural and urban settings. Satellites can provide communication connectivity to remote villages, including meteorological information and education services for poor communities. The advent of more than 230 instruments in over 70 satellite missions in the next 10 to 15 years, with sensors providing a wide variety of data, provides an opportunity for scientists to understand the complex interactions between various components of the non-linear, coupled Earth system.

44. The Integrated Global Observing Strategy links space-based observations with ground-based observations. Enabling technologies, such as GIS, satellite positioning systems, photogrammetry, artificial intelligence and neural networks, are enriching the satellite-based information systems to provide services to user communities. The FAO Global Information and Early Warning System uses integrated socio-economic and statistical data in combination with remote-sensing and other environmental information to monitor the food situation at regional, national and international levels, to alert the international community to impending food shortages. The seamless integration of satellite-based services on the World Wide Web, along with other conventional services, can provide information to users in a format and style more understandable to them.

45. In addition, applications of satellite communications technology for sustainable development use its ability to connect rural and remote locations, reaching areas impossible or expensive to connect with wire networks. Satellite communications can be used to provide much of the information needed in remote areas, such as:

(a) Health care (tele-medicine): satellite communications could help to expand access to health-care professionals throughout the developing world, and have been used in emergency situations;

(b) Distance education (tele-education) applications, such as two-way interactive video conferencing, including over the Internet, allow educational centres and research professionals to access data and information on a wide range of subjects;

(c) Warnings of bad weather and natural disasters to remote areas and ships: satellite telecommunications offer increased reliability compared to the standard terrestrial maritime communications facilities that were used in the past;

(d) Disaster response: after a natural disaster, satellite communications can be used to coordinate response efforts and can provide on-the-ground reports to decision makers, complementing information from remote-sensing satellites and other sources.

46. However, with all of these technologies there is an urgent need for appropriate human resource development and for scientists from different disciplines to work together to understand and implement the scientific solutions needed to ensure sustainable development.

2. Electronic networking

47. Electronic connectivity is increasing rapidly in all regions of the world. In the United States, it is estimated that the number of households connected to the Internet increased from 14.9 million in 1995 to 46.5 million at the beginning of 2000, and this number will more than double in the next five years. Taking business access into account, it is anticipated that there will be 171 million Internet users in the United States by 2004.⁶ Significantly, it is projected that at least half of these users will be women. In Western Europe, Internet subscribers increased by 75 per cent in 1999 to 34.5 million, while Internet users increased 69 per cent to 64.3 million people.⁷ Asia and Pacific Internet use has grown rapidly and is expected to reach 130 million by 2005. Much of this new growth will be fuelled by China, whose annual rate of Internet growth over the next five years is expected to reach 60 per cent or some 33 million users.⁸ In Latin America, the number of Internet users is expected to triple over the next three years, increasing from 8.5 million today to 24.3 million by 2003.⁹ In Africa, the Internet has grown rapidly in the last few years. At the end of 1996, only 11 African countries had Internet access; by September 2000, all countries except one had achieved permanent connectivity. Despite the rapid growth in the Internet, access in Africa has been confined largely to the capital cities, although 16 countries have Internet access in some of the secondary towns. It is difficult to calculate the actual number of Internet users in Africa, but there are more than 1 million dial-up subscriber accounts, with about 200,000 in North Africa, 650,000 in South Africa and about 150,000 in the remaining 50 African countries. According to Economic Commission for Africa (ECA) estimates, each subscription carries, on average, about 3 users, putting total users at about three million, with about 1 million outside South Africa. This works out to about 1 Internet user per 250 people, compared to a world average of one user per 35 people. The ratio in other regions is: North America and Europe, 1 in 3; Latin America and the Caribbean, 1 in 125; South East Asia and the Pacific, 1 in 200; East Asia, 1 in 250; Arab States, 1 in 500 and South Asia, 1 in 2,500.¹⁰

48. Due to these rapid technological improvements in computing and telecommunications and the number of Internet users, electronic access to data has significantly improved, with such tools as web-based meta-databases and Government and organization home pages providing direct links to data sources. Problems of non-uniform standards and methods for handling information are being overcome, although new problems of intellectual property rights to data and information are arising. One example of improved electronic networking is the United Nations system-wide web site on national implementation of the UNCED commitments. This site provides links to both international sites and government-hosted sites containing country information on sustainable development. In this context, the United Nations Statistics Division launched a meta-database of United

Nations system development data accessible on the Internet. UNEP is also planning an environmental information meta-system. In a strategic partnership with the Global Environment Facility, UNEP is initiating the Sustainable Technologies Alternatives Network, which will seek to improve knowledge management and information-sharing for environmentally sound decision-making and implementation of multilateral environmental agreements.

