Part III — Plenary Sessions

Tuesday, 9 December 2003, 2.00 p.m. to 6.00 p.m.
Moderator: Frank Rose

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15 Response from the Scientific Community to the UN Challenge

Opening Address by Dr Koïchiro Matsuura, Director-General of UNESCO

« It is a great pleasure and an honour for me to be here with you today on the occasion of this conference on the Role of Science in the Information Society. Allow me to express my appreciation to CERN and its Management for this opportunity to share some reflections with you.

Over the months that have passed since preparations began for the World Summit on the Information Society, UNESCO has addressed itself to the very concepts underpinning the organization of the summit. On a number of occasions, I have drawn attention to the qualitative difference between 'information' and 'knowledge' as well as to the inherent plurality of policy options, cultural context and routes of development associated with the nexus between science, technology and society. Just recently, during the 32nd Session of the General Conference of UNESCO, a Round Table of Ministers was held on this very subject. There was wide recognition that modern science and technology and their applications are powerful and pervasive in their impact, but there was also an acknowledgement that the claims of human creativity, cultural diversity and political choice point us towards plurality not uniformity. The idea of a single, all-embracing information society towards which all nations are moving without deviation was found by the participants at the Ministerial Round Table to be neither an accurate description nor a desirable prescription.

UNESCO's current overall strategic priority is aimed at contributing to the humanization of the globalization process. I know that this lofty terminology can sometimes seem far removed from the lived realities of people in their homes and communities, but it does represent an important orientation. The debate over knowledge societies needs to be attuned to this overall concern, which insists that the building of inclusive, participatory and just societies must be done through processes that respect human dignity, plurality and solidarity as well as human rights and fundamental freedoms.

Let me stress that the building of knowledge societies must be inclusive. This means inclusive of all persons without distinction so that everybody is empowered to create, receive, share and utilize the information and knowledge freely for his or her benefit — whether this be for reasons of economic betterment, social recreation, cultural expression and enjoyment, or civic participation. Within this concept, information and communication technologies (ICTs) are to be seen as tools dedicated to human development, not as an end in themselves.

The growth of knowledge societies depends on the production of new knowledge, its transmission through education and training, and its dissemination through ICTs. Scientific research and discovery, and associated technological applications, are the driving forces behind the creation of knowledge societies but we must remember that science is itself a social construct. How science impacts on society is shaped by society, for example, through national policies on science and technology and through social and institutional mechanisms for organizing research and understanding its implications.

Roger Cashmore of CERN has said that "Without science, there would be no information society." How true. But the role that science plays in the making of knowledge societies does appear to be one of the best kept secrets of our time. How many people even know that Tim Berners-Lee is the inventor of the World-Wide Web? Or that CERN's decision to make the Web foundations and protocols available on a royalty-free basis was crucial to the Web's very existence? As Berners-Lee put it, “Without this commitment, the enormous individual and corporate investment in Web technology simply would never have happened and we wouldn’t have the Web today.”

While science has made knowledge societies possible, science itself is being changed in the process. As scientific knowledge advances, this has an effect on the very way in which science is conducted. For example, synergy among the disciplines of science has been accelerated by ICTs. This is evident as a dramatic increase in cross-disciplinary invention, research and collaboration at a distance, as well as in the more rapid dissemination of information. The knowledge base of this growth is cumulative and increasingly inter-disciplinary. We are still far from restoring the unity of the sciences but the fact that new technologies are facilitating greater dialogue between disciplines is to be welcomed.

This inter-disciplinary communication should not be construed narrowly. Scientific disciplines should increase their contacts not only with one another but also with other modes and traditions of enquiry, especially in terms of the ethical, social and environmental implications of scientific and technological developments. The ethical dimension, by the way, corresponds to the principal priority of UNESCO’s Social and Human Sciences sector and is central to the work of COMEST, the World Commission on the Ethics of Scientific Knowledge and Technology.

Scientific advance and technical innovation are closely associated with the emergence of new capabilities, which is not new. From the very beginning of the age of scientific discoveries, people have devised tools for improving health, raising productivity, and facilitating learning and communication. What is new is the pace of change, the range of its impact and the unprecedented character of some of the challenges and opportunities being generated. Today, science is marked by digital, genetic and molecular breakthroughs that are pushing far beyond yesterday’s frontiers of knowledge. These breakthroughs are creating new possibilities for improving health and nutrition, expanding knowledge, eradicating poverty, and stimulating economic growth.

However, we are at a critical juncture. At a time when the current phase of the scientific–technological revolution shows no signs of slowing down, can we continue to ignore the fact that one in five of the world’s people live on less than one dollar per day and one in seven suffer from chronic hunger? The international community responded to the pressing need to address this state of affairs at the 2000 United Nations Millennium Summit by agreeing on a set of key development goals with time-bound targets — for reducing poverty, raising levels of education, improving standards of health, enhancing empowerment, and reversing the loss of environmental resources.

Harnessing science and the power of ICTs can, both directly and indirectly, contribute substantially to realizing every one of the Millennium Development Goals. It can create new economic opportunities that lift individuals, communities, and nations out of poverty. Furthermore, it can ensure greater availability of health and reproductive information, facilitate the training of medical personnel and teachers, and help to empower women with the same rights and opportunities as men.

The task before us is to transform these possibilities into realities, on the clear understanding that the unequal distribution and utilization of knowledge are barriers to peaceful, sustainable development. In the words of the 1998 World Development Report: “Knowledge is like light. Weightless and intangible, it can easily travel the world, enlightening the lives of people everywhere. Yet millions of people still live in the darkness of poverty unnecessarily.” Not only do the poor countries and poor people have less capital and income at their disposal than their rich neighbours, but their access to knowledge is also more limited. Knowledge for development is crucial for the future prospects of developing countries so that they may apply the growing stock of global 'electronic knowledge' to their own advantage and solve their own problems in their own way.

In conclusion, I can assure you that UNESCO will pay great attention to the outcome of this conference. I wish you all a successful meeting. »

16 The Essence of the Web

Dr Tim Berners-Lee, Web inventor and Director of the World-Wide Web Consortium[1]

« Hello, it is good to be back. I am going to start with some of the original talk about the invention of the WWW and its genesis here at CERN and, in response to popular demand, I shall then say a bit about the Semantic Web.

So, first, what is the Web? It is fundamentally a decentralized thing and when we really use it practically it becomes a fractal thing. It used to be difficult to explain what the Web would be like. Now it is difficult to explain why it was difficult because that it is so obvious to everybody.

CERN was an exciting place to be for the computer scientist in the 1980s, with many information systems on different computers and on different networks, all incompatible. So the idea was to devise a means of being able to communicate and share information.

