World Commission on the Ethics
of Scientific Knowledge and Technology
8th Ordinary Session
Bratislava, Slovakia, 27-29 May 2013
Ref: SHS/EGC/COMEST2013/EN/pub-6.

United Nations
Educational, Scientific and
Cultural Organization

Organisation
des Nations Unies
pour l'éducation,
la science et la culture

# ETHICAL ISSUES IN SCIENCE GOVERNANCE AND THE SCIENCE-SOCIETY RELATIONSHIP

## DRAFT REPORT

**revision n° 5**

## December 2013

This revision of the report has been prepared by the Secretariat in response to the decision of the 8th Ordinary Session and taking account of additional comments received since the Session and of discussion with the Chair of the Working Group. It is proposed as potentially suitable for final adoption.

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# I. PREFACE

Concerns about science governance and the science-society relationship are long-standing in UNESCO and been part of the work of COMEST since its inception. The present report summarizes and articulates the outcomes of a series of activities and reflections designed to respond to a resolution adopted at the 2005 UNESCO General Conference requesting the Director-General to review existing ethical frameworks and normative instruments and report on the advisability of elaborating an "international declaration on science ethics" to serve as a basis for an "ethical code of conduct for scientists".[1]

The context of this resolution was given *inter alia* by concerns about the substantive relevance and normative status of such existing instruments as the 1974 Recommendation on the Status of Scientific Researchers and the 1999 Declaration on Science and the Use of Scientific Knowledge, in view of which it could reasonably be considered whether the most appropriate institutional response would not be to develop a new, more comprehensive and fully up-to-date, but at the same time specifically ethical, normative instrument. COMEST had considered these issues at its 4th Ordinary Session (March 2005) and adopted a recommendation including a proposal to undertake a feasibility study on elaborating an international declaration on science ethics. The COMEST recommendation was taken note of by the General Conference.

However, when the Director-General duly reported to the Executive Board in 2006, he concluded that adoption of a new normative instrument was not the most appropriate mechanism to take forward the ethical concerns expressed by Member States.

This conclusion, which the Executive Board endorsed, was based on a series of regional and national expert consultation meetings held in Krakow, Poland (March 2006), Tokyo, Japan (April 2006), New Delhi, India (April 2006), Geneva, Switzerland (May 2006), Bangkok, Thailand (May 2006), and Belo Horizonte, Brazil (May 2006).[2] The preliminary conclusions from the meetings had also been considered and endorsed by COMEST at its Extraordinary Session in June 2006 and Ordinary Session in Dakar, Senegal (December 2006).

Rather than development of a new normative instrument, UNESCO was therefore invited to work towards a general ethical framework to guide scientific activity on the basis of the Executive Board decision quoted in the preface. The existing normative instruments constitute an important component of this prospective ethical framework.

UNESCO is thus called upon to reflect, on an ongoing basis, on ethical concerns that may, after due consideration, call for action to regulate scientific conduct in specific ways. Whether such action requires the elaboration of specific normative instruments, or might effectively proceed through other channels, is an open question.

The basis for the work of COMEST between 2007 and 2013 was originally stated by the Executive Board, at its 175th session in 2006, taking note of the

[1] 37 C/resolution 39.

[2] A further consultation meeting was held in Cairo, Egypt, in October 2008. Consistently with the results of the 2006 process, the meeting was invited to consider not adoption of a new normative instrument but monitoring of the implementation of the 1974 Recommendation and its place within a general ethical framework to guide scientific activity.

recommendations made by COMEST to the Director-General following its aforementioned 2006 Extraordinary Session.[3] These were as follows:

1. Member States should be reminded of the principles adopted by them in the 1974 Recommendation on the Status of Scientific Researchers, and this instrument, together with the Declaration on Science and the Use of Scientific Knowledge, should be taken as a general reference for future works;
2. An assessment, from an ethical perspective, of the implementation of previous work of UNESCO in this area was deemed necessary, especially the 1974 Recommendation and the Declaration on Science and the Use of Scientific Knowledge.
3. The work that has been undertaken by UNESCO so far, such as the collection of codes of conduct worldwide, the critical and comparative analysis of existing codes, as well the elaboration of educational tools should be supported and encouraged;
4. Further international reflections and consultations should be carried out and fostered in order to identify a general ethical framework to guide scientific activity that will cover other stakeholders beyond the focus on scientists;
5. UNESCO, with the advice of COMEST, should work out such a general ethical framework;
6. The subsequent elaboration and/or implementation of specific codes of conduct for scientists should rely on Member States and the scientific community;
7. In this regard, it is necessary to set up a wide participatory process, involving all stakeholders as well as the society at large with a view to initiate actions in relevant sectors in the society.

The two-level structure of this mandate should be stressed. UNESCO is invited to act in certain specific areas, but to reflect on science ethics as a whole. Effective action “in relevant sectors in the society” requires both shared thinking within the terms of “a general ethical framework to guide scientific activity” and differentiated responsibilities consistent with diversified institutional competence.

The task of COMEST, similarly, is wide-ranging. In all areas of concern, COMEST is called upon to provide independent advice to UNESCO by formulating, on a scientific basis, ethical principles that can shed light on the various choices and impacts occasioned by new advances in scientific and technological fields, thus fostering a constructive ethical dialogue on the values at stake.

The general orientation of the present report was adopted following detailed discussion at an Extraordinary Session in November 2008 and successive drafts were considered at subsequent Ordinary and Extraordinary Sessions in 2009, 2010, 2011 and 2012.

At the 8th Ordinary Session, held in Bratislava, Slovakia, in May 2013, COMEST considered revision n° 3 of the present report and gave a mandate to the Science Ethics Working Group to finalize the report on the basis of an agreed detailed outline.

In parallel, COMEST has been closely involved with the UNESCO process to monitor and to consider the desirability of revising the 1974 Recommendation on the Status of Scientific Researchers. While institutionally separate from the present report, consideration of the desirability of revising the 1974 Recommendation raises many of the same ethical issues as those associated more generally with science governance and the science-society relationship.

[3] Document 175 EX/14, p. 7.

At its 6th Ordinary Session (Kuala Lumpur, Malaysia, June 2009), COMEST adopted a recommendation on the subject, concluding that, while still valuable, the 1974 Recommendation fails to deal with certain major issues of contemporary concern and does not, by itself, provide a fully adequate framework for the adoption by Member States of appropriate policies. The recommendation was duly noted by the UNESCO Executive Board and informed Member States' discussions on the issue in 2011 and 2012.

Subsequently, COMEST was also associated with the Preliminary Study on the Technical and Legal Aspects Relating to the Desirability of Revising the 1974 Recommendation, which was prepared by an Ad Hoc Expert Group including six individual members of COMEST. At the 8th Ordinary Session in 2013, COMEST considered and endorsed the draft Preliminary Study, on the basis of the final version of which the General Conference decided in November 2013 that a process to revise the 1974 Recommendation should be initiated.

## II. INTRODUCTION: THE SCIENCE-SOCIETY NEXUS

"Science ethics" refers to the principles according to which scientific activity should be conducted and to the mechanisms by which conformity to such principles is promoted, fostered or ensured.

An ethical approach to science is not an external imposition. On the contrary, the quest for knowledge and understanding incorporates essential ethical values, such as integrity, truth and respect for reasoned argument and evidence. There is therefore a strong sense in which the criteria for what counts as "good science" are, in part, ethical. While they remain the subject of epistemological and sometimes political controversy, such values are universal in the thin sense that they command broad acceptance, at a general level, across disciplinary, national and cultural boundaries. They have, indeed, been explicitly recognized in international normative instruments, which are precisely premised upon agreement on common rules – based on values but not reducible to them – in the context of background disagreement about fundamental principles and values. There is, on the other hand, no consensus on what such rules mean in detail and how they should be applied to specific circumstances. The idea of science is compatible with multiple interpretations of what it entails, and diversity is therefore indispensable in the practical implementation of science ethics.

Even in the absence of any disagreement about the nature of "science", the practical pressures under which it is conducted cannot guarantee that the ethical values of honest inquiry always be recognized or honoured. Furthermore, public support for science depends on the perception that knowledge is not only pursued diligently and impartially for its own sake, but also contributes to broader human needs or well-being. Science thus connects to external values that neither clash with nor simply duplicate its own internal logic.

The field of science ethics is broad and in some respects controversial. It concerns not just professional scientists but also all those with responsibility for research policies and the communication of scientific knowledge to relevant audiences. It is thus considerably broader than "research ethics", which refers only to one specific area of professional conduct. The wider group of responsible stakeholders includes UNESCO, in pursuance of its established normative mandate, but also states, with respect to the implementation of internationally agreed principles, and entities such as professional associations, universities, academies and funding bodies, without which ethical principles cannot be embedded in routine scientific practice.

The thematic and disciplinary scope of science ethics is also broad. As defined by Article 1(a)(i) of the 1974 Recommendation on the Status of Scientific Researchers, science "signifies the enterprise whereby mankind, acting individually or in small or large groups, makes an organized attempt, by means of the objective study of observed phenomena, to discover and master the chain of causalities". There might be scope for debate whether this view of science extends to the human sciences, where the notion of "causality" may not be appropriate. In addition, current debates in epistemology might call into question the kind of "objectivity" taken for granted in 1974. Nonetheless, the emphasis on science as a socially organized activity characterized by its structures and procedures ensures that the definition is inclusive with respect to the many different ways of doing science.

Article 1(a)(i) of the 1974 Recommendation further stresses this point by adding two additional features to the definition. First, science "brings together in a coordinated form the resultant sub-systems of knowledge". The various *sciences* are thus explicitly components of *science*. Secondly, science provides humankind with knowledge that it can use "to its own advantage". No definitional line is drawn, therefore, between science and technology or between basic and applied science. Finally, Article 1(a)(ii) explicitly states, for the avoidance of doubt, that "The expression 'the sciences' (…) includes the sciences concerned with social facts and phenomena", at least in so far as they comprise "a complex of fact and hypothesis, in which the theoretical element is normally capable of being validated".

