



Economic and Social Council

Committee on Economic, Social and Cultural Rights

General comment No. 25 (2020) on science and economic, social and cultural rights (article 15 (1) (b), (2), (3) and (4) of the International Covenant on Economic, Social and Cultural Rights) *

I. Introduction and basic premises

1. The intense and rapid development of science and technology has had many benefits for the enjoyment of economic, social and cultural rights. At the same time, the risks – and the unequal distribution of these benefits and risks – have prompted a rich and growing discussion on the relationship between science and economic, social and cultural rights. Several important documents have been issued on this subject, such as the Venice Statement on the Right to Enjoy the Benefits of Scientific Progress and its Applications, adopted in 2009, the Universal Declaration on Bioethics and Human Rights, adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in 2005, the Recommendation on Science and Scientific Researchers, adopted by UNESCO in 2017, the report of the Special Rapporteur in the field of cultural rights on the right to enjoy the benefits of scientific progress and its applications (A/HRC/20/26) and the Committee's general comment No. 17 (2005) on the right of everyone to benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he or she is the author. Indeed, UNESCO, declarations made at international conferences and summits, the Special Rapporteur on cultural rights, and eminent scientific organizations and publications have upheld the "human right to science", referring to all the rights, entitlements and obligations related to science.

2. In spite of these developments, science is one of the areas of the Covenant to which States parties give least attention in their reports and dialogues with the Committee. This has led the Committee, after a wide consultative process, to develop this general comment on the relationship between science and economic, social and cultural rights.

3. The Committee focuses primarily on the Covenant right of everyone to enjoy the benefits of scientific progress and its applications (art. 15 (1) (b)), as it is the right most frequently invoked in relation to science. However, the purpose of this general comment is not confined to this right, but is also to develop the relationship more broadly between science and economic, social and cultural rights. The Committee also examines the other elements of article 15 related to science, especially the obligations of States parties to take steps for the conservation, the development and the diffusion of science (art. 15 (2)), to respect the freedom indispensable for scientific research (art. 15 (3)) and to promote international contacts and cooperation in the scientific field (art. 15 (4)). The Committee also highlights the relevance of article 27 of the Universal Declaration of Human Rights for this analysis.

II. Normative content

Scientific progress and its applications

4. According to the definition used by UNESCO in its Recommendation on Science and Scientific Researchers,

the word "science" signifies the enterprise whereby humankind, acting individually or in small or large groups, makes an organized attempt, by means of the objective study of observed phenomena and its validation through sharing of findings and data and through peer review, to discover and master the chain of causalities, relations or interactions; brings together in a coordinated form subsystems of knowledge by means of systematic reflection and conceptualization; and thereby furnishes itself with the opportunity of using, to its own advantage, understanding of the processes and phenomena occurring in nature and society (para. 1 (a) (i)).

UNESCO adds that "the term 'the sciences' signifies a complex of knowledge, fact and hypothesis, in which the theoretical element is capable of being validated in the short or long term, and to that extent includes the sciences concerned with social facts and phenomena" (para. 1 (a) (ii)).

5. Thus, science, which encompasses natural and social sciences, refers both to a process following a certain methodology ("doing science") and to the results of this process (knowledge and applications). Although protection and promotion as a cultural right may be claimed for other forms of knowledge, knowledge should be considered as science only if it is based on critical inquiry and is open to falsifiability and testability. Knowledge which is based solely on tradition, revelation or authority, without the possible contrast with reason and experience, or which is immune to any falsifiability or intersubjective verification, cannot be considered science.

6. The Universal Declaration of Human Rights refers to "scientific advancement" and the Covenant refers to "scientific progress"; these expressions emphasize the capacity of science to contribute to the well-being of persons and humankind. Thus, the development of science in the service of peace and human rights should be prioritized by States over other uses.

7. Applications refer to the particular implementation of science to the specific concerns and needs of the population. Applied science also includes the technology deriving from scientific knowledge, such as the medical applications, the industrial or agricultural applications, or information and communications technology.

Enjoy the benefits

8. The term "benefits" refers first to the material results of the applications of scientific research, such as vaccinations, fertilizers, technological instruments and the like. Secondly, benefits refer to the scientific knowledge and information directly deriving from scientific activity, as science provides benefits through the development and dissemination of the knowledge itself. Lastly, benefits refer also to the role of science in forming critical and responsible citizens who are able to participate fully in a democratic society.