Now, there are different models of communication. One of the commonest models of communication is that I send you a lot of messages and then, once you have digested them and perhaps understood them, you send me a lot of messages back. But there is another way of looking at it: we decide to build something together and we draw up a document that has common terms that we understand. The idea of the Web was to be able to do that across the Internet. And because we are using computers, we hope that not only will we have the finished product but we will also be able to track how we got there. I termed this process 'interactivity' at the time but now I term it 'inter-creativity'. The challenge at CERN at that time, then, was to develop an 'inter-creative' system so that all the data about how things work available on computers or networks could be accessed by any computer in a compatible format.

So there was a lot of heterogeneity. Now, heterogeneity is a Good Thing. Diversity is a Good Thing. It is good to have a variety of types of computer and operating systems in a large organization like CERN where there are many visitors from a large number of different home institutes: you don't want to tell everybody to buy the same computer system or use the same mail-reading software.

In a way CERN in the 1980s was interesting as a microcosm of the world. It was also a good substrate for the growth of the Web. Almost everybody had some sort of workstation on his office desk, which was unusual at the time. Also, those workstations were networked. So CERN staff were potential Web users.

1. http://www.w3.org/2003/Talks/1209-rsis-tbl/
http://www.w3.org/2003/Talks/1113-sw-tbl/

The Web design involved taking the idea of Hypertext and the Internet, which had already existed for some 20 years beforehand, and all the information systems out there and then generalizing to make an abstract information system that would be sufficiently general and sufficiently flexible to allow all the systems to be part of it. I wanted every system out there to be a part of the World-Wide Web.

In asking something that big of everybody, I knew that I could not tell them all to write a standard generalized markup language (SGML) or tell them all to store it on some mainframe or on a Mac or a PC. I had to let people store their information however they liked. So flexibility and minimal constraint became a design constraint for the Web architecture and that is still the case. The Web constrains as little as possible so as not to constrain how you think, how you organize your data and what software to use, so as to allow you to invent new applications within the Web whenever you feel like it.

Here are a few Web milestones. I wrote a memo in 1989 suggesting the idea, which didn't get very far. But you have to remember that CERN is primarily a physics laboratory and not a software tools organization and so, quite properly, the initial response to the Web idea was: "If it is a good idea, you should be able to buy it shrink-wrapped off the shelf. If it is not available off the shelf, it can't be a good idea." But in 1990 my boss at the time, Mike Sendall, suggested I play around with a new type of computer, the NeXT computer, and test it out with Hypertext.

So I started programming in the autumn of 1990 and the first World-Wide Web program was released on 25 December. I then hawked the program around the high-energy physics community at CERN and put it out on the Internet for general use the following summer. At that stage the program ran only on the NeXT computer which was not very compatible with other systems. But in 1992 Pei Wei and a group of students in Finland produced two browsers that ran on Windows. Instructions about how to install Viola if you wanted to browse the Web on a Unix machine were then published in the *CERN Computing Newsletter*. In 1993 the National Center for Supercomputer Applications (NCSA) brought out the Mosaic browser developed by a team under Mark Andreessen and his support contributed to the Web's dramatic growth.

It was in about 1993–94 that people started to say: "Look, the Web is obviously going to take off. We are completely reorganizing our company around the Internet and the Web. We want to know where the standards will be defined. We need a group to meet with other people who think that this is important. Why don't you form a consortium?" So we formed the World-Wide Web Consortium in 1994. Initially it was organized between MIT and CERN and then with MIT and INRIA in France, and subsequently Keio University in Japan, as hosts. We now have many offices in other countries.

So, the idea of the Web is that there is only one Web. It does not constrain anything. It must be universal in many dimensions.

For example, it must run on any hardware and over any network. Originally, there were gateways from DECnet into the Internet but DECnet faded very quickly as the VAX/VMS machines got Internet on them. The Internet has done a great job by being ubiquitous and flexible, allowing a clean interface between the Web and the underlying network. Life is much simpler now.

It must run for any operating software and any application software, any browser. It is fundamental to the way the Web works that anybody should be able to write a browser but it amazes me, by the way, that people sometimes still make websites that only work using a particular browser.

The Web has to work for any language: it has to be international and it should be able to work with junk. Actually, it should not be forgotten that some junk can become important. It is important to be able to publish stuff that is not very valuable because the valuable stuff actually starts off that way. So, whether it is a very polished work or the grain of an idea, which may subsequently become a polished piece of work, it should still be publishable on the Web. A lot of information systems before the Web were conceived on the principle that only technical reports that have reached a certain standard should be published.

The Web must work for personal as well as public data. A lot of the important data in your real life is in your address book and your calendar. Some of the experimental data you may keep to yourself until you have tested it, of course, but then it must be accessible by anybody.

It also has to take into account that some 20% of people have some sort of disability. W3C have now produced guidelines on how to do that.

There is one other dimension along which data and information vary. The original name in French of the IT Department at CERN was Division de Données et Documents, DD (Data Handling Division in English). Documents are things that you read and data is stuff you put in a computer. Data is boring to read but documents are things that computers cannot process. Data is much more useful because you can process it and documentation is much more exciting because you can read it, surf it, listen to it, watch it, play in it and walk through it, depending on which medium you use. So the Web must encompass all those things. And this brings me to the Semantic Web.

The Semantic Web is all about machines exchanging data in such a way that they understand what the data mean. If I download a bank statement it comes down currently in some SGML format and I put it in my computer. However, the word ‘date’ does not explain what ‘date’ really means. So on the Semantic Web if you are going to publish that data, you don’t just say ‘date’, you actually use a form of XML which uses what is called the namespace. This means that instead of using a date you are using a name which is really a Web address. For example don’t say *colour*, say <http://example.com/2002/std6#Col> instead. Now you can argue about whether *colour* should have a *u* or not and what *colour* actually means. But when you use an XML tag for *colour* it means that somebody has defined and owns a specific meaning of *colour*. So you cannot make any assumptions about what *colour* really means and therefore you cannot use it. This technology called the Resource Description Framework (RDF). So the Semantic Web is about people sharing definitions.

The basic atom of the Semantic Web is just one piece of data. Most of the information now is in relational databases and the atomic unit of relational databases is the cell. The horizontal row is an object and the vertical row is a property and where they intersect you record the values for each of the given properties: subject, verb, object. My car — has colour — red. Three things, a triple. Then you draw circles and arrows and each arc represents a binary relationship with a subject and an object and importantly the arc has a type. So we have typed arcs. Both the subject and the property and the value are typically represented, identified by URIs and this stuff is called the Resource Description Format (RDF). It is a standard — a W3C recommendation, with which you can encode data in XML for data exchange.

When you encode a table, of course, you can encode it in circles and arrows because the circles and arrows are very flexible. And you can take a tree. Lots of data are in trees. The Semantic Web is about using the same URIs for things. The tree and the table can be merged when the same URIs are used for the same things in different files.