The structure of this report reflects the concerns summarized above. Its purpose is not primarily to consider the basic ethical principles by which science should be guided, since these have already, to a large extent, been enshrined in international normative instruments. Reflection on principles should therefore proceed with a view to clarifying, and where necessary extending, the existing ethical framework. Principles, however, have little weight if they are neither implemented nor embedded in routine scientific practice. In addition to long-standing implementation gaps, there may be new challenges that put specific pressure on ethical scientific behaviour. It is on making ethical principles real, with due sensitivity to the contemporary context of science, that this report concentrates its attention.

The report considers first (section III) the context within which questions about science governance and the science-society nexus arise, emphasizing the challenges that stem from contemporary changes in the institutional dynamics and social setting of science, as well as in prevailing public attitudes. While there is an extensive existing basis of principles, some enshrined in authoritative and consensual statements by the international community, they are not in all respects up to date and directly applicable and require, at the very least, systematic critical consideration.

In section IV, the report proposes a framework for thinking about the relationship between science and society that identifies key issues, reflects on the – existing or new – principles that may be mobilized to address them, and suggests some directions in which practical action could be taken to support a relationship more consistent with the fundamental ethical principle that all human beings have the right "freely … to share in scientific advancement and its benefits" (Universal Declaration of Human Rights, article 27).

Comprehensive practical action entails a coherent conception of science governance, including such questions as identification of stakeholders and of their appropriate roles, basic institutional principles, mechanisms for reflexive monitoring, and guiding objectives and values. While, in practice, the relationship between science and society unfolds within a system of governance that is to a large extent predetermined – although it remains open to adjustment and even fundamental reform – the importance of objectives and values suggests that it is more productive for analytical purposes to regard governance as responding to an ethical vision for the relationship between science and society. Governance issues, while implicit throughout the report, are therefore considered systematically in section V.

Section VI, finally, draws conclusions from the analysis and offers specific recommendations for action that could enhance science governance and improve the relationship between science and society, focusing in particular although not exclusively on measures that could be implemented through UNESCO programmes.

## III. CHALLENGING NEW DYNAMICS

Science and technology are currently in a process of rapid change. Change relates to areas of research that offer the potential for powerful new interventions in the fabric of matter and of life, with possible world-changing applications. In addition, however, change is institutional and social. Forms of academic and scientific organization established in the 20th century have been reshaped and in some respects transformed. What it means to be a scientist in 2013 is not what it meant in 1933 or even 1973. And cultural meanings and social understandings of science have themselves shifted, in part for very familiar reasons related to the 20th century development, through the deployment of science and technology, of weapons of mass destruction, but in part also for broader and more elusive social reasons that have to do with changing notions of authority and with the erosion, at least in Western Europe and North America, of the post-religious distinctively modern faith in science.

These far-reaching changes have major ethical implications. While they do not render obsolete the basic ethical principles of integrity, impartiality and orientation towards human benefit, they do raise new questions about what they mean in practice and how they might be enshrined in workable institutions. Some such challenges derive from issues that have recently acquired enhanced relevance to the international community, e.g. in the various areas covered by environmental ethics, particularly in light of the very broadly applicable principle of sustainability.

In addition, they point to possible limitations: issues that can be dealt with adequately only by developing principles that are to some extent new. Among scientific and technological advances that appear to undermine or destabilize existing ethical principles or mechanisms, nanoscience and the various forms of nanotechnology deserve mention, especially in so far as they may converge with other areas of scientific and technological development, such as in the life sciences and in information technologies.

Among the issues that require consideration in this regard is the public distrust of science that is currently central to science governance – especially but not uniquely in Europe. The precautionary principle, at least as often called upon in public debate, is an example of a concern framed in ethical terms that relates to real practical concerns but at the same time reflects a background fear of science. The social dynamics of the debate on “human enhancement” also reflect fear of science as well as concerns about specific misuses of technology.[4] This climate of suspicion, which may even, on occasion, be expressed by violence against scientists, favours a prohibitive approach to science governance, as shown for instance by attitudes towards geo-engineering, dual use research of concern, particularly in the life sciences, and certain areas of the cognitive sciences. The question of equitable access of all to the benefits of science, which is of core ethical significance, is raised in particularly stark form by the potential for radically new applications in such areas.

The notion of “technoscience” is helpful in making sense of these trends. It aims at summarizing a new paradigm of science and its relation to society that entails a

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[4] Much of this debate derives from a seminal report published by the US National Science Foundation in 2002. The book version of the report is Mihail C. Roco & William Sims Bainbridge. *Converging Technologies for Improving Human Performance: Nanotechnology, Biotechnology, Information Technology and Cognitive Science*. Dordrecht: Kluwer Academic Publishers, 2003. The US National Science Foundation itself published a report in 2009 on *Ethics of Human Enhancement: 25 Questions & Answers* [available online at http://ethics.calpoly.edu/NSF_report.pdf].

growing orientation of science – and of public thinking about science – towards technological applications. At the same, science is more complex and specialized and involves greater levels of uncertainty. Technoscience is also more global, more economically oriented and more privatized than more traditional modes of organization of knowledge production.

Alongside these social dynamics are the governance challenges that arise from the globalization of science. The need for global governance of science is both clear in principle and poorly defined in practice, as exemplified by the success and limitations of a body such as the Intergovernmental Panel on Climate Change. Furthermore, it is no longer realistic to envisage science governance, whether at national or global level, in purely technical, regulatory or policy-centred terms.

Further challenges derive from new conceptions of the role of science and technology in economic development, which have influenced both policies and institutional practices. Research – a notion that itself rearranges the distinction between science and technology – is now regarded as key factor of innovation and thus as a priority issue in economic competitiveness. As a result, research funding and the status of researchers are increasingly shaped by considerations of efficiency that are not directly related to the content of scientific activity itself. The tendency to more quantitative evaluation of individuals and institutions, which underpins the fashion for rankings, is in turn a direct consequence of this trend. Finally, issues of political control – which have never been absent from science and technology – apply to a much broader range of knowledge processes.

It is the comprehensive and far-reaching nature of these new dynamics that calls into question both in principle and in practice the various forms of science-society relationship that emerged during the 20th century. The following sections provide more detailed analysis of some of the most significant.

### III.1 Scientific and technological change

Quite apart from the changing social and institutional context, the internal development of science itself is producing new ethical challenges. These may require new principles or refinement of existing principles. They may also, and perhaps are more likely to, require development of new mechanisms for the institutionalization of ethics that are adapted to a changed environment.

The key scientific changes tend to fall into three distinct but interrelated categories.

First, scientific and technological development throws up new objects that may have ethical implications. This possibility is most familiar from bioethics, but can also be generalized. For instance, it should at least be considered whether nanoscale manipulation raises specific issues even without reference to actual or hypothetical technological applications. Ultimately, one might ask whether the very definition of science adopted in the 1974 Recommendation on the Status of Scientific Researchers, as quoted in section II above, requires revision. The fact that such a conclusion would undoubtedly be premature at the present stage of scientific and technological development does not mean that the question should not be asked on an ongoing basis. Furthermore, while many aspects of this discussion are epistemological, it would be misleading to draw a rigid distinction between epistemology and ethics. In particular, the nature of knowledge relates closely to the responsibilities attendant on its possession. This relation will be discussed in more detail in section IV.

Secondly, and much more importantly in light of current concerns in public debate, scientific and technological development produces new capacities for action and therefore new risks of ethically undesirable consequences, whether intended or unintended. Examples are familiar and largely overlap with areas in which science and technology give rise to new fears and new expectations. The possibility that new technologies might, through deliberate use or accidental release, cause serious and irreversible harm calls for new forms of vigilance that affect both the burden and the standard of proof. In particular, it is a major challenge – exemplified by debates on genetically modified crops and foods and on atmospheric and electromagnetic pollution – to establish scientifically sound ways of dealing with public debates about competing unproven hypotheses that claim to demonstrate or to dismiss harmfulness.

Thirdly, as already noted in the previous section, new scientific and technological developments may reshape the professional landscape of science in ways that challenge established institutional ethics procedures. A relevant example in this respect is converging technologies: the reshaping of connections between areas of technology might undermine or destabilize existing ethical frameworks. For example, codes of conduct or ethical codes based on disciplines and enforced by disciplinary scientific associations might be rendered obsolete by people working in cutting-edge converging technology, whose work may escape existing normative frameworks or regulations. There is a need, therefore, to adapt on an ongoing basis the institutional framework guiding scientific conduct in order to ensure that cutting-edge research is not escaping the purview of ethics. Adaptation at this level should be one important component of follow-up of international normative instruments such as the 1974 Recommendation on the Status of Scientific Researchers and the 1999 Declaration on Science and the Use of Scientific Knowledge. Action at a global level may be required to make scientists aware of their social responsibilities and to help Member States develop and implement mechanisms to inform about the pros and cons of such technological developments.

### III.2 Scientific integrity and social benefits in new social and institutional contexts

Science is a social activity, and not simply an epistemic one. To be a scientist is to be a certain kind of professional, and not simply to be the producer of a certain kind of knowledge. These points, which are familiar from the contemporary sociology of science, also follow directly from the definition adopted by the 1974 Recommendation on the Status of Scientific Researchers. The straightforward implication is that changes in the social or institutional context within which science is conducted have consequences for science and for scientific knowledge.

Many of the significant changes that have occurred in recent decades are a consequence of the considerable expansion of student numbers along with forms of globalization that have combined to erode traditional academic communities and self-understandings. While there are many positive aspects to this change, it has also undermined the historically constituted basis of scientific integrity without, hitherto, producing robust alternatives. The challenge is all the greater that any global standard of integrity now needs to incorporate a greater diversity of cultural practices and value systems than in the past.