Take part in cultural life

9. The right to enjoy the benefits of scientific progress cannot be interpreted as establishing a rigid distinction between the scientist who produces science and the general population, entitled only to enjoy the benefits derived from research conducted by scientists. This restrictive interpretation is contrary to a systematic and teleological interpretation of this right, which takes into account the context, the object and the purpose of this provision, in accordance with article 31 of the Vienna Convention on the Law of Treaties.

10. Culture is an inclusive concept encompassing all manifestations of human existence. Cultural life is therefore larger than science, as it includes other aspects of human existence; it is, however, reasonable to include scientific activity in cultural life. Thus, the right of everyone to take part in cultural life includes the right of every person to take part in scientific

progress and in decisions concerning its direction. This interpretation is also implied by the principles of participation and inclusiveness underlying the Covenant and by the expression, “to enjoy the benefits of scientific progress”. Such benefits are not restricted to the material benefits or products of scientific advancement, but include the development of the critical mind and faculties associated with doing science. This understanding is corroborated by the *travaux préparatoires* on the drafting of article 15 of the Covenant, which demonstrate that the article was intended to develop article 27 of the Universal Declaration of Human Rights, which recognizes not only a right to benefit from the applications of science but also to participate in scientific advancement. The Universal Declaration of Human Rights is relevant to establish the scope of all the rights enshrined in the Covenant, not only because the preamble to the Covenant refers explicitly to the Universal Declaration of Human Rights, but also because both instruments represent international endeavours to give legal force to the rights in the Universal Declaration of Human Rights through the adoption of binding treaties. Thus, doing science does not only concern scientific professionals but also includes “citizen science” (ordinary people doing science) and the dissemination of scientific knowledge. States parties should not only refrain from preventing citizen participation in scientific activities, but should actively facilitate it.

11. The right enshrined in article 15 (1) (b) encompasses not only a right to receive the benefits of the applications of scientific progress, but also a right to participate in scientific progress. Thus, it is the right to participate in and to enjoy the benefits of scientific progress and its applications.

Benefit from the protection of the moral and material interests resulting from any scientific, literary or artistic production of which he or she is the author

12. The Committee already examined this right in 2005 in its general comment No. 17, in which it stressed the difference between this human right, which protects creators of scientific discoveries, and “most legal entitlements recognized in intellectual property systems” (para. 1). It is unnecessary to repeat this analysis here. Nevertheless, the specific relationship between intellectual property rights and the right to participate in and to enjoy the benefits of scientific progress and its applications is addressed in section V.

The freedom indispensable for scientific research and creative activity

13. In order to flourish and develop, science requires the robust protection of freedom of research. The Covenant establishes a specific duty for States to “respect the freedom indispensable for scientific research” (art. 15 (3)). This freedom includes, at the least, the following dimensions: protection of researchers from undue influence on their independent judgment; the possibility for researchers to set up autonomous research institutions and to define the aims and objectives of the research and the methods to be adopted; the freedom of researchers to freely and openly question the ethical value of certain projects and the right to withdraw from those projects if their conscience so dictates; the freedom of researchers to cooperate with other researchers, both nationally and internationally; and the sharing of scientific data and analysis with policymakers, and with the public wherever possible. Nevertheless, freedom of scientific research is not absolute; some limitations are possible, as described in section III below.

Take steps for the conservation, the development and the diffusion of science

14. States parties should not only abstain from interfering in the freedom of individuals and institutions to develop science and diffuse its results. States must take positive steps for the advancement of science (development) and for the protection and dissemination of scientific knowledge and its applications (conservation and diffusion).

III. Elements of the right and limitations

15. The right to participate in and to enjoy the benefits of scientific progress and its applications contains both freedoms and entitlements. Freedoms include the right to participate in scientific progress and enjoy the freedom indispensable for scientific research. Entitlements include the right to enjoy, without discrimination, the benefits of scientific progress. These freedoms and entitlements imply not only negative, but also positive obligations for States. Furthermore, this right contains the following five interrelated and essential elements.

A. Elements of the right

16. Availability is linked to the obligation of States parties to take steps for the conservation, the development and the diffusion of science. Thus, availability means that scientific progress is actually taking place, and that scientific knowledge and its applications are protected and widely disseminated. States parties should direct their own resources and coordinate actions of others to ensure that scientific progress happens and that its applications and benefits are distributed and are available, especially to vulnerable and marginalized groups. This requires, *inter alia*, instruments for the diffusion of science (libraries, museums, Internet networks, etc.), a strong research infrastructure with adequate resources, and adequate financing of scientific education. In particular, States should promote open science and open source publication of research. Research findings and research data funded by States should be accessible to the public.