Also it is important to use URIs for the verbs. Think how many times somebody makes a table and writes at the top a US 'zip code' or UK 'postal code', and in fact when you write a five-digit zip code, it means exactly the same thing as the postal code but the computer is never told that it is. It is so useful to tell the computer that, particularly when, for instance, you have huge enzyme and protein databases and they share a very large number of concepts. So the Semantic Web is about telling the computer that "this means the same as that". Think of it as a semantic link informing the computer that this concept is the same as that concept.

You then have to find common terms, which is difficult because it entails defining standards. When you do this in a small group it is easy. When you do it with a large group it is not. So the proteonics group gets together the genomics group and they decide what really counts as a protein and what does not. You end up with different communities of different sizes with a certain amount of overlap. The fundamental difference between the Semantic Web and a lot of the knowledge representation projects in the past is that the latter tended to define things as one big tree that includes all animate and inanimate things in a single ontology, in one big Dewey Decimal classification system. But this does not work because everybody has a different way of looking at data.

So, the system has to be completely web-like. You don't expect total consistency. You expect people to have made inconsistent definitions and so on. Thus you may have lots of different applications in your life and they share concepts just like stations on the metro share different coloured lines. When you take a photo, all the camera does is to record the picture and the time at which you took it. If you correlate that date with your calendar, you can find out where you were and who you were meeting. If you can combine the camera and the calendar information, it might be useful for searching for photographs of particular people. If the camera tells you where you were, you can work out where the photograph was taken and so on. The Semantic Web is about connecting different applications together.

There is just one word of caution. In a company, the customer relationship management group shares a lot of data and concepts with other parts of the company. They share some technical concepts with engineering and they share the concept of the company part numbers which are in the catalogue, which is public, in the engineering data, which are not public, and in the theorem database, which is very private. But the company has defined its own part numbers and so has not shared these concepts with anybody else. So some concepts are not global in all respects.

So remember, this is not a tree. Your life is a web and your data is a web and so you need something that will express them as a web. At the moment people in enterprise software are trying to connect different pieces of given applications using lots of little XML handling programs. We recommend using RDF as a hub. The RDF language has been a recommendation for a while. RDF Schema is just being revised but it is basically very stable. The ontology level is called OWL, a more sophisticated language that is going through the last phases of the W3C process and is now pretty stable. We are about to start looking at the more expressive things such as rules and query languages. The really exciting moment comes, of course, when you can get everybody to use the same language in a particular discipline or medical application. Remember, initially it was not exciting using the Web. You had to have a vision of what happens if we all use it.

People ask: "What is the 'killer app' for the Semantic Web?" The whole idea is that there is *no* single killer application. The idea is connecting applications together. For instance, the Semantic Web will make it possible to track the experimental conditions in which scientific data were obtained. It will tell you which bit of equipment you used to take a reading. So if you want to re-use old data, you will have information on the experimental conditions and other factors.

Some of the immediate challenges are the effort it takes to do the standardization. Some of the possible problems, from fear of patents. We have done a lot of work in the World-Wide Web Consortium to make sure that the infrastructure will be royalty-free.

There were three phases of acceptance for the Web: The first phase was: "Why should I use angle brackets for my document?" The second phase was: "Okay, we are using your Web; we are using the Web tools. They seem to work." And the third phase is: "Wow, did you see what I just did? Can you believe what is out there?" We haven't got there yet. Selling expectations is important. It will take time for people to realize that you can't just download a complete Semantic Web development kit and turn your company into a Semantic Web company overnight. But there are now a significant number of start-up companies that are totally based on Semantic Web technology. Some of the large companies, who used to pooh pooh the Semantic Web, are now saying nice things about it and starting groups doing it. We have to go not too fast and not too slow and to try to set and meet those expectations as well as we can. When we get to stage 3, I'll let you know and we can all celebrate. »

17 Visionary Panel Discussion: Science and Governance

Address by H E Mr Ion Iliescu, President of Romania

« Science plays an important role in the history of human civilization and in modern times it represents the foundation for the economic and social development of society. We have enough examples to justify the statement that the decline or disappearance of some civilizations stems from ignoring or marginalizing scientific and technical activity, from persecuting the scholar and replacing the creative spirit with acceptance of some dogma.

Today we are at a turning point regarding the way in which we approach the relations between science in society on the one hand, and creativity and production of added value on the other from the perspective of the impact of the new information and communication technologies whose spearhead is the Internet. The old World-Wide Web, the global network, is the producer and at the same time a consumer of scientific goods operating in both cases as the support and catalyst for creative actions irrespective of their nature. Creativity becomes the most important quality indicator when we assess the social capital of a nation.

Science is not effect in itself. It is neutral in relation to the moral and spiritual values of a material civilization and culture. This statement has important consequences for the present and for the future. The role of science is permanently growing. The world needs permanently renewed instruments of knowledge and new technologies that meet its material and spiritual needs.

Of course, as for the information society the priority topics of scientific research have a direct connection to all aspects of information: collection, processing, storage and handling. In all these processes, there is a need for new ideas, new technologies, new material and applications in a broad range of scientific fields: physics, chemistry, mathematics, informatics, the study of matter, logic, philosophy, linguistics and so on.

We will witness the emergence of frontier fields such as artificial intelligence or biotechnology. There is a clear difference between access to information and access to knowledge. If, thanks to the new technologies, access to information will be rapidly democratized, the same thing does not happen in the case of the access to knowledge as the increasing complexity of research and development activities serve to widen the digital divide.

On the other hand, due to their complexity, the problems facing humankind require a global response through the active participation of all concerned. Given the realities of the moment, it is hard to believe that the existing inequities in scientific activities between the developed and the developing countries can be removed without a methodical, open and steadfast approach to attaining the UN Millennium Goals. The firm political will of all governments and the strengthening and enlargement of public–private partnerships will be required to achieve this.

I believe that information and scientific and technological knowledge together with fundamental resources such as water, food, education and health must be considered universal utility goods governed by a regime that should allow access to them by all inhabitants of the planet. There is a direct link between science and democracy as there is between democracy and economic growth. Open societies with consolidated democracies will be favoured since the development of science essentially depends on the existence of a political and intellectual environment that is open, proactive, stimulating and tolerant of different and even critical approaches to reality. If the creation processes stimulate and are cumulative in time and space, discontinuities that are the product of political, ideological or religious constraints, particularly in the field of the access to information and knowledge, can result in development delays, poverty and social and cultural exclusion.

The creation of the information society and the development of the economy of symbolic goods and knowledge in the service of all the inhabitants of the planet entail not only the definition of the role and place of science in society but also the creation of a global mechanism for free access to scientific and technical knowledge, particularly that financed by public money. In order not to waste resources, scientific priorities need to be defined at planetary level, which should lead to the setting up of research programmes open to all global actors, public and private alike.

I would like to extend my appreciation to the initiatives taken by CERN, acting as it does within a large international cooperation framework that has led to important developments for the information society that are now making possible the emergence of Grid technology. This specific application will allow the sharing of IT resources regardless of their geographic location. RoGRID, a Romanian Grid consortium, which involves representatives from the research and development, academic and business communities, will, I hope, bring a substantial contribution to the success of the Grid project at global level.