Expansion and globalization have also coincided with growing commercial pressures, due to the movement towards privatization in some countries, greater pressure to rank and to evaluate researchers and institutions, public funding retrenchment in higher education and research, and the high profitability expectations associated with cutting-edge development, especially in the life sciences. One practical consequence has been a tendency towards contractualization of scientific research, with conditions attached that may conflict with traditional principles of open access and public benefit. Furthermore, it can be highly tempting, especially in the context of international cooperation, to engage it what has been termed "ethical dumping", i.e. locating activities deliberately in the jurisdictions where the lowest ethical standards apply, notably with regard to informed consent on the part of subjects and stakeholders.[5]

In so far as privatization may be one aspect of contractualization, it is unclear whether mechanisms for implementation of ethical principles can apply in the same way to privately funded and executed research as to research conducted in whole or in part within the public sector, but the challenge of institutional change should at least be recognized.

It is at least conceivable, therefore, that current modes of institutional organization of science, including such features as large-scale cooperation, capital-intensive "big science", confidentiality requirements and pressures on scientists to respond to evaluation-driven pressures, might tend to erode ethical standards. They certainly make it unrealistic to regard ethical science as something that can be achieved through, or even defined in terms of, purely individual attitudes and behaviour.

It is controversial whether the frequency and severity of scientific research misconduct – fabrication, falsification and plagiarism – and of questionable research practices have increased. The problems may, after all, be simply more extensively studied and investigated. Nonetheless, even the possibility that the institutional conditions in which science is conducted may be undermining science ethics is a matter for concern and deliberation. Further research is undoubtedly needed to improve knowledge not just of the nature and frequency of misconduct but also of the social and institutional conditions that encourage or discourage ethical conduct in science.

Finally, new expectations addressed to science point towards the need for a more expansive conception of science ethics.

One example is heightened expectations in connection with environmental issues, with respect to which science is called upon both to enable societies to understand the threats they face and to provide tools to counter such threats and to minimize their impact. From an ethical perspective, the much-discussed precautionary principle is exemplary of this new context.[6] Broader conceptions of risk and uncertainty are current within contemporary societies and create challenges not just for the predictive capacity of science but also for its ability to maintain public trust. While there is general agreement that science should take responsibility for its unintended consequences and contribute to sustainable development via the capacity of humankind to deal with ever more complex and long-range causal chains, it is unclear which specific responsibilities should be shouldered by which scientists or scientific institutions in this regard. These issues are of particular significance in developing countries, the territories of which include a large proportion of the natural goods (fauna, flora and mineral resources), the status of which as global public goods is a matter of debate.[7]

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[5] This issue is further discussed, with reference to the work of the OECD Global Science Forum, in section IV.3 below.

[6] Cf. COMEST, *The Precautionary Principle*, UNESCO, 2005.

[7] COMEST has considered these issues in detail with respect to climate in its reports *The Ethical Implications of Global Climate Change* (2010) and *Background for a Framework of Ethical Principles and Responsibilities for Climate Change Adaptation* (2013).

Science and technology are also expected to contribute to the achievement of key social goals and values. The expectations themselves are not new: science and technology have always been closely connected to the idea of "progress". However, their content has undoubtedly changed, first because progress is no longer taken for granted as an outcome of scientific endeavour, and secondly because the goals and values at stake are increasingly diverse, and perhaps contested. A particularly important area of debate is the relation between science and the economy. Concern that science stands in excessively close connection to economic values leads to questions about the ethically desirable relation between science and human values. In this respect, ethical issues in relation to science are closely connected to broader social issues about equity and inclusion.

These considerations relate directly to the status of scientific researchers, understood as the set of institutional mechanisms that can create the conditions in which, through individual commitment and conformity, science can operate consistently with its foundational values.

The trends described above have several potentially damaging implications, which may need to be counteracted by specific response measures. Scientists, especially in developing countries, may have limited control over their own intellectual agendas, which are set by the priorities of external funding agencies. Similarly, scientists everywhere may be hampered in pursuing research that does not fit into currently fashionable directions, whether defined thematically or in terms of scale and scope. "Big" science is indispensable in certain areas; it may be much less relevant in others. Finally, as noted above, the way in which research careers are evaluated is highly significant for the way in which science is actually done, and may bias intellectual activity in a number of ways.

Of particular significance in this regard is the role of expertise. In very practical terms, a scientific expert may be regarded as a scientist answering non-scientific questions – i.e. those raised by the policy process or in societal debate – on the basis of scientific competence. Whether some proposed measure is "safe" is a good example of the questions experts are requested or required to answer. Since in many cases the relevant standard of "safety" is external to the scientific knowledge, the expert is called upon to exercise judgement in a way that is scientifically grounded but cannot be scientifically validated. It follows that questions such as the nature of the expert's authority, who counts as an expert, and how expertise should be used, are *prima facie* indeterminate.

It should not be surprising, given these features of expertise, that issues of impartiality, uncertain responsibility and conflict of interest should be of such significance in contemporary societal debates about science and technology. This issue will be discussed in more detail in section IV.

### III.3 Tensions between private and public interests

A primarily public conception of science has long been dominant and has shaped science institutions in most countries. In this conception, of which the influential 1947 report *Science: the Endless Frontier* by Vannevar Bush was one powerful statement, the state has a leading role in setting priorities, in channelling funding and in establishing institutions to enable the internal dynamic of science to flourish. In playing its role, the state can also ensure that large-scale public projects of strategic importance are effectively implemented and their social benefits harnessed. While it would be a an exaggeration to regard the Manhattan project, which was unique, as a template for public science in general, it nonetheless served as a backdrop for the elaboration of a durable vision. The scientific institutions that emerged in the mid-20th century in most countries, including developing countries after independence, followed a similar generic pattern.

Within public science, the role of the private sector was not necessarily insignificant. However, it followed the same template and was based on similar epistemological and organizational principles. The major role of corporations such as IBM, Bell and Xerox in funding Nobel-level basic research is well-known.

In the last 30 years, this framing conception of science, along with the institutions and social representations attendant on it, has been profoundly transformed. Henceforth, in a context of relative public retrenchment, private corporations have a major role, in science as in other areas, in shaping processes, institutions and outcomes that may be inadequately regulated.

In addition, the shifting balance between public and private funding – which is just one major dimension of the change – has consequences for the institutional organization of research and for the status of researchers that require both better empirical assessment and enhanced ethical reflection. Among issues that might deserve detailed consideration in this regard are the freedom and autonomy of researchers; their employment rights, in particular at doctoral and postdoctoral level; the implications of project funding; and the consequences of competition between institutions, notably through rankings.

### III.4 Divisive globalization

Science does not function in isolation from other global trends that are tending to reconfigure and in some respects sharpen inequalities. A challenge for ethical thinking is thus to interpret general principles in light of social settings that hamper equitable benefit sharing.

In addition, in practice, the ethical framework for science does not really extend beyond the developed countries. Yet it is equally important to consider the status of researchers in the developing world.

It is important to emphasize, furthermore, that global divides do not operate just between countries, but also at the global level between a range of different actors, issue areas and processes.

With respect to the social sciences, the 2012 *World Social Science Report* noted a series of overlapping divides.[8] Many of these apply equally to the physical and life sciences, although the relation between lay and professional knowledge is undoubtedly different in the latter cases.[9] The list, and the comments below, may serve as a reminder of the complexity of the issues under consideration:

- geographical divides (the most familiar and obvious, although it is equally true that the geography of science has changed considerably over the past 20 years),
- capacity divides, including between institutions in the same country,
- unequal degrees of internationalization of knowledge production across disciplines and knowledge areas,

[8] International Social Science Council, *World Social Science Report. Knowledge Divides*. ISSC/UNESCO, 2010.
[9] For more systematic and geographically differentiated discussion, see the *UNESCO Science Report 2010. The Current Status of Science around the World*. UNESCO, 2010.

- disciplinary divides, in a context where significant moves towards transdisciplinary science are in evidence in certain areas,
- the divide between mainstream and alternative approaches,
- divides produced by the increasingly competitive nature of research, embedded in new management practices,
- divides between academics, policy-makers and society, which are among other things linguistic in nature,
- divides within societies with respect to their conceptions of science and attitudes towards its applications, which are in some cases (e.g. climate change, biotechnologies) highly polarized.

These divides need to be taken into account. Indeed, some of them are, for all practical purposes, inevitable. At the same time, those that are of ethical significance need to be overcome, or at least reduced, lest they preclude any serious realization of the human right to share in scientific advancement and its benefits. All of these divides are set within the broader context of globalization.

While many aspects of science governance remain national, and others are within the purview of specific institutions, such as universities and professional associations, it is increasingly necessary to consider certain aspects of science at a global level, particularly in light of ethical concerns. Poor coordination between ethical frameworks to promote science ethics heightens the risk, already noted in section III.2, of ethical "dumping", understood as strategic migration of unethical practices to the least demanding jurisdictions. Yet, in general terms, institutions for global governance of science, in so far as it may be necessary, are inadequately developed.

On the other hand, international, intergovernmental and multinational actors have a growing role in the funding of research, and thereby also shape its priorities and structures. Furthermore, such actors may exert a powerful influence over outcomes, and in particular the ways in which research is used, not least through the elaboration of rules on trade and intellectual property rights.

The challenges that arise from the globalization of science, technology and innovation are of several kinds. They are not so much thematically distinct from those discussed in previous sections, which apply at all levels, as institutionally specific.

The first set of challenges relate to regulatory gaps, in other words to issues that, because they cross boundaries and involve entities subject to different jurisdictions, end up escaping regulation altogether, either in the strictly legal sense that they are beyond the law, or in the practical sense that no effective mode of regulation is available. "Ethical dumping" to avoid informed consent requirements and other ethical safeguards has already been mentioned. There are also regulatory gaps that relate to intellectual property, to certain forms of experimentation (for instance, with respect to geo-engineering), and to health, safety and risk assessment (for instance, with respect to potential cross-border propagation of controlled substances).

A second, rather different set of challenges concerns policy issues such as priority setting, funding, evaluation, organization of public debate etc., which are not in the strict sense regulatory. While scientific practice is increasingly globalized, science policy remains primarily national, with some significant regional exceptions such as in the European Union. In which respects such absence of policy coordination might have ethical implications is a matter that deserves further discussion.