IV. Conclusions

49. Chapter 40 of Agenda 21 lays the foundation for transition to the new knowledge-based economy of the twenty-first century. This new knowledge economy has the potential to enhance individual skills, facilitate greater resource efficiency and promote technological advances to help reduce the gap between developed and developing countries and between rich and poor. The new knowledge economy presents us with both an opportunity and a challenge. We can take advantage of this opportunity only if we increase our investment in human beings, recognize the value of diverse views and appreciate the power of stakeholder participation. We can meet the challenge by building information infrastructures, adopting conducive policy and regulatory frameworks, fostering a positive business climate with improved services and financing, and generally supporting measures to ensure that people everywhere can benefit from the information revolution. Greater access to information and wider public participation in the use of information can be a force that unites rather than divides us.

50. As we look ahead, we have two main challenges: one is to create a more level playing field for decision makers around the globe; the second is to understand the full potential of new technologies.

51. With respect to the first challenge, greater attention must be given to strengthening decision-making in all countries by improving data collection, standardization, access and participation by civil society groups, including women and youth. Countries must be assisted with both technical and financial resources, as required, for this purpose. We have a responsibility to ensure that information technologies are used to narrow the gap between developed and developing countries and between those currently included in the new knowledge economy and those not yet taking part.

52. The second challenge is learning how to structure information for new uses and new users that have — and will have — access to information through new communications technologies. Our minds are still too conditioned by the printed page and the linear timeline of a film or tape to appreciate what the new freedom of flexible access makes possible. This is a challenge to all information providers, including Governments, the United Nations system, the private sector, NGOs and individuals. We need to assemble useful information on sustainable development in more comprehensive integrated frameworks that allow multiple points of access and that respond to the needs of many users. These evolving information systems will need to balance and combine the entrepreneurial possibilities to sell information and to finance the information systems themselves with the collective benefits from wide and free access to information. The underlying imperative is to guide policy-making in more sustainable directions.

V. Recommendations

53. Recommendations on the three key issues covered in the present report are set out below.

A. Bridging the data gap

54. The Commission may wish to:

(a) Recognize the important role that testing countries have played and the contribution they have made in finalizing a core set of indicators of sustainable development organized by themes and sub-themes under the Commission's work programme on indicators of sustainable development;

(b) Endorse the core set of indicators thus developed as a valuable starting point for countries that may wish to organize and elaborate their own national programmes for the testing, development and use of national level indicators of sustainable development;

(c) Continue its work programme on indicators of sustainable development, giving particular attention in the next phase to assisting developing countries and countries with economies in transition that may wish to develop a national indicators programme with technical information, advice and capacity-building support, and advance further work on modalities for the linkage and aggregation of indicators, building on and cooperating with existing research and development efforts;

(d) Encourage countries to make better use of indicators, indices and other statistical measures appropriate to specific national conditions and priorities, and to more closely monitor and report on progress being made at the national, regional and local levels towards defining and achieving national goals for sustainable development.

55. The Commission may wish to urge that:

(a) Public participation be promoted and facilitated as an important tool for improving the quality of data and in sustaining the political will needed to support a strong information infrastructure;

(b) A directory of meta-data repositories be established at various administrative levels containing easily available data compiled in ways that are usable by policy makers;

(c) The role of the private sector, NGOs and other major groups, particularly women and youth, in data analysis and reporting, be taken more fully into account in national information systems.

56. The Commission may wish to call on Governments and/or international organizations to:

(a) Work together, at the national and international level, to address technical differences in methods, reporting periods, data collection and aggregation, and in this regard, stress the importance of using common methodologies for data and indicators of sustainable development (e.g., standardized methodology sheets);

(b) Mainstream sustainable development data and information procedures and services by institutionalizing and strengthening integrated geo-spatial information systems for collecting, analysing and value-added processing of information for policy makers and other user groups;

(c) Make greater use of spatial information systems to combine and integrate economic, social and environmental information. Use of data at different geographical scales would be improved by geo-coding of such data;

(d) Develop strategic partnerships with non-governmental organizations, particularly women's and youth groups, as well as the private sector, to stimulate innovative data-generation and data-collection methods;

(e) Provide support and or funding to indigenous and local communities, as appropriate, to assist them in managing their traditional knowledge and resources more effectively.

57. The Commission may wish to request international organizations to:

(a) Streamline international data collection by building on existing efforts in harmonization of indicators, methodologies and data standards and recognizing the important role that the Statistical Commission can play in this regard;

(b) Develop a common framework for identifying those core data sets and information that are critical for the implementation of sustainable development and related multilateral agreements.