The role of conferences like this one today is to define the values and structures of the Information Society. This is a complex and lengthy process, as we need to harmonize various opinions regarding the world, various moral and cultural values and divergent economic interests. In this process, governments are called upon to play a central role in their position as exponents of nations and their interests. In order to better attain the specific goals and missions of governing, governments must find in the Information Society the instruments for a more effective and transparent governance. The Information Society creates the premises and structures for the accession of new types of solidarity and civic responsibility. Civil society, its bodies based on a decision autonomy and independence from public power, can better express themselves in an information society that is decentralized and organized in a network.

This can offer us a solution to surpassing the limits of representative democracy by creating the conditions for the accession of participative democracy as early as possible in order to resolve the democratic deficit specific to current society. Globalization is not a process that is confined exclusively to its economic dimension. It is increasingly regarded as a danger for national and cultural identity through homogenization and structuring of a global popular culture. This danger is debatable. However, the issue of protecting and furthering cultural and identity diversities is a central one when we draft the structures of the Information Society. Diversity is an essential source of creativity and it must be used rationally, not conflictually.

These considerations led us to the idea of drawing up a positive utopia that should allow the full use of the opportunities offered by new information technologies without becoming addicted to them. In order for us to be creative as individuals we must preserve our lucidity, our critical spirit. We must have a firm and clear-cut system of moral and social political values. We must be open to the new and willing to have a dialogue, aware of our limitations as well as the limitations of technologies. As political decision-makers, let us not forget that our mission is to further and defend the public interest. In the process of drawing up decisions, we need feasible information and solid knowledge, both products of human creation, science and technology.

It is only in this way that we can say that we meet the exigencies of good governance. The Information Society must comprise the morality of science and the citizens' responsibility for democracy, development and peace. We cannot allow the Internet, communication networks and the information environment to be turned into vectors for spreading hatred, religious fanaticism, xenophobia and racism and into instruments of international terrorism and organized crime. The age that we are living in is not only one of the access to information but also one of a permanent search for a balance between economic imperatives and society's need to reorganize our relations with all our fellow men and women and for the increase in the level of our participation and involvement in the life of society. »

Address by Dr Tim Berners-Lee, Inventor of the World-Wide Web and Director of the World-Wide Web Consortium

« The University of Oxford used to refer to its physics as experimental philosophy, which I think is rather appealing. When we founded the World-Wide Web Consortium, we said that we do everything but the philosophy. However, with the Semantic Web we are doing more and more of it.

But the idea of physics being originally called experimental philosophy prompted me to consider that perhaps we should call the building of the Semantic Web 'philosophical engineering'. Both are related to the fundamental questions of who we are and why we are here: one seems to be basically analytical and the other basically synthetic.

Science is constantly asking the question "why?" When we talk about building the Internet society we are always asking the question "how?" And it seems to us that the question "how?" is forced on us by the need to have lunch and dinner and have a roof over our heads, whereas the question "why?" comes from somewhere deep inside. But when we analyse the questions: "Why are we here to discuss something?" and "How we are going to discuss it", we realize that "why?" and "how?" are inseparably the same question. They are the *yin* and the *yang* of the same thing. You cannot separate the analysis and synthesis if you really try to build anything. If you are trying to do engineering and create an information society and at the same time you are not doing science, there is a fundamental contradiction. I feel that science is completely inseparable from the Information Society. »

Address by Dr Walther Lichem, Austrian Federal Ministry of Foreign Affairs

« I am the odd man out here. I am a diplomat. Allow me therefore to address the topic of this conference from the global diplomatic governance perspective and make a few comments on that.

Every day I see a growing complexity in our global agenda. In fact it is becoming ever clearer to me that we traditional diplomats are no longer able to cope with that agenda. We have to broaden the decision-making process and reach out to those who produce and provide knowledge. This is perhaps the key issue. What we are confronting here is the need to build the bridge between knowledge production and the definition of issues on the one hand and the definition of policy options at the global level on the other. This has implications in terms of process. It also has constitutional implications.

This is also related to a second basic phenomenon which we are living at all levels of our societal organization. It is the evolution from societies of verticality, obedience and command to a society of horizontality, of societal interaction, of participation and of contribution and to a society where in fact something is occurring that one could call political processes at global level. Some of the rules of national politics increasingly apply to global politics.

In fact, the WSIS process has something of the dimensions of global politics. In my experience over the past decades, this global summit event is more truly global and inter-sectorial at the same time than any other. This reflects the new verticality. It reaches down to the citizen. Our new global agenda has the citizen as actor and as victim at the same time and it affects all levels of societal organization from the communes, cities, and nation states to the global level.

Let me first try to define the term used to describe this new participatory process. What is *global governance? Government* is a vertical process of known definitions entailing transfer of decisions to lower levels for implementation. *Governance* is a horizontal process of interaction between the public decision-making structures and elements of society at all levels that are affected by those decisions and contribute to that decision-making process, including at the global level. *Global governance* is therefore a process that has moved on from inter-state diplomacy with diplomats speaking from behind the names of their respective States.

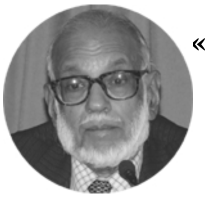
In traditional political processes at national level, the providers of input for the decision-making process are excluded from that process for lack of legitimacy and mandate. What role should academia, the knowledge provider, play to prevent this happening at global level? It is perhaps highly significant in this context that apart from this RSIS conference, academia, one of the fundamental stakeholders of civil society, was largely excluded from the WSIS's preparatory processes. Similarly, while academia is represented by CERN as an intergovernmental organization, initially no reference was made to scientific academia in the first draft of the Declaration of Principles.

In my opinion, this raises classic questions for the future: where do we go and how do we go and what structures should we have for the way we want to go? If we assume that knowledge production and the institutions of knowledge production are indispensable elements of global governance, we must ask ourselves how we get there. Politics and political science will tell to you "Aggregate, articulate and access the processes." This means that the institutions of knowledge production must *aggregate and articulate* the broad issues and address not just other scientists but also people like me, the non-scientists. They must not be content merely to *sit in on* the decision-making front. We need you to be *involved* in it. I believe that this bridge between us will increasingly define you too.

Now, as you know there is also something else emerging on the horizon: *knowledge politics*. That means politics to contain knowledge production. There is a fear that knowledge production is dangerous and national commissions are being set up see what can and should be done to control knowledge production. But the fact is: knowledge is faster than control.

If we look to the future, you the scientists must approach the political processes from within the freedom in which you operate. The key challenge in my view is how we are to construct this partnership in global governance. »

Address by Professor M. G. K. Menon, Indian Space Research Organization



« I shall be speaking specifically to the issue of governance. Many of the examples I cite are drawn from the context of India, one of the better developed countries amongst the developing countries in terms of the information society, but will be familiar to those from other developing countries.