Governance of science must thus be conceived at several distinct and interlocking levels, including the much expanded group of states that are major actors in science and technology, the global and regional institutions with competence in various areas relevant to science governance, and non-state actors including powerful multinational corporations.

### III.5 Development ethics and social inclusion

Article 27(1) of the Universal Declaration of Human Rights has an inherently distributive character and thus bears directly on issues of social justice. Failure to give substance to the right to participate in science, on the basis of fair opportunities, and to enjoy the benefits of technology, constitutes a *prima facie* injustice as does, at a systemic level, failure to promote an institutional framework within which the right is likely to be realized.

While these considerations are abstract, they are given very tangible substance by contemporary forms of institutional organization of science and technology and by the interaction between the internal dynamics of scientific inquiry and social pressures thereon. As argued above, technoscience in the context of globalization impedes equitable benefit sharing in specific and ethically challenging ways.

Differential access to the scientific process and to the applications of technology thus leads to social exclusion within societies and to unequal development opportunities between them. Ethical consideration of development has a number of interlocking dimensions – including such areas as trade, finance and global governance – but the role of science and technology is of central significance, especially perhaps in the emerging areas of converging technologies. Furthermore, such technologies create the potential for new forms of social exclusion based on differential access to prosthetics, in an increasingly broad sense, which call for ethical consideration and perhaps, in due course, policy responses.

These issues go to the heart of science governance and the science-society relationship. They cannot be reduced to linear “applications” of science, but rather bring into play complex configurations of policy environments, commercial pressures and societal expectations that are value-laden and potentially value-transformative. They are thus inherently ethical.

## IV. AN ETHICAL VISION FOR THE SCIENCE-SOCIETY NEXUS

Science does not lack an ethical framework. On the contrary, its basic principles are well-established, and have been enshrined in numerous international documents, some with legal force, as well as a wide range of statements, codes, declarations and other frameworks adopted by institutional and professional communities.

However, it is arguable that, even with respect to the traditional challenges of taking seriously article 27 of the Universal Declaration of Human Rights, the science ethics framework is incomplete. It is in particular much stronger on issues of responsibility and integrity that are internal to scientific practice than it is on broader issues of the science-society relationship. Furthermore, many of the challenges discussed in section III correspond to gaps or limitations in the existing ethical framework. It is therefore true in general terms that science ethics does not currently have an up-to-date, comprehensive and consensus-based normative framework.

Since the existing international framework is incomplete and only partly operative, it is an open question whether established principles require development, expansion, refinement and perhaps even revision in light of changing circumstances or emerging ethical challenges.

There is a body of internationally agreed ethical principles for science, as thus broadly defined, that includes universal normative documents (e.g. the 1974 Recommendation on the Status of Scientific Researchers, the 1999 Declaration on Science and the Use of Scientific Knowledge); regional agreements (e.g. within the European Union and the African Union); and agreements on matters other than science ethics that include principles of direct relevance to science ethics (e.g. the 1992 Convention on Biological Diversity). While these principles are of continuing relevance, and provide valuable guidance for practical action to support a general ethical framework for scientific conduct, they are neither complete nor fully consistent. The extensive network of complementary principles adopted in professional or institutional settings helps to provide a more complete framework but, given their diversity and lack of coordination, such principles do not guarantee consistency. Furthermore, their authority typically does not extend beyond those individuals or institutions that have subscribed to them.

There is thus no comprehensive normative instrument that deals exclusively with science ethics and addresses all aspects of the subject. As a result, any attempt to analyze the existing normative framework must start from a disparate set of documents, adopted at different times and levels and for different purposes, and the content of which is not coordinated. For instance, the 1999 Declaration on Science and the Use of Scientific Knowledge makes no reference to the 1974 Recommendation on the Status of Scientific Researchers, even though they cover much of the same ground.

Unsurprisingly, the various components of the existing normative framework dovetail imperfectly. In some cases, different documents may overlap, with the result that distinct and possibly incompatible principles may apply to the same issue. In other cases, there may be gaps covered by none of a range of potentially applicable instruments. The likelihood of such gaps is increased by the dynamic of scientific and technological change, which, as argued in section III, redraws the boundaries of disciplines and scientific fields.

Furthermore, even considered in isolation, some normative instruments may appear dated or even obsolete. This affects not so much the general principles they state, which are as durable as the basic conception of science that underpins them, as the language in which they are expressed, the institutional setting they presume, and the mechanisms they are related to. The 1974 Recommendation on the Status of Scientific Researchers is particularly open to challenge in this respect, which explains the decision by UNESCO in November 2013 to initiate its revision.

Finally, certain issues of major contemporary relevance appear inadequately covered, at least by the 1974 Recommendation on the Status of Scientific Researchers, which, in particular, predates the notion of sustainability as currently emphasized in international thinking on environmental issues. In so far as sustainability is itself an ethical principle, involving responsibility for assessment of the impact of current choices on the unknown interests and values of future generations, this gap is an important one, that is only partly filled, with respect to science ethics, by the later provisions of the 1999 Declaration on Science and the Use of Scientific Knowledge or of instruments not specific to science ethics, such as the 1992 United Nations Framework Convention on Climate Change or the 1992 Convention on Biological Diversity.

While the principle of sustainability is uncontroversial as a general ethical principle relating to the satisfaction of human needs over time, it is important also to note that sustainable development constitutes a knowledge regime that goes considerably beyond its core. Sustainable development serves as a banner for scientists, as a source of international funding, as a new knowledge market, and as a basis for authority claims based on the (correct) observation that management of the global commons requires urgent attention. These questions take on much greater urgency and are reflected in different ways in developing countries, on the territories of which are to be found a major part of the “natural goods” (flora, fauna and mineral resources) that arguably constitute “global public goods”.

Principles that might facilitate ethical framing of such issues, in particular bioethics and environmental ethics, are available in various international statements and agreements that are not explicitly ethical in scope, such as the Millennium Development Goals. Such statements and agreements can help to identify principles that could contribute to a general ethical framework to guide scientific activity.

What this entails for science ethics at international level is the need to establish a basis for practical discussion, involving all relevant stakeholders and taking account of the very different levels at which ethics may call for institutionalization, on the new ethical developments that may be required by contemporary social pressures or by the internal logic of ethical deliberation itself.

The existing normative framework may be in some respects out of date, it may not be comprehensive, and it may be fragmented. Nonetheless, it is richly developed and offers an indispensable starting point for future development. In particular, it offers a series of specific connections between the general principles according to which science should be oriented and the design principles according to which scientific institutions should be set up. The analysis hereafter of the 1974 Recommendation on the Status of Scientific Researchers and the 1999 Declaration on Science and the Use of Scientific Knowledge serves to illustrate and support this claim.

The following sections offer some brief indications on the issues that need to be addressed in the elaboration of a more comprehensive and up-to-date normative framework for science ethics.

## IV.1 Analysis of existing normative instruments

### *IV.1.i 1974 Recommendation on the Status of Scientific Researchers*

Keeping in mind the general articulation between principles and institutions, the key substantive ethical principles of the Recommendation can be summarized quite simply.[10] They converge on the responsibilities incumbent on researchers as a corollary of the status afforded to them. The word "responsibility" occurs on numerous occasions in the Recommendation, and refers to several separate but connected issues.

- Responsibility to ensure that science serves the interests of humanity as a whole: "the full potentialities of scientific and technological knowledge [should] be promptly geared to the benefit of all peoples" (article 19).
- Responsibility of scientists to conduct themselves in accordance with high ethical standards: "effective scientific research calls for scientific researchers of integrity and maturity, combining high moral and intellectual qualities" (article 10). The availability of such researchers in turn depends on effective education, training and awareness-raising at all levels.
- Responsibility to respect accountability to the public, as a corollary of enjoyment of "the degree of autonomy appropriate to their task and to the advancement of science and technology" (article 8).
- Generic requirement of humane, social and ecological responsibility in research conduct (article 14 as quoted above), "social" responsibility being interpreted in terms of service to one's own country (article 9(c)) and of "community service" (article 11(b)).
- Specific responsibility to be "vigilant" with respect to the "probable and possible social and ecological consequences of scientific research and experimental development activities" (article 12(b)(iv)).

In generic terms, these general statements about responsibility appear to have enduring relevance. Nonetheless, the 1974 Recommendation is dated. Thus, the Recommendation takes for granted a primarily "public sector" framework for science[11] and assumes implicitly that the major threats from inappropriate scientific research or misuse of research results or scientific knowledge relate to the Cold War logic of the "arms race". Conversely, major issues of contemporary concern are not explicitly dealt with, although they may of course be adequately covered by the general principles enshrined in the Recommendation. Such issues include the public character of science, in terms of both the organization of its activities and access to its knowledge; post-Cold War security concerns; sustainable development, notably in the context of environmental threats; the relation of science to the dynamics of globalization; and the implications (especially ethical) of new forms of science and recent technological breakthroughs. In addition, contemporary concerns about gender inclusiveness are unsurprisingly absent from the text.

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[10] The full text of the Recommendation is accessible at: http://portal.unesco.org/en/ev.php-URL_ID=13131&URL_DO=DO_TOPIC&URL_SECTION=201.html.

[11] Although article 2 does explicitly extend the scope of the Recommendation to all researchers, irrespective of employment status.

Of particular significance is the fact that, while the exclusive emphasis on public science may have been reasonable in 1974, not least in terms of defining the responsibilities that specifically belong to Member States, many contemporary concerns relate to scientific conduct regardless of its institutional setting, and therefore appear to call for a framework that is less oriented towards research policies, broadly understood, and more focused on individual scientists and scientific communities. If so, while Member States would undoubtedly continue to have a key regulatory role, not least via their science and technology policies, a broader perspective on “codes of conduct” for scientists might be required, taking account of the full range of voluntary and mandatory professionally enshrined mechanisms for ethical regulation.