B. Improving the availability of and access to information

58. The Commission may wish to call upon Governments to:

(a) Make a high-level commitment to the need to establish national integrated information systems for decision-making for sustainable development and clearly identify the national units or agencies that have lead responsibility for coordinating and/or compiling data;

(b) Ensure that the needs of policy makers for information and data are clearly articulated by them and linked with the data-collection efforts of statistical offices so that the resources invested in information and data programmes clearly support policy objectives;

(c) Develop multimedia and, as appropriate, multilingual communication strategies to promote wider public access to information. Such strategies should encompass all types of communication tools, from traditional and non-formal to advanced modern technologies, and should operate at all levels from local to global;

(d) Facilitate public access to sources of relevant sustainable development data and information by supporting the development of appropriate institutional and regulatory frameworks for data gathering, sharing, diffusion and use of information, including the review of existing rules, modalities and protocols, with the aim of making information more accessible to all citizens;

(e) Encourage the development and establishment of a minimum set of common benchmarks for disclosure policies and/or practices by public agencies;

(f) Ensure that public access to information is maintained by discouraging and/or regulating, as appropriate, the migration of public or publicly held information into limited access commercial information systems;

(g) Identify innovative approaches, including making more efficient use of existing infrastructure, to provide local solutions for mobilizing financial resources for effective implementation of information objectives for sustainable development.

59. The Commission may wish to call upon Governments and/or international organizations to:

(a) Develop needed infrastructure and implementing capacity-building programmes that reach out to segments of society that are currently excluded from the information revolution, giving particular attention to women, youth, older persons and the poor as a means to ensure wider participation in the rapidly expanding information-based knowledge economy. In this context, the Ministerial Declaration adopted by the Economic and Social Council at the high-level segment of its substantive session of 2000 recommended the establishment of community information centres to ensure access to lower income and other currently excluded groups;¹¹

(b) Encourage the wider use of multilingual information sources through, inter alia, terminology work in all languages to facilitate better understanding of sustainable development concepts and issues, including a thesaurus or glossary programme in United Nations languages that defines the terms used in the context of various international negotiations and multilateral agreements on sustainable development;

(c) Promote strategic partnerships between Government agencies, civil society groups, multilateral organizations and the private sector to mobilize political and financial support for national information infrastructures within which sustainable development information systems can be developed and improved through wide participation.

60. The Commission may wish to urge bilateral and multilateral donors to: ensure that development assistance includes building information capacity for sustainable development at the national level.

C. New information technologies

61. The Commission may wish to call on international organizations to:

(a) Cooperate to (i) provide cost-effective access to space technology inputs for sustainable development, and (ii) help with capacity-building in developing countries to interpret, analyse and integrate satellite-based information into operational applications;

(b) Promote the networking of decentralized data repositories applicable to, inter alia, distance education, tele-medicine, natural resource accounting and weather and climate forecasting, agricultural development, environmental and natural resource management, poverty alleviation and sustainable development planning.

62. The Commission may wish to request Governments, international organizations, civil society groups and business groups to:

(a) Establish strategic partnerships for the formulation and implementation of forward-looking strategies for the development and networking of Internet-based information systems, including the provision of advice, technical and other forms of assistance in such undertakings;

(b) Support initiatives to introduce, develop and implement multilingual and multi-dialect capabilities and local content in Internet-based systems so as to ensure the widest dissemination of information, in particular to those groups currently excluded.

Notes

¹ Michael Hart, "The social dimension of freer trade and globalization", *World Economic Affairs* (summer 1996).

² A set of indicators for sustainable consumption and production have also been developed in accordance with decision 7/2 of the Commission; a background document providing a status report on this work is before the Commission.

³ See "Recommendation on the integration of two ways of knowing: traditional indigenous knowledge and scientific knowledge", paper presented at a seminar on the documentation and application of indigenous knowledge, Inuvik, Northwest Territories, Canada, 15-17 November 1996.

⁴ See Elena Petkova and Peter Veit, "Environmental accountability beyond the nation-state: the implications of the Aarhus convention", *Environmental Governance Notes* (World Resources Institute, April 2000).

⁵ See *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 3 (A/55/3)*, chap. III, para. 17, "para. 10".

⁶ See Strategis Group, *Cyber Atlas: The Web Marketer's Guide to Online Facts* (February 2000).

⁷ See *Cyber Atlas: Hardware — More ISPs for Western Europe* (2000).

⁸ Estimates of the Strategis Group, June 1999.

⁹ See *Chicago Tribune*, "Dot-Coms Flourish in Latin America", November 2000.

¹⁰ See Mike Jansen, "African Internet status, ICT developments, policies and strategy: African Internet", accessed at sn.apc.org in September 2000.

¹¹ See *Official Records of the General Assembly, Fifty-fifth Session, Supplement No. 3 (A/55/3)*, chap. III, para. 17, "para. 8".