The first point I would like to make is: when we talk of governance we have to look at the manner in which one governs. Is it to be a top down process as it has been in the past with kings, monarchs, oligarchies deciding for the people or should it increasingly become a democratic process where society at large decides its own future? Connectivity is of paramount importance for this latter process of democratization.

As scientists we take pride — and rightly so — in the role that science has played in the discoveries that have led to the technologies and applications of today's Information Society. But I ask myself: what is the use of all this information and this enormous power that information technology provides, leading to what is referred to as a knowledge society, if it is not used from the viewpoint of better governance to create a civil society in which human needs are met? To me ultimately the touchstone is the manner in which technology, and that is true for information technology, can meet human needs and create a good civil society, and I ask myself: can this be accomplished if large numbers of people are left out of the system?

Today they are left out in terms of actual and lost opportunities. If one looks at the world today, one sees that it is social injustice and inequalities that are at the root of most societal turbulence. The question is: how does one eliminate such social injustice and inequalities? The issue is not that everyone has to be equal, but rather that we must eliminate situations in which basic essential human needs in education, health care and employment are not met.

I have always felt that information technology is a force multiplier in all these fields, enabling one to accomplish things on a scale that would not otherwise be possible. As I was listening to Tim Berners-Lee giving his talk on the next move to the Semantic Web and beyond, I was reflecting on how all-pervasive information technology has become over the last ten years — and the immense contributions that he and CERN have made in bringing this about. And I asked myself the question: if this is the power of science, why is there so much social injustice, so many inequalities and why are so many human basic needs not met?

For example, I know that many people in Western nations do not realize the magnitude of the employment problem in developing countries as they evolve from rural to urban societies and from agricultural to industrial or post-industrial societies. Employment cannot be ensured through huge per capita investment which would make it unaffordable to most countries, but through high-technology, low investment per capita, high-productivity programmes. This can only come about if one uses the knowledge increasingly becoming widely available.

Similarly, on the education front, almost 200 million adult Indians cannot read or write today. The illiteracy rate is reducing at the rate of about 1.5 per cent per annum. At this rate, it would take at least 20 years to reach a level of 95 per cent literacy, and in the meantime the absolute number of the illiterate is growing. We cannot eradicate adult illiteracy using the standard processes. But it has been demonstrated that if we use computer techniques in the right way, we can make a person literate not in 200 or 300 hours, but in 20 to 30 hours.

Yesterday Ismail Serageldin gave us an example of the hole-in-the-wall experiment of slum children who by just playing around with a computer and looking at the screen can teach themselves to browse the Internet in less than one hour. I am proud that this was pioneered in India by an Indian IT company, NIIT. It is important for us to remember that the information technologies are powerful tools for eradicating illiteracy, providing information and improving the knowledge capacity of enormous numbers of people. That is true of the health as well as the employment sectors.

Dr Borrero referred to geographical information systems utilizing satellite images and comparing this with ground-based systems. I was Chairman of a system called the National Natural Resources Management System (NNRMS) of India which was to use space-based data in conjunction with ground-based data for resource evaluation in many areas. Ask yourself what happens in a country such as India. You see a picture of a wheat field, but you need to know it is a wheat field; you need to know whether it is in good condition or being attacked by pests; you need to know the extent of grain yield. All this information comes from people who speak and write in local languages but you need to collect it all on a centralized basis if you want to correlate ground-truths with the satellite data. There is then a language problem, which is enormously complex in a country like India with 18 official languages and 10 scripts. But now there are information technologies under development that will enable us to overcome this.

Some 40-odd years ago in 1965, we did an experiment in education using satellite technologies which essentially entailed moving a US satellite overhead India to beam the pictures down on two and a half thousand villages in remote areas for viewing on battery-based television. The purpose of this experiment was to broaden the horizons of people who had never seen anything beyond their locality. This was a pioneering effort at conscious satellite-based education and awakening awareness. In a sense, when I speak of information technology I am not necessarily speaking only of the most advanced technologies of relevance to the research community. I am speaking of technologies that are relevant to vast numbers. You must think of this in terms of an iceberg. You only see the tip of the iceberg in terms of the elite and of those using advanced technologies but below that there is a huge submerged extent of people who are not able to use them.

Therefore, I believe that we must consider how we bring to bear the power of information technology in a variety of ways. For example, I use a computer but a lot of the time it does not work because there is a power cut. Information technologies assume the existence of stable electric power generation and supply but such conditions do not always exist in developing countries. Is it beyond technology to have these systems operate on simpler power supply sources — not with expensive and limited UPSs?

You also find, for example, that you have to solve the 'last mile' problem in terms of broadband access. You may even be able to provide broadband access capabilities through optical fibre networks but then you find that the 'last mile' problem cannot be dealt with unless you use wireless technologies and mobile telephones. So I look at information technology not just as the Internet and the Web but the access to it and in terms of all technologies used in conjunction and for society as a whole, particularly the millions of deprived in developing societies. I would like to quote part of a statement at the 2002 World Telecom Development Conference:

"The problem [of the lack of ICT infrastructure] that faces the developing countries is the high cost of building such infrastructure. What is required is low cost infrastructure. The requirement in developing countries is significantly different; to provide lower-cost basic access with a reasonable basket of important services such as Internet and voice communication. All the known techniques need to be harnessed to reduce the cost of telecom infrastructure."[1]

Thus one is not necessarily looking for the most advanced capabilities but for those that will make a real difference to people in their daily lives. So we cannot have governance, we cannot have a civil society, we cannot have a good society if human needs are not met. In order to meet human needs we need to apply these technologies on a locale-specific basis.

The last example I would like to quote is from the field of agriculture. The Green Revolution in India was based on the dwarfing genes in varieties of grain grown in Japan brought to Mexico with work of such people as Norman Borlaug, its application in India where they were hybridized with Indian varieties meeting locale-specific climatic and other conditions to achieve maximum grain yields and acceptability. The key requirement is therefore significant relevant adaptation to local conditions.

Similarly, in the area of governance, developing countries must recognize their responsibility and not just rely on developed countries to do the development for them. They have to recognize their responsibilities and put in place national policies appropriate for the purpose so that they can lead the development. But to accelerate this there has to be co-operation of a significant order, particularly involving the scientific community of the developed nations to find on a joint basis the relevant technological solutions. »

Address by Mr Talal Abu-Ghazaleh, United Nations Information and Communication Technologies Task Force and Arab Regional Network of the United Nations Information and Communication Technologies Task Force:

« Like Dr Lichem I am an odd man out here. Unlike him, I come from the business community in the field of professional services. I would like to present a layman's view to an august audience of scientists. I had prepared a visionary scientific paper, but I have decided to put it aside and talk to you heart to heart. If you find what I have to say nonsense, remember that one of the greatest leaders of the world, Churchill, once said: "The greatest lesson in life is to realize that fools are sometimes right." So grant me the benefit of the doubt.