As a result, there is a two-fold challenge. On the one hand, implementation of the 1974 Recommendation, with its limitations, must be monitored as effectively as possible, since it remains a highly relevant statement of the intimate link between science policies and science ethics and since its basic ethical principles have lost none of their validity. On the other hand, ongoing reflection is required to ensure that the general ethical framework to guide scientific activity – which should include but cannot be limited to the 1974 Recommendation – is kept up to date and constantly connected to the concrete exigencies of science.[12]

### *IV.1.ii 1999 Declaration on Science and the Uses of Scientific Knowledge*

Given its limitations and the need to reflect on its continuing relevance, the Recommendation should also be considered in light of the 1999 Budapest Declaration on Science and the Uses of Scientific Knowledge, first adopted by the World Science Congress and subsequently endorsed by the UNESCO General Conference, along with the Action Plan addressing broad science policy issues adopted at the same Conference.

It is important to note, however, that the Declaration does not have the same normative status as the Recommendation and does not currently command universal respect. Furthermore, the Declaration is neither an application, nor an extension, supplement or replacement, of the Recommendation, to which it makes no specific reference. Nonetheless, the existence of the two instruments entails that a connection be established between them.

The Declaration has a similar ethical orientation to the Recommendation. However, it is updated substantively to take account of new concerns, including specifically “the growing complexity of the relationship between society and its environment”. In addition, it is unconnected to detailed institutional considerations, and it is premised upon a much broader understanding of the stakeholders of science. In addition, the Declaration addresses a number of issues outside the scope of ethics strictly understood that lacked prominence in 1974, such as globalization, the information and communication revolution, biodiversity and sustainability, gender balance, disadvantaged groups, and traditional and local knowledge systems.

The main ethical issues covered by the Declaration are as follows:

- science should be for the benefit of humanity as a whole (article 1) but, alongside its benefits, has led to “environmental degradation and technological disasters, and (…) contributed to social imbalance or exclusion”;

[12] In this respect, COMEST welcomes the resolution adopted by the UNESCO General Conference at its 37th session in November 2013 (37 C/Resolution 40) to initiate revision of the 1974 Recommendation.

- scientists have "a special responsibility for seeking to avert applications of science which are ethically wrong or have an adverse impact" (article 21) – a responsibility more specific and far-reaching than provided for in the Recommendation;

- a specific requirement is placed upon Member States to "establish suitable measures to address the ethics of the practice of science and of the use of scientific knowledge and its applications" (article 40), which goes beyond the background institutional framework of the Recommendation;

- "science curricula should include science ethics" (article 41), which reflects the emphasis in the Recommendation on education and training, but goes beyond it in giving "science ethics" intellectual autonomy as a sub-discipline, and not simply a topic.

The discussion in section III points to the need to consider together, within one ethical framework, a series of issues that are still often regarded as separate – even though existing instruments asset their connectedness. These issues are, in outline:

- the nature and purpose of science, considered internally as well as externally,
- the conduct of scientists,
- the policies and institutions that shape the way in which science actually operates,
- the role of the public in relation to science,
- the uses to which science is put.

Combining these issues points to a complex and multi-faceted nexus between science and society that constitutes the proper object of a comprehensive ethical approach to science. It should be emphasized that the science-society nexus needs to be considered in terms of values – not simply as an external, instrumental relation. Expansion of knowledge, development of self-understanding, enrichment of values – these are closely connected processes that correspond to the co-evolution of science and society.

This emphasis on co-evolution helps to avoid the common tendency to reduce the science-society nexus to questions of authority and control. Trust in science is of course important, as is democratic control of applications of science. However, they are complementary rather than opposed, and they do not between them exhaust the nexus.

Thus, globalization, the extension of virtual worlds, economic competition and the exponential growth of research and scientific publications are giving rise to new social attitudes towards science. To varying extent in different parts of the world, there is a new fear of science and of its complexity, at the same time as societal responses are driven by unverified information especially as vastly increased amounts of scientific information are now directly available to laypersons, without the traditional filters of scientific authority. Urgency tends to play a major role in societal debates about science, even when the research process itself is ill-equipped to deal with it. Furthermore, established notions of informed consent operate poorly at such levels, which dilute questions of ownership, involvement and impact.

Among principles or orientations that may be considered as the basis for an ethical vision are:

- extensions of the principle of responsibility, including but not limited to the precautionary principle (a new approach to risk assessment, taking account of scientific uncertainty and social constructions of risk);
- consideration of the social utility of scientific research – how to assess and what conclusions to draw from it, in particular from the perspectives of benefit sharing and justice;
- consultation of the public in the case of controversial scientific research, notably within the area defined above as "technoscience";
- possible bans on certain techniques (or possibly even research directions) in the name of shared social values (whether nationally or internationally);
- enhanced training and awareness-raising on ethics of science directed at scientists but also more generally at all those with a role with the societal organization of science.

One important contribution in this regard – which converges with COMEST's own reflections – is the work of the Committee on Freedom and Responsibility in the Conduct of Science of the International Council for Science (ICSU), which "does not attempt to dictate new universal norms and codes. ICSU's role is rather to provide an overall framework for reflection and debate".[13] The Executive Summary of the report makes the key point that "Individual scientists have a responsibility to conduct their work with honesty, integrity, openness and respect, and a collective responsibility to maximize the benefit and minimize the misuse of science for society as a whole", from which it follows that "A central aspect of ensuring the freedoms of scientists and the longer term future of science is not only conducting science responsibly but being able to publicly demonstrate that science is being conducted responsibly".

With this in mind, an ethical framework for the science-society nexus may be considered by reference to five main pillars, which are explored in more detail in the following sections:

- bridging and reducing knowledge divides,
- promoting integrity and responsible research and innovation
- integrating agendas,
- ensuring public participation and rethinking expertise,
- producing and sharing benefits.

### IV.2 Bridging and reducing knowledge divides

At the most general level, based on article 27(1) of the Universal Declaration of Human Rights, access to scientific information may be regarded as a human right. The benefits of scientific advancement could, conceivably, be shared equitably while science remains under the restrictive control of certain social groups, corporate entities or states. However, the Declaration specifically refers not just to the benefits but to scientific advancement itself. This implies equitable participation in the global community of science, and therefore a fair basis for access to scientific information.

What this entails in practice is less clear-cut, particularly as several distinct issues are involved, including the distinct intellectual property regimes of copyright and patent and the controversial application of the latter to scientific discoveries, mobility of scientific personnel, and confidentiality for research considered sensitive by its funders. The 1974 Recommendation on the Status of Scientific Researchers does state explicitly "that open communication of the results,

[13] *Freedom, Responsibility and Universality of Science*, ICSU, 2008.

hypotheses and opinions – as suggested by the phrase 'academic freedom' – lies at the very heart of the scientific process, and provides the strongest guarantee of accuracy and objectivity of scientific results".[14] Similarly, and more vaguely, the 1999 Declaration on Science and the Uses of Scientific Knowledge does enshrine "the importance of total, unrestricted access to scientific research and education and to information and data" (article 16). The institutional implications are, however, left unspecified except with respect to the right of scientists to publish their work.

Clarification of such matters is an important issue for science ethics. Contemporary challenges such as changing modes of publication, new commercial and security pressures, evolving technologies, etc., are redistributing the conditions of access to scientific information in ways that risk creating new barriers detrimental to developing countries even as they remove some traditional obstacles to the circulation of scientific information. In order to clarify debate, appropriate distinctions should be made between the processes by which information is *produced*, within the scientific process itself, *disseminated*, through both scientific and general media channels, and *used*, through technology in its various forms.

Further discussion of open access principles for publications and data, which are one institutional response to knowledge divides, is proposed in section V.2 below.

### IV.3 Promoting integrity and responsible research and innovation

Numerous institutions are actively engaged in considering how the contemporary challenges sketched in section III above bear on the core scientific value of integrity and on the long-standing concern to ensure that research and innovation operate in responsible ways that take full account of societal impacts, broadly understood. For the purposes of this report, what is important is less to propose alternative or overarching frameworks than to underline the value of multi-stakeholder dialogue to ensure coherence between existing and emerging frameworks along with reasonably shared perspectives on what the values of integrity and responsibility entail in contemporary settings. In the context of globalization, neither the dialogue nor the shared perspectives can be taken for granted.

The work of the OECD Global Science Forum (GSF) is of direct relevance in this regard, since it was premised on the ethical gaps and discrepancies that may emerge in global science, to the detriment of professional and institutional incentives towards integrity and responsibility.

In 2007, a workshop was organized in Tokyo by the GSF and the Ministry of Education, Culture, Sports, Science and Technology of Japan (MEXT) to explore ways of dealing with allegations of misconduct, and to extract lessons learned and good practices. Among the findings of the workshop was that misconduct in international collaborations represents a major challenge, as the principles, definitions, rules, and procedures may differ, or be absent, in the collaborating countries, complicating efforts to deal with the allegations in a rapid, complete, confidential, and fair manner. Among the conclusions was therefore a recommendation to strengthen contacts among the responsible national officials, to foster exchange of information, assist one another in promoting integrity, and

[14] The quotation marks around "academic freedom" are in the original text.

consider ways of harmonising principles and procedures across national boundaries.[15]

In response to this recommendation, the GSF Co-ordinating Committee for Facilitating International Research Misconduct Investigations brought together research funding and evaluation bodies from a number of OECD countries to consider the practical issues raised by addressing research misconduct in the contemporary context.

Emphasizing the very practical institutional issues involved in investigating research misconduct allegations in international collaborative research projects, the Co-ordinating Committee adopted a "Practical Guide", annexed to its report, which incorporates a fundamental set of principles, guidelines and suggested procedures for conducting international research misconduct investigations, which could be adopted by those putting together international projects.[16]

One outcome of the work conducted in the OECD Global Science Forum was the Second World Congress on Scientific Integrity, which was held in Singapore in July 2010. The Congress adopted in draft the Singapore Statement on Research Integrity, which was subsequently finalized and published after further consultation.[17] The Statement is based on four basic principles:

- *Honesty* in all aspects of research
- *Accountability* in the conduct of research
- *Professional courtesy and fairness* in working with others
- *Good stewardship* of research on behalf of others

Parallel work was done, with many of the same stakeholders, in the context of the European Science Foundation Member Forum which, together with the All European Academies (ALLEA) produced the consensus document "The European Code of Conduct for Research Integrity", launched at the Second World Conference on Research Integrity. The code addresses good practice and bad conduct in science, offering a basis for trust and integrity across national borders.[18] The ESF Member Forum has also developed guidelines for setting up national structures to foster and supervise research integrity.[19]

The code is intended to offer a reference point for all researchers, complementing existing codes of ethics and complying with national and European legislative frameworks. It is not intended to replace existing national or academic guidelines, but represents agreement across 30 countries on a set of principles and priorities for self-regulation of the research community. It is proposed by its sponsors as providing a possible model for a global code of conduct for all research.

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[15] OECD Global Science Forum, *Best Practices for Ensuring Scientific Integrity and Preventing Misconduct*, November 2007.
[http://www.oecd.org/dataoecd/37/17/40188303.pdf]

[16] OECD Global Science Forum, Co-ordinating Committee for Facilitating International Research Misconduct Investigations. Final Report, submitted by the Delegations of Canada and of the United States, OECD, May 2009
[http://www.oecd.org/dataoecd/29/4/42713295.pdf].

[17] Information on the Congress and the Statement is available at http://www.wcri2010.org/index.asp.

[18] Source: http://www.esf.org/activities/mo-fora/research-integrity.html.

[19] *Fostering Research Integrity in Europe*. Report by the European Science Foundation Member Organization Forum on Research Integrity, ESF, 2010.
[http://www.esf.org/index.php?eID=tx_nawsecuredl&u=0&file=fileadmin/be_user/CEO_Unit/MO_FORA/MOFORUM_ResearchIntegrity/ResearchIntegrity_report_finalpublished.pdf&t=1318341450&hash=66c6687642b2ee6928a560907f7e6889975ef092]

For the purposes of the code, the term “research misconduct” embraces many things, including insufficient care for the people, animals or objects that are the subject of or participants in research; breaches of confidentiality, violation of protocols, carelessness of the kind that leads to gross error and improprieties of publication involving conflict of interest or appropriation of ideas. Many of these unacceptable research practices are addressed in the European Code of Conduct for Research Integrity.

The European Commission has also been strongly engaged in these areas, both through the procedures established for its own research activities and through its promotion of a model of responsible research and innovation that reflects the broad range of concerns summarized in this section, along with the aspiration that the European Union play a leading role in responding to them.[20]

### IV.4 Managing risk

There is a well-documented tendency to over-simplify issues of ethical concern in ways that make them difficult to address, for instance by splitting technical assessment, cost-benefit analysis and ethical scrutiny. One negative effect of this approach is to make ethics an external constraint on techno-social choices, whereas ethics should be regarded as a constitutive feature of them.

With this in mind, it is important to engage in reflection on the application of the language of risk and uncertainty to scientific and technological issues that have been framed by the existing normative framework in terms of “dangers”, taking account of and extending the previous work on the precautionary principle, with the objective of clarifying the “vigilance” required of scientists with respect to possible misuses of science.

### IV.5 Ensuring public participation and rethinking expertise

The Executive Summary of the ICSU report on *Freedom, Responsibility and Universality of Science* correctly notes that “There is an increasing recognition by the scientific community that it needs to more fully engage societal stakeholders in explaining, developing and implementing research agendas”. Furthermore, what is true of research agendas is even more applicable to technological applications, which may have very direct, albeit poorly recognized, impacts on human health and well-being.

On the other hand, establishing adequate procedures for public participation in areas of sometimes great technical complexity is by no means straightforward. Experience in many national and institutional settings shows that debates that are poorly prepared and configured may simply become adversarial forums in which polemical positions are taken, thereby precluding any serious public scrutiny of choices that need to be taken – sometimes urgently – about issues that fall, or may be considered by some as falling, within the regulatory competence of states.

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[20] In brochure format, the EU position is stated in http://ec.europa.eu/research/science-society/document_library/pdf_06/responsible-research-and-innovation-leaflet_en.pdf.
A more analytical approach is provided in the 2013 report *Responsible Research and Innovation. Options for Strengthening Research and Innovation*.
[available online at http://ec.europa.eu/research/science-society/document_library/pdf_06/options-for-strengthening_en.pdf]

In order to address these issues, it is important to reflect, *inter alia*, on the question of lay competence and on the issues relating to the establishment of "hybrid" forums for multi-stakeholder discussion of ethical challenges. In this respect, the problem is not just the narrowness of expertise but also its sometimes partisan character.

The conceptual and practical challenge is to avoid establishing a clash between public participation and expertise, as if the role of the public could be enhanced by downgrading the indispensable role of experts. This is a key area where the role of ethics requires enhancement in both reflection and institutional procedures. Far from being a decorative commentary, ethics has an integral role to play in science as a societal process because it provides the critical and reflexive equipment with which pressing questions can be formulated.

### IV.6 Producing and sharing benefits

The general question of benefit sharing has already been referred to (section III.5 above), and the overarching ethical principle that applies to it, derived from article 27(1) of the Universal Declaration of Human Rights, is well-established and widely recognized.

Applications in specific areas, on the other hand, raise issues that require further consideration. The example of nanotechnologies is instructive in this regard.

Nanotechnologies are still in an early stage of development and there are still opportunities to be prospective and anticipatory in identifying ethical issues that may emerge. In addition, the impact of nanotechnologies is global. As industrial and commercial development proceeds, the focus is gradually moving from possible technological futures, with a view to better understanding of the scientific potential and possible societal impact of new developments, to the regulation of conduct in areas of science where cutting-edge agendas are already being pursued. Thus, to take just one interesting example, the European Commission Recommendation on a Code of Conduct for Responsible Nanosciences and Nanotechnologies Research[21] specifically calls upon research funding agencies to refrain from funding research in certain supposedly problematic areas and, explicitly or implicitly, calls upon "responsible" researchers to abstain from engaging in such research. This exemplifies the connection between ethical concerns about science and technology and science ethics in the strict sense. However, the practical emphasis on nanotechnologies should not be interpreted as a statement that this area is of unique or overriding importance from an ethical perspective.

Earlier work of COMEST emphasized state-of-the-art review and conceptual development,[22] awareness-raising[23] and reflection on policy implications.[24] Noting that the invisibility and rapid development of nanotechnologies, their possible military and security uses and global impact, and the risk of a "nano-divide" between the developing and developed countries, give rise to specific ethical concerns, COMEST pointed to four areas of action: articulating an ethical framework, awareness raising, ethics education, and research and development policies. Nanotechnologies should be regarded, in this respect, not as a *sui generis* area calling for development of an *ad hoc* ethical framework, but rather as

[21] Adopted in February 2008. EC Document C(2008) 424 final.
[22] Henk T.A.M. ten Have (ed.), *Nanotechnologies, Ethics and Politics*. UNESCO Publishing, 2007.
[23] *Ethics and Politics of Nanotechnology*. UNESCO, 2006.
[24] *Nanotechnologies and Ethics: Policies and Actions*. UNESCO, 2008.

one set of issues to which a general ethical framework to guide scientific activity needs to apply. Conversely, science ethics principles developed to address specific features of nanotechnologies should be considered as *prima facie* applicable to other areas with similar background features. Many such areas, including the general field of “convergence”, imply overlap between science ethics and other areas, including particularly bioethics. Effective management of such overlap calls for recognition of the institutional specificity of bioethics, which is not within the competence of COMEST, alongside with appropriate collaboration, especially between COMEST and the International Bioethics Committee, with respect to science ethics as applied to professional conduct in the life sciences.

## V. FULFILLING THE VISION: ETHICAL GOVERNANCE OF SCIENCE

The need to embed ethics in routine scientific practice establishes a strong connection between science ethics and science policies. The integrity and credibility of science do not depend solely on the values, attitudes and behaviour of individual scientists. There are crucial background institutional conditions, defined in particular by science policies, for which individual scientists cannot be held responsible.

Ethics is therefore not just a matter of principles, but also of governance. At national level, ethical institutions and mechanisms may need strengthening, especially in developing countries. Action may also be required to address gaps in international coordination at regional and global level. In order to reflect on what might need to be done, it is important to clarify what the global governance might entail and what its ethical features might look like.

In general terms, science governance depends on answers to three interrelated questions:

1. How to build response to key social needs – or, more generally, promotion of human well-being – into science policies, in the differentiated ways appropriate to the various levels at which the interface operates (priority setting and programming, funding, higher education, institutional design in research systems, etc.)?

2. How to weave together the necessary autonomy of science, which is internally connected to its integrity, with accountability and with responsiveness to externally generated priorities? This is of course a tension, not a clash: scientists as citizens may well share the externally generated priorities, but cannot be assumed or required to do so.

3. How to channel the results of science into a policy process that can actually address social needs and thereby produce the intended outcomes by which it is legitimized?

Adequate answers to these questions may be expected to have positive, mutually reinforcing effects on both the conduct of science itself and public understanding of and attitudes towards science. In turn, such positive effects serve as favourable preconditions for more dynamic science backed and effectively utilized by more vigorous policies.

Among the key issues to be addressed within a framework for global governance of science are science divides (notably in relation to development) and the related capacity-building challenges, private-sector science, research policies, and applications of science to concrete policy issues. The challenge in this regard is not to establish some kind of global regulatory mechanism but rather to facilitate cooperation, interchange, coordination etc. of existing mechanisms and across disciplines in order to improve the effectiveness of ethical frameworks that already exist.

The existing normative framework implies a pluralized and "distributed" model of ethics in which multiple sites with distinct logics combine to promote and entrench ethics at all levels of scientific conduct. For present purposes, six levels of ethical institutionalization may be distinguished:

- international normative standards and indicative ethical frameworks;

- national legislation and regulations;
- national ethics committees and similar bodies;
- institution-specific processes, including employment contracts and institutional ethics committees;
- ethics education and training, including the full range of awareness-raising activities;
- the various issues relating to dissemination and circulation of scientific information, including in particular the ethical aspects of publication.