1. Quoted from the Policy Statement by H E Agum Gumelar, Minister of Communications Department of Communications, The Republic of Indonesia.

I want to start with the question of the definition of governance. I have yet to come across a well-defined, agreed-upon definition of governance. There is work to be done on a defining what we understand by governance and also on resolving the conflicts it implies. I would like to cite three conflicts associated with the issue of governance.

First, there is the conflict between governance and democracy. If you want the rule of the majority, do you accept it even if the majority wants the worst? So the question arises as to *when* we should apply governance and when democracy. Secondly, there is the issue of legitimacy. If an election produces a leader who is a tyrant, a madman or a thug, should you accept him? In other words, do you want to be able to decide when legitimacy should prevail and when governance should prevail? Thirdly, there is a potential conflict between governance on the one hand and authority or rules on the other. Do we go by the rules or do we go by what governance dictates?

That is, of course, if we know what governance *is*. I have been conducting courses and seminars on governance in business and I am still a very young student on that subject. Shakespeare wrote: *"For there is nothing either good or bad, but thinking makes it so"*[1]. So it is also something that very much depends on your personal view and your own judgment. Having listened to all our distinguished speakers, whose views I very much respect, I am still not sure of the meaning of governance and how it is to be applied. It gets even more complicated when we come to global governance because we are no longer talking about governance in a community, in a business, in an institution or in a government context, but in an inter-state, intergovernmental or global context. That adds another perspective since we are then faced with the problem of *which* rules prevail.

I fully agree with President Iliescu when he speaks of transparency, openness, participation, fairness, independence and accountability, but how does a businessman, an accountant or a consultant put these principles into practice when it comes to every-day management of a business, a government or in the context of global issues?

Governments and businesses have to work in their own interests and I work for my own interest. There is no difficulty there. But a balance has to be struck between my interest as a businessman or as a private individual or as a government and fairness. Coming from the developing world, let me tell you in story form what the developing world is worried about with regard to global governance.

My name is Abu-Ghazaleh, which means 'father of the gazelle', and I always liken the relative positions of the developed and the developing worlds to a fight or race between the lions and the gazelles. The lion has to run just faster than the slowest gazelle to catch a gazelle. But the gazelle has to run faster than the fastest lion in order to survive. That is an unfair race. All you are asking of the lion is to be able to run fast just enough to catch the slowest gazelle. You are asking the weaker to run faster than the stronger just in order to survive.

I therefore call on the lions of this world to recognise that it is in the interest of the global community to apply the laws of governance. You have to think of maintaining both communities, because this world would be very ugly if the gazelles became extinct. In fact, the situation would be even worse because the lions would then start eating each other! »

1. Hamlet, II ii.

Further Comments by President Iliescu

« Over the last 50 years we have witnessed increasing social inequalities and inequities at a time when new technologies and new knowledge have contributed to a dynamic economic growth that is without precedent in history. In spite of this economic growth, poverty has not diminished throughout the world and the gap between rich and poor countries has continued to widen. So something appears to be wrong with the rules of the old economy. Globalization is not responsible for this. On the contrary, globalization and new dynamics engendered by the growth of knowledge and the development of new technologies could provide an opportunity for poor countries to have more access to this knowledge and these new technologies. But in reality the contrary appears to be happening. The digital divide has become yet another handicap for the poor in trying to reduce the gap.

What are the sources of these inequities and the reasons for this malfunctioning of the old economy? I think this is mainly to do with the rules of the market economy. The market economy has many virtues. It promotes initiative, creativity, the pursuit of quality and the spirit of competition. At the same time, it generates social polarization on a global scale. What can we do? Some correction has to be made to the rules of the market economy.

After World War II, Western European countries promoted the so-called 'social market economy' with the involvement of the state through fiscal and social policies aimed at reducing social inequalities. Which institution could do the same on the global scale? We do not have such institutions. International organizations such as the United Nations, the IMF, the World Bank, the World Trade Organization and the International Labour Organization do not have such goals and instruments to act in that way. We need a world institution whose main goal should be to introduce a correction to the market economy rules in favour of the poor countries in order to raise their potential to use their resources and to reduce the gap that exists between rich and poor countries. It is in the interest of the lions, the rich countries, to act in this direction. Otherwise, the market economy works only in favour of the rich. If we do not take some action in this direction, the gazelles, the poor, will migrate to the rich countries in their millions. I see this as the main problem facing the international community today. »

– **Question From the Floor**

The Web is both an instrument of universality and a source of controversy in exacerbating the digital divide. How is this conflict to be resolved?

– **Response by Tim Berners-Lee**

"We should not regard the digital divide specifically as an Internet problem. The issue of whether the Web will exacerbate or help to resolve the digital divide is still a moot point. It is true that the existence of the Internet changes the parameters; it adds an extra dimension to the divide and can accelerate the pace of change. Thus service industry jobs can migrate from one country to another faster. Thus when people talk about Internet governance, they are often not referring to ways of solving the problems of the world that are highlighted by the Internet. They mean such things as how the Internet operates, who pays for the links, which protocols to use and interconnection problems. But we shouldn't overlook the ways in which interconnectivity is already being used to reduce the gap. A missionary recently told me about someone who had taught himself to translate from his native tongue into English by finding two copies of the Bible on the Web. He now sells his services as a translator on the Internet, which brings in a lot of money into the village. That is a great story. However, while the existence of the Internet might make you change your plans about how you deal with the world's inequalities, it can't fundamentally resolve them."

– **Response by President Iliescu**

"The Internet and the Grid are tools and technologies that could help humanity to increase productivity but they will not solve social and economic problems and inequalities."

18 Summary of the Conference

The following text comprises a summary of the RSIS Conference submitted for the Proceedings by Professor M. G. K. Menon, Indian Space Research Organization

Object of the Conference

There have been spectacular advances in various fields that underpin Information Technology: computers systems; telecommunication systems; space systems; radio and broadcasting systems; and in the detailed areas of both software and hardware relevant to each of these sectors. These have been based on similar advances in the areas of microelectronics, lasers and optical fibres, magnetic storage, cellular telephony and mobile computing, user-friendly software, etc. What is particularly important is that these different areas are no longer compartmentalized, but have converged into one major stream of Information Science and Technology. As a result, the world is increasingly becoming what has often been referred to as a 'Global Village'; it would be preferable to call it a 'Global Neighbourhood' — when one realizes the need also for qualities of being good neighbours. With these developments, one is moving into a knowledge society. A consequence of this is that knowledge is now accepted to be a resource — but which has the unique property of not being lost or decreased by usage or sharing. Knowledge is becoming increasingly commodified — being now regarded as wealth, which is closely guarded through systems of patents and royalties, and by barriers organized through intellectual property regimes. This is in contrast to earlier periods of human history, when knowledge was for the common good, to be shared by all, and characterized by transparency.