It is important to consider which levels of action should be emphasized, and which institutions should take responsibility for them. This connection between the normative framework and the institutional mechanisms discussed in the following section is essential to an adequate concept of governance.

In this context, ethical consideration of governance points in two directions that are at once complementary and potentially in tension.

On the one hand, in principle, governance should be rule-based, otherwise it is unlikely to be inclusive or equitable, given the strategic significance of science and technology in the contemporary world. Rule-based governance requires a degree of inclusion from day-to-day political debate and lends itself naturally to an emphasis on expert knowledge. Ethics, in so far as it is based on explicit principles, also has a natural affinity with rule-based governance.

On the other hand, democratic deficits are very visible in the areas of science and technology, and in principle call for stronger public engagement and thus a more process-based than rule-based approach to governance. Obviously, such an approach further calls for a pluralistic understanding of knowledge and expertise that leaves open the possibility that laypersons might have much to contribute even to highly technical discussions. In this perspective, ethics still has an important role to play, but less as a technique of adjudication (applying general principles to specific cases) and more as a shared language of justification.

The tensions between these two perspectives are real, but should not be exaggerated. Rules also require processes in order to be interpreted and implemented, and conversely processes can operate effectively only if they can rely on (second-order) rules.

Furthermore, the two directions should not be interpreted simplistically as a clash between governance by science and governance by public opinion. Democracy is not merely about majority rule, but at least as much about protecting the rights of minorities. It is essential, therefore, to create institutional mechanisms that give poor countries and poor people a voice in the process of global governance as well as within each jurisdiction. Even if they cannot shape decisions, they have a right to be heard.

In addition, wherever existing rules constrain autonomy or choices in the pursuit of development, there may be a need for the equivalent of an escape clause. Such a provision to opt out of obligations enshrined in international rules, without having to forsake rights, would provide countries that are late-comers to development with the requisite degrees of freedom in the national pursuit of development objectives. It is important to recognize that in democratic situations, exit has as much significance as voice.

### V.1 Open access

Publication issues are of great significance in this respect, and ongoing debates about open access deserve careful ethical consideration. This will be facilitated if open access is not regarded, as it sometimes is, as an intellectual property regime. In fact, open access says nothing about copyright or its absence. In addition, it should be noted that the phrase "open access" does not prejudge how such access is to be ensured and how it affects the scientific information available. Commercial open-access models effectively shift part of the cost of publication from the reader to the author, while typically maintaining traditional quality control. Whether, on balance, such a move favours or hampers the equitable participation of developing-country scientists in global science is a question that would require careful study. Non-commercial open-access models tend to require third-party funding and may also entail reduced quality control. The distributive implications, again, are not clear-cut. Finally, the Internet is itself a medium of publication, and not simply of dissemination of published material. However, while self-published information may be "open-access" for the reader, it may not have the same scientific status as other information available through the same medium. Whether the indiscriminate nature of information available via Internet raises ethical issues is another matter for careful consideration.

However, no consideration of access to scientific information that focuses exclusively on modalities of publication can be regarded as adequate. Open access to published material does not and cannot ensure effective access to unpublished material or to data and other background information, which may be more important for availability than the written-up version of the results. Nor is this concern merely abstract. It is well known that commercial funding of research – which is of growing significance in many areas, including in particular the life sciences – may involve contractual limitations on publication of results. Similarly, editors of scientific journals have expressed major concerns about the difficulties in reviewing papers in the absence of the data on which they are based, and have in some cases introduced requirements to make available such data to referees, typically on a confidential basis. It is therefore equally important to reflect ethically on what should be published – and how – and on access to resources such as data that are not in any strict sense publishable.

### V.2 Codes of conduct

The issue is less to develop *an* "ethical code of conduct for scientists" (in the singular) than to develop appropriate (plural) ethical standards and mechanisms for the regulation of scientific conduct with due regard to the diversity of (national, disciplinary, etc.) situations and to the fact that not all regulation is or should be within the competence of Member States. The emphasis on a participatory process involving scientific communities and other stakeholders follows directly from this requirement. One implication is that State-level monitoring of implementation would be inadequate if not supplemented by monitoring at a more general level of the multiple processes by which ethical principles for science are institutionalized. There is a place for regulation as for exhortation, for labour contracts as for professional standards, for national uniformity as for institutional specificity.

### V.3 Status of scientific researchers

The question of the "status" of scientific researchers, as elaborated in the 1974 Recommendation on the Status of Scientific Researchers, is of considerable significance in terms of the vision of an ethical governance of science.

The drafters of the Recommendation were, to quote the preamble, “Persuaded that [concrete action for the introduction and pursuit of adequate science and technology policies] can considerably assist in the creation of those conditions, which encourage and assist indigenous capability to perform research and experimental development in an enhanced spirit of responsibility towards man and his environment”. As discussed above in section IV.1.i, they thus sought to combine in one document considerations on science ethics and on science policies that sketch a strong framework to support science for society.

The idea that the status of scientists – as professionals and as citizens – is closely related to the position of science within society is based on consideration of the institutionalized and professionalized nature of modern science, which connects its fundamental values to its practical modes of organization. The 1974 Recommendation proposes the following definition in this regard: “The word ‘status’ as used in relation to scientific researchers signifies the standing or regard accorded them, as evidenced, first, by the level of appreciation both of the duties and responsibilities inherent in their function and of their competence in performing them, and, secondly, by the rights, working conditions, material assistance and moral support which they enjoy for the accomplishment of their task.” (article 1(e)). Such structural features connect to science ethics as the institutional background that makes ethical science possible.

Ethical science thus requires a certain mode of institutionalization of which professional, adequately trained, permanent and secure researchers are an essential component. It follows that monitoring the status of scientific researchers is not a task tangentially connected to ethics, and perhaps better conducted in an alternative framework of assessment of national research systems, but on the contrary a core task of science ethics. Indeed, the weakness of a research system, in terms of the standard variables by which it can be characterized (policies, resources, scientific performance, response to social needs, interdisciplinary networking), may be expected to correlate strongly with the likelihood of unethical behaviour within it. This entails a distinctive perspective on ethics. Ethical behaviour should not be seen as a form of “heroism”, accessible only to people who are for whatever reason “virtuous”. Rather ethics is something to be “routinized” by capacity-building that embeds it in the ordinary institutional structures of science.

Conversely, as discussed in earlier sections of this report, the intimate link between science policy and science ethics precludes subjection of science to ethical perspectives not derived from the logic of science itself. The purpose of an ethical approach to science is not to block scientific progress or to regulate scientific activity but on the contrary to allow them fully to flourish.

However, while the overall scope and purpose of the 1974 Recommendation remain valid, its detailed institutional content is no longer capable of providing concrete and effective guidance for an ethical governance of science that affords an appropriate status to professional scientists.

When invited to express a view on this point, COMEST adopted at its 2012 Extraordinary Session a recommendation on the desirability of reviewing and updating the 1974 Recommendation, which expressed concern that it is insufficiently recognized as a source of ethical guidance for science policies, and shared the view expressed by certain UNESCO Member States, and noted by the Executive Board at its 189th session, that “the 1974 Recommendation … might be more effective if revised, supplemented or replaced by an updated framework taking account of contemporary ethical and regulatory challenges relating to the governance of science, possibly on the basis of the principles expressed in the

1999 Declaration on Science and the Use of Scientific Knowledge and in the 2005 Universal Declaration on Bioethics and Human Rights".

On this basis, COMEST emphasized four specific points:

1. Despite its enduring value, the 1974 Recommendation suffers in certain important respects from outdated language and from an excessively narrow framing that excludes or underplays important issues of contemporary concern, including but not limited to gender, environmental responsibility, the role of the private sector and of military research, the globalization of science and technology, and the impact of new information technologies.
2. Revision of the 1974 Recommendation would be desirable. If successfully completed, a revised Recommendation would provide a powerful and relevant statement of science ethics as the basis for science policies that would favour the creation of an institutional order conducive to the realization of article 27(1) of the Universal Declaration of Human Rights.
3. However, no steps taken to review or update the 1974 Recommendation on the Status of Scientific Researchers, including preliminary consultation thereon, should have the effect of qualifying or limiting the validity or applicability of the existing text. On the contrary, consistently with the decision taken by the Executive Board at its 189th session, UNESCO Member States should be urged to give due consideration, in their national science policies, to the general principles propounded in the existing 1974 Recommendation.
4. In consultations regarding the possible updating of the 1974 Recommendation, alongside reference to the 1999 Declaration on Science and the Use of Scientific Knowledge and to the 2005 Universal Declaration on Bioethics and Human Rights, efforts should be made to build on the statements of ethical principles for science developed by relevant intergovernmental bodies, including at regional level, and by science communities through their academies and professional associations. To this end, provision should be made for a broad public consultation preparatory to consideration by the UNESCO Member States of specific proposals for revision of the text of the 1974 Recommendation.

Subsequently, the UNESCO Executive Board decided that a preliminary study should be undertaken on the technical and legal aspects relating to the desirability of revising the 1974 Recommendation on the Status of Scientific Researchers.[25] COMEST members were actively involved in the Ad Hoc Expert Group that conducted the study.

The study notes that:

> The major ethical principles of non-discrimination, integrity, freedom and autonomy of scientific researchers, and respect for their human rights and fundamental freedoms, are both unobjectionable and highly relevant. Today, as in 1974, it is necessary to assert and to take seriously the right, enshrined in article 27(1) of the Universal Declaration of Human Rights, "freely … to share in scientific advancement and its benefits". Furthermore, there remain strong reasons to endorse the rationale of the 1974 Recommendation, which is that the general ethical principles that apply to science need to be embedded in concrete institutional arrangements.

However, the study also questions whether the details of the institutional template assumed in the 1974 Recommendation remain relevant, in view of a range of dynamics and challenges that overlap with those discussed in Section III above.

[25] "Preliminary study on the technical and legal aspects relating to the desirability of revising the 1974 Recommendation on the Status of Scientific Researchers", UNESCO, May 2013 [available at http://unesdoc.unesco.org/images/0022/002203/220309E.pdf].

It was on this basis that the member states of UNESCO decided, at the General Conference in 2013, that a process should be launched to revise the 1974 Recommendation.

Consistently with its earlier recommendations on the subject, COMEST considers that a revised recommendation on the status of scientific researchers will in due course be of value in ensuring the institutional conditions for ethical governance of science.

### V.4 Ethics education

If the tendency to regard science and society as external to one another is to be overcome, as proposed in section IV, public awareness becomes a constitutive and not simply incidental aspect of governance.

Science ethics cannot be reduced to principles, or even to institutional mechanisms to investigate and if appropriate punish unacceptable behaviour. The challenge is to embed ethics – including in particular the crucial principle of vigilance – in routine scientific practice: to make it, as already emphasized, not an optional add-on but a constitutive component of science. In order to meet this challenge, taking account of careful analysis of the conditions that tend to favour unethical behaviour, it is essential to act at a range of different levels to build awareness of science ethics among not just professional scientists but also technicians and all people actively working in science and technology. Avoiding deliberate misuse of science is undoubtedly an important ethical issue, but it is unlikely that it can be addressed solely or even mainly through education. Avoidance of inadvertent failure to meet high ethical standards, on the other hand, depends on education and training, although it cannot be achieved without adequate institutional oversight.

In order to take forward this discussion, consideration should also be given in this regard to gaps in existing provision of education and training and possible action, with a particular focus on international coordination and cooperation and on capacity building in developing countries. If it is the case that, in certain areas, not enough is being done, there are potentially important practical consequences, which concern the capacity of science and technology to respond to human needs or well-being, possibly harmful side-effects, and public trust in science.

Finally, awareness of ethical issues in science and of the steps taken by relevant institutions to promote science ethics can contribute usefully to public trust in science. There is much existing and valuable work in outreach, public information and popularization, and to a lesser extent in effective public participation in social choices about science and technology. There may however be gaps that need to be addressed by new kinds of initiatives.

Issues relating to scientific publication, referred to above from a professional perspective, are also relevant to the level of public awareness and understanding of science

### V.5 Consulting the public on controversial innovative technologies

As argued in section IV.5, enhancing public consultation and engagement requires both a different approach to expertise and a degree of institutional innovation. In particular, experience in many countries and on many issues suggests that conventional forms of democratic pluralism cope poorly with the societal and regulatory questions raised by controversial innovative technologies.

One important and well-attested reason is that such conventional forms favour engagement on the basis of self-selection by those who have the strongest recognized stake – whether in terms of values or of potential benefits and burdens – in the decisions under consideration and the greatest capacity to mobilize. It follows that extreme opinions tend to be over-represented in debates organized along such lines, mirroring the tendency in general public debate, which is not in this sense "organized" at all. Climate change, genetically modified foods and nanotechnologies are examples of this tendency for debate to become confrontational rather than consensus-oriented. It follows also that unrecognized interests, related to diffuse benefits and burdens, and disempowered groups tend to be poorly represented in the more conventional forms of public debate and consultation.

Both of these patterns of exclusion are of ethical concern. An ethical approach to science governance and the science-society relationship therefore requires serious consideration to be given to alternative procedures that can ensure that the public broadly understood, and not just pre-constituted interest groups, is effectively represented in reflection and decision-making on controversial innovative technologies.

### V.6 Local, indigenous and traditional knowledge

The notion of "the public", as used in sections IV.5 and V.5 above, is clearly simplistic. With respect to the societal challenges of science and technology there are diverse "publics" that stand in very different relations to scientific, political and policy processes. While a full review of the cleavages and inequalities of power and resources that lead to profound differences in the ability of different groups to make their voice heard or to achieve exit from unpalatable knowledge and policy regimes would be beyond the scope of this report, it is important to make specific reference to the situation of indigenous people, and more generally local, indigenous and traditional knowledge.

Alongside patterns of disempowerment that are often shared with other social categories and groups, indigenous people occupy a distinctive position with respect to the cultural meaning of their interaction with contemporary technoscience. Thus, in addition to the general question of benefit sharing, from which they have often unjustly been excluded, indigenous people have consistently raised the broader question of whether the extraction and distribution of "benefits" is the right way to envisage the interaction of science and technology with the world. In so far as local, indigenous and traditional knowledge involves alternative understandings of what constitutes the world that humans inhabit – understandings that do not so much clash with science as operate at a different level – it may be threatened, when power relations are unequal, by very instrumental technoscientific worldviews.

The combination of these two concerns – about benefit sharing and about cultural vulnerability – has led the international community to adopt a number of decisions specifically designed to assert the value of local, indigenous and traditional knowledge and to protect the rights of those who define themselves by it.

At its 10$^{th}$ session, held in Nagoya (Japan) in 2010, the Conference of the Parties to the Convention on Biological Diversity adopted the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization, which aims at sharing the benefits arising from the utilization of genetic resources in a fair and equitable way, including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding, thereby contributing to the conservation of biological diversity and the sustainable use of its components. Article 7 of the Protocol specifically states that "each Party shall take measures, as appropriate, with the aim of ensuring that traditional knowledge associated with genetic resources that is held by indigenous and local communities is accessed with the prior and informed consent or approval and involvement of these indigenous and local communities, and that mutually agreed terms have been established".

The same Conference of the Parties also adopted the "The Tkarihwaié:ri Code of Ethical Conduct to Ensure Respect for the Cultural and Intellectual Heritage of Indigenous and Local Communities".[26] Consistently with the concerns summarized earlier in this section, the code, which is voluntary, extends beyond benefit sharing to take into account, in the language of the preamble, "the holistic concept of traditional knowledge and its multi-dimensional characteristics which include but are not limited to spatial, cultural, spiritual, and temporal qualities". It combines general ethical principles (respect for existing settlements, cultural aspects of intellectual property, non-discrimination, transparency/full disclosure, prior informed consent and/or approval and involvement, inter-cultural respect, safeguarding collective or individual ownership, fair and equitable sharing of benefits, protection of affected indigenous and local communities, precautionary approach) with considerations specific to the situation of indigenous and local communities.

While these two instruments by no means exhaust the field of ethical issues raised by the relation between science and technology and local, indigenous and traditional knowledge, they are exemplary both of the major ethical considerations and of the way in which established ethical principles can be mobilized to address emerging issues.

[26] Convention on Biological Diversity, COP 10 (2010), Decision X/42. The full text is available online at http://www.cbd.int/decision/cop/?id=12308.

## VI. CONCLUSIONS AND RECOMMENDATIONS

Ethics too often has a rather decorative role in contemporary debates about science and technology. Rather than being merely the language in which worries are clothed, ethics needs to take its place in the engine room, shaping not just what to with specific technologies but how to build a society in which science and technology constitute a shared inheritance and a common entitlement, consistently with article 27(2) of the Universal Declaration of Human Rights.

On the other hand, the task of ethics is not to decide questions of public concern, but rather to inform their consideration by offering structured principles and modes of argument that reflect a broadly acceptable language of justification – and where necessary of critique.

The need to distance ethics both from decoration and from prescription constitutes the overarching conclusion of this report. It is refracted through a number of specific issues to consideration of each of which ethics can make a valuable contribution.

The first analytical conclusion of this report is that science, its governance and the science-society relationship are currently being reshaped by comprehensive and far-reaching dynamics that require both new thinking and new ethically based institutional responses. Among these dynamics, the most significant are:

- Scientific and technological change, which induces new intellectual and institutional models as well as new pathways for technology to reshape societies;
- New social and institutional contexts within which scientific integrity and the equitable distribution of social benefits are placed under pressure;
- Tensions between private and public interests that call for renewed safeguards to preserve the public good;
- Divisive globalization, which integrates the world without equipping it with broadly shared worldviews on background ethical principles that can be relied upon the produce practical consensus;
- Patterns of exclusion between and within societies, driven *inter alia* by differential access to science and technology, that demand ethical approaches both to development and to social inclusion.

In the face of such dynamics, existing ethical frameworks are neither irrelevant nor powerless. Nonetheless, the numerous international documents, as well as the wide range of statements, codes, declarations and other frameworks adopted by institutional and professional communities, may not be fully adequate to address current and especially emerging ethical challenges.

This report points to five areas in which new ethical thinking and new institutional developments are required:

- **Bridging and reducing knowledge divides**, working towards the realization of article 27(1) of the Universal Declaration of Human Rights;
- **Promoting integrity and responsible research and innovation**, including through normative initiatives at relevant levels;
- **Managing risk**, taking account of and extending the previous work on the precautionary principle, with the objective of clarifying the vigilance required of scientists with respect to possible misuses of science;

- **Ensuring public participation**, even on complex and controversial issues, which in turn means rethinking expertise to recognize the diversity of forms of knowledge and competence;
- Strengthening ethical and institutional frameworks to ensure that **benefits** are both **produced** by the application of technologies and equitably **shared**.

The connection between ethical thinking and institutional developments is absolutely crucial in this respect. If ethics is to be neither decorative nor hegemonic, it needs to be articulated with governance in the broad sense, including not just formal processes of regulation but also the full range of self-regulatory dynamics that emerge from society itself.

In order to achieve this, six areas of priority concern are identified in this report.

- Development of an **open access** model for science, including but not limited to publication, that favours intellectual dynamism, integrity and contribution to the well-being of humanity;
- Review and where necessary revision of existing **codes of conduct** to ensure consistency with a coherent overarching ethical framework and to eliminate the gaps that have emerged from the institutional development of science;
- Updating and refinement of existing frameworks to clarify the **status of scientific researchers**, including but not limited to the UNESCO Recommendation on the subject, with a view to ensuring consistency between the institutional structures of science and the agreed ethical standards by which it is to operate;
- Promotion of **ethics education**, both for professionals and for laypersons, in order to embed agreed ethical principles in the institutional routines of science and technology;
- Enhanced efforts to **consult the public on controversial innovative technologies**, mobilizing new institutional modalities where appropriate;
- Sustained efforts at all relevant levels to assert the value of **local, indigenous and traditional knowledge** and to protect the rights of those who define themselves by it.