Scientists are well aware that it is the discoveries in science, and the technologies and applications that these have enabled that have been the major driving force behind the rise of the information and knowledge society of today. It is the advances in mathematics, physics, chemistry, and now in biology, as also innovation corresponding to discovery, in engineering and technology, that have constituted the basis for the rapid advance to an information society. The discovery of the electron and the development of electronics that this made possible; the discoveries in electromagnetism and of electromagnetic waves that opened up radio and television broadcasting, quantum mechanical studies of the solid state and the discovery of the transistor, leading to increasing levels of integration in integrated circuits; the discovery of the laser and its opening up of broadband optical fibre-based communications; Boolean algebra and the digital language which underpins all facets of information technology; understanding of magnetic phenomena which has led to enormous information storage systems; advances in mathematics that have underpinned software development; the development of the Internet and of the World-Wide Web which has enabled information systems to become all-pervasive; the underpinning science and technology relevant to space systems; these are but illustrations of work in primary areas of science that have contributed so much to the information revolution that we are witnessing.

Whilst it has to be recognized that there have been many driving forces, including those of business, industry, entrepreneurship, societal needs and the like, it can certainly be stated that it is scientific discoveries and the technological changes that these have led to, which have provided the wherewithal for the development of today's information society.

Scientists would like to see science continuously grow and develop, from the base which it has already reached to enable a better understanding of Nature and also to ensure that the benefits from this understanding will benefit society. For science to grow and develop, it will need the basic ambience in which it has so far flourished — of transparency and openness; and there will be need for the continuing faith of society in science, and support for science that comes from this. Indeed, as we move into the future there will be a need for a stronger compact between science and society than what has existed in the past. It is not from the viewpoint of any ego that scientists would like to claim that science has been a major driving force of information technology which has led to the new information society. It is only to point out the role it has played and the role it can continue to play to advance information society and overcome the many limitations that still exist if it is provided with the right conditions and support.

There are many issues that are looming ahead arising from too narrow an appreciation of intellectual property rights, of copyrights, of issues that are handled in the World Trade Organization, the World Intellectual Property Organization and other such bodies where the principal stakeholders are governments, business, industry; and science seldom has a voice in these. It is the concern of scientists that decisions in these areas should not hamper the growth and future of science itself, for that would be like killing the goose that laid the golden egg.

Nature of the Conference

The Conference was organized at the initiative of CERN, with the fullest support and participation of UNESCO, ICSU and TWAS. In some sense this was a wholly new initiative for CERN, all of whose activities hitherto had been directly related to high-energy elementary particle physics, creation of the infrastructure technologies needed to pursue this area at the frontiers, and more recently the related aspects of high-energy astrophysics. As I saw it, the Conference was a remarkable success. All concerned with its organization and implementation need to be warmly congratulated — the Director-General of CERN; Dr Roger Cashmore, Director of Research, and all of the staff in CERN who have worked very hard.

CERN is normally very good at bringing together the highest quality scientists from round the world; it would not be unusual to find many Nobel Prize winners in this auditorium on any single occasion. However, for this Conference, with active involvement of its partners, CERN brought together many high level personalities not only in science and engineering, but from culture, politics, philosophy, social and developmental work. There were many distinguished international leaders like Adolf Ogi (Special Adviser to the Swiss Federal Council on WSIS Switzerland), Adama Samassékou (President of WSIS), Dr Yoshio Utsumi (Secretary-General of ITU), H R H Maha Chakri Sirindhorn, Princess of Thailand, Dr Nitin Desai (Special Adviser on WSIS to the Secretary-General of the UN), Mr Koïchiro Matsuura (DG, UNESCO) Dr W. Erdelen (ADG for National Sciences UNESCO), the President of Romania, Mr Ion Iliescu and many others. One of the most distinguished was undoubtedly Dr Tim Berners-Lee, the inventor of the Web, which he invented whilst at CERN.

This initiative and effort was something completely new for CERN, but handled with panache. It was essentially because, for its own work, CERN has always used the most advanced computational techniques: massive parallel processing, the Web and now the Grid. CERN has, therefore, been a pioneer in these and at the forefront of information technology capabilities. Even without this facet, CERN has been greatly respected for its ability to build sophisticated hardware to carry out huge experiments in basic science, and for doing this and for the analysis to elicit co-operation from an enormous number of scientists and engineers distributed in many countries in many laboratories, and demonstrate success. Its abilities in networking have been spectacular and it has throughout its existence kept up its *élan*. CERN, therefore, not only has the capabilities in information technology, but even more important, its own credibility in its field of action, with deep commitment to science, its future and to international efforts. It was most appropriate for CERN to take the initiative in this and to provide the leadership.

Organization of the Conference and Outputs from it

The Conference had two Plenary Sessions on two successive afternoons. The first keynote presentations at the start of the Conference were given by very distinguished leaders in different areas, some of whom I have already referred to. Then, there were a number of parallel sessions which dealt with the manner in which information technology might be able to transform present activities in various sectors: education, economic development, environment, and health and also one on enabling technologies. The Rapporteurs of each of the parallel sessions presented a summary of the discussions at the plenary session on the second afternoon. This was followed by a Visionary Plenary Session on Science and Government.

Clearly, the Conference was not a technical one on information technology. It attempted to fulfil its primary objective, namely to address the Role of Science in the Information Society. It is clear that with the increasingly strong coupling between science and technology on the one hand, and technology and the various activities of society on the other, those concerned with discoveries and innovation cannot function any longer in a compartmentalized stand-alone mode. Scientists should somehow get involved with the problems relating to implementation of their discoveries and their applications to ensure that maximum benefit flows to society. The Conference very clearly highlighted an appreciation of this new role of science, particularly with reference to the information society. It was for this reason that the Conference dealt with the various important areas of human, economic and social development, and the manner in which the new information technology through its highly pervasive nature might impact on these, and on what more needs to be done to ensure the maximum benefits.

In the area of education, it became clear that whilst everyone accepted it as a key element for development and for moving into the knowledge society of the future, there was increasing recognition of the significant backlogs as far as developing countries are concerned, in quality and quantity; there are also problems of a different nature faced in the developed countries. In all of these areas, technology can enable society to leapfrog into the future, without having to go laboriously through the various steps that society has followed in this field in the past. Various aspects of e-learning were covered such as web-based learning, open-university systems, open courseware and the like.

In the area of health, it was clear that telemedicine will soon come of age, and can enormously increase the availability of limited human resources of skilled doctors to be able to reach out to much larger numbers than has so far been possible; there are also great opportunities in specific areas such as safe drinking water.

In the field of environment it was underlined that one needs to understand the various aspects of ecological systems at micro and macro levels; and to understand the physiology of the Earth System. It is important to have timely availability and dissemination of information based on world-wide international collaboration. This would relate to areas such as climate, the oceans, desertification, biodiversity, coastal ocean management, pollution and many more.

For economic development it is vital that information technology is made much more widely available. There is clearly a digital divide in the world today. The Secretary-General of the UN has expressed confidence that this can and will be overcome. For this there is a need for specific national policies so that implementation can take into account local-specific aspects. Lowering of costs of IT systems and access are key elements in overcoming the digital divide. It is not more capabilities that are necessarily called for, except for special situations and applications. What is needed is to enable rapid, more equitable, widespread availability. For this, open source software can be an important element. For both economic development and for the sake of science itself, there is a need to ensure open access to all publicly funded databases.

Enabling technologies would be clearly necessary, and of great importance, to meet the various requirements in each one of these areas. Particular reference was made to large new projects like the Grid, in which CERN is playing a key role.

The general consensus that emerged is the need for greater equity to enable information technology to benefit global society as a whole and not be a means to create further divides between and within societies. The importance of this particularly came out in the Visionary Panel towards the end of the Conference.

The WSIS and Beyond

A clear message should go out to RSIS from the scientific community, a representative fraction of which is assembled at RSIS. As host of this Conference, the Director-General of CERN could deliver it. Whilst conveying the gist of what has transpired here, the message must also clearly state that scientific discoveries have played a key role in bringing about the information society of today. In this, the RSIS endorses what is already present in the WSIS Draft Declaration of Principles. Scientists are therefore genuinely concerned about the future of the information society, particularly as it moves into a knowledge society which holds abundant promise of a better world. Therefore scientists are willing to contribute in every way possible to ensure that the developments that take place are equitable, for the benefit of all of humankind, and avoid the possibilities of what has been termed a digital divide. RSIS should also endorse the WSIS Draft Plan of Action that relates to meeting the needs for science for its own progress. The scientific community should bring to the notice of the WSIS that the directions of pure research or discoveries cannot be determined beforehand; but faith in the fundamental concept that an improved understanding of Nature can be of ultimate benefit to society will result in an ambience and an environment in which science can flourish. The relevant applications that flow from scientific discoveries can be directed; and science would depend on the wisdom of society to ensure that these applications are in the right direction.

As important as the message to the WSIS is, it will be even more important to ensure that the momentum generated by the RSIS Conference continues, so that an even more affirmative message can go out to WSIS 2005 in Tunis. CERN and its partners, UNESCO, ICSU and TWAS, should, in their own spheres of influence, work on the issues thrown up at the RSIS Conference, and on the scientific efforts that are needed to deal with these. In this they will have even more willing partners, such as the InterAcademy Council and other bodies. Through these efforts, not only can scientific solutions be found, but governments can be influenced and public awareness and understanding created. Anything that is worthwhile accomplishing calls for effort. On the part of CERN this might appear to be a diversion from its thrust areas — but its scientific credibility is so high, its capabilities and accomplishments in the area of information sciences and technology so significant, and its abilities in networking of scientific effort so outstanding, that such scientific efforts will truly benefit the cause of a just and equitable society. It is a cause worth pursuing.

19 Key Message from RSIS

Concluding Remarks by Professor Luciano Maiani, Director-General of CERN

« In parallel to the World Summit, the present Conference was devised to emphasize the Role of Science in the Information Society.

We at CERN, together with our scientific colleagues at UNESCO, at the International Council for Scientific Unions and the Third World Academy of Science, felt that the voice of the scientific community should be heard at the World Summit, for at least four reasons.

- First, it was basic science that made possible the technologies underlying the Information Society.
- Second, the needs of the scientific community have often driven new developments in Information Technologies, such as the Internet and the World-Wide Web.
- Third, continuing scientific research is necessary to underpin future developments of the Information Society, from new electronic devices to the future architecture of the Internet, for example through the sharing of distributed computing resources via the Grid.
- Fourth, the scientific community has the potential to empower scientists from many regions of the world that have not been prominent in recent scientific research, but have important, valuable human resources and have original perspectives on many of the fundamental problems we all face — what Adolf Ogi termed ‘science sans frontières’, and what Adama Samassékou indicated as ‘indigenous knowledge’.

Our efforts to organize this conference were stimulated by the challenge made by the UN Secretary-General, Kofi Annan, to the world scientific community. As he wrote in *Science* magazine last March, while “recent advances in information technology, genetics and biotechnology hold extraordinary prospects for individual well-being and humankind as a whole, the way in which scientific endeavours are pursued around the world is marked by clear inequalities.” Annan called on the world’s scientists to work with the United Nations to extend the benefits of modern science to developing countries. One of the objectives of RSIS has been to respond to this challenge. Adama Samassékou reminded us here of the need for solidarity in confronting this task.

With input from the on-line forum we have conducted over the past few months, you scientists, policy-makers and stakeholders from around the world have reviewed the prospects that present developments in Science and Technology offer for the future of the Information Society, especially in education, health, environment, economic development and enabling technologies. I feel that RSIS has helped to develop a vision for how information and communication technologies can be applied for the greater benefit of all. These are some of the results that have emerged from the five parallel sessions.

1. In the field of education, there is consensus that education is necessary for development, that South–South cooperation can play a key role and that ICTs are essential in the learning process in all stages of life.
2. Health: ICTs can help in priority public-health areas such as safe water, for example in capacity-building.
3. Environment: planners and decision-makers need accurate and timely information; scientific North–South collaboration is essential to ensure the accessibility of data.
4. Economic development: open-source software should be made available; the exchange and use of scientific data could be a model for the rest of society.
5. Enabling technologies: it is important for scientists to engage in the policy arena and define projects with clearly visible benefits, for example the Grid.

As Princess Sirindhorn reminded us, *there is no single formula for development,* but I feel that *several general themes* have emerged as guidelines and have received clear support at RSIS:

- that fundamental scientific information be made freely available;
- that the software tools for disseminating this information be also made freely available;
- that networking infrastructure for distributing this information be established world-wide;
- that training of people and equipment to use this information be provided in the host nations.
- that general education is an indispensable basis for the Information Society.

Several of the objectives defined by RSIS are making headway.

The WSIS draft Declaration of Principles recognizes:

"that science has a central role in the development of the Information Society", and that **"many of the building blocks of the Information Society are the result of scientific and technical advances made possible by the sharing of research results."**

Moreover, the WSIS draft Action Plan aims to:

- promote affordable and reliable high-speed Internet connection for all universities and research institutions,
- promote electronic publishing, differential pricing and open access initiatives,
- promote the use of peer-to-peer technology to share scientific knowledge,
- promote the long-term systematic and efficient collection, dissemination and preservation of essential scientific digital data,
- promote principles and metadata standards.

On your behalf, I shall urge the Heads of State gathered at WSIS to adopt these aspects of the draft Declaration of Principles and Action Plan and to endorse fully the guidelines that have emerged from our discussion. We scientists must then commit our best efforts to implementing the Action Plan and demonstrating real progress by the time of the next WSIS meeting in Tunis in 2005.

I thank you for your engagement in this meeting, and look forward to working with you to attain these worthy goals. »

The Conference rose at 6.00 p.m.