17. Accessibility means that scientific progress and its applications should be accessible for all persons, without discrimination. It has three dimensions: first, States parties should ensure that everyone has equal access to the applications of science, particularly when they are instrumental for the enjoyment of other economic, social and cultural rights. Second, information concerning the risks and benefits of science and technology should be accessible without discrimination. Third, everyone should have the open opportunity to participate in scientific progress, without discrimination. Thus, States parties should remove discriminatory barriers that impede persons from participating in scientific progress, for instance, by facilitating the access of marginalized populations to scientific education.

18. Quality refers to the most advanced, up-to-date and generally accepted and verifiable science available at the time, according to the standards generally accepted by the scientific community. This element applies both to the process of scientific creation and to access to the applications and benefits of science. Quality also includes regulation and certification, as necessary, to ensure the responsible and ethical development and application of science. States should rely on widely accepted scientific knowledge, in dialogue with the scientific community, to regulate and certify the circulation of new scientific applications accessible to the public.

19. Acceptability implies that efforts should be made to ensure that science is explained and its applications are disseminated in such a manner as to facilitate their acceptance in different cultural and social contexts, provided that this does not affect their integrity and quality. Scientific education and the products of science should be tailored to the particularities of populations with special needs, such as persons with disabilities. Acceptability implies also that scientific research has to incorporate ethical standards in order to ensure its integrity and the respect of human dignity, such as the standards proposed in the Universal Declaration on Bioethics and Human Rights. Some of these standards are that the benefits to research participants and other affected individuals should be maximized and any possible harm minimized with reasonable protection and safeguards; the autonomy and free and informed consent of participants should be guaranteed; privacy and confidentiality should be respected; vulnerable groups or persons should be especially protected in order to avoid any discrimination; and cultural diversity and pluralism should be given due regard.

20. As explained in paragraph 13 above, the protection of freedom of scientific research is also an element of the right to participate in and to enjoy the benefits of scientific progress and its applications.

B. Limitations

21. Some limitations on the right to participate in and to enjoy the benefits of scientific progress and its applications might be necessary, as science and its applications can, in certain contexts, affect economic, social and cultural rights. Nevertheless, limitations on the right must respect the requirements of article 4 of the Covenant: first, limitations have to be determined by

law; second, they must promote “the general welfare in a democratic society”; and third, any restriction must be compatible with the nature of the right restricted. As understood by the Committee, this implies that limitations must respect the minimum core obligations of the right, and must be proportionate to the aim pursued. This means that where there are several means reasonably capable of achieving the legitimate aim of the limitation, the one that is least restrictive to economic, social and cultural rights must be selected, and the burdens imposed on the enjoyment of the right should not outweigh the benefits of the limitation.

22. Limitations on the applications of science and technology can be used to guarantee the safety and quality of products used by persons. Human rights impact assessments might be necessary to protect persons against risky applications. Limitations on the research process can also be necessary, particularly when the research affects human beings in order to protect their dignity, their integrity and their consent when involved in the research. When the research is done in countries or among populations different to those of the researchers, the State of origin must guarantee the rights and obligations of all parties involved. Nevertheless, any limitation on the content of scientific research implies a strict burden of justification by States, in order to avoid infringing freedom of research.

IV. Obligations

A. General obligations

23. States parties must take steps, to the maximum of their available resources, for the full realization of the right to participate in and to enjoy the benefits of scientific progress and its applications. While full realization of the right may be achieved progressively, steps towards it must be taken immediately or within a reasonably short period of time. Such steps should be deliberate, concrete and targeted, using all appropriate means, including the adoption of legislative and budgetary measures.

24. As with all other rights in the Covenant, there is a strong presumption that retrogressive measures taken in relation to the right to participate in and to enjoy the benefits of scientific progress and its applications are not permissible. Examples of retrogressive measures include the removal of programmes or policies necessary for the conservation, the development and the diffusion of science; the imposition of barriers to education and information on science; the imposition of barriers to citizen participation in scientific activities, including misinformation intended to erode citizen understanding and respect for science and scientific research; and the adoption of legal and policy changes that reduce the extent of international collaboration on science. In the exceptional circumstances under which retrogressive measures may be inevitable, States must ensure that such measures are necessary and proportionate. The measures should remain in place only insofar as they are necessary; mitigate inequalities that can grow in times of crisis and ensure that the rights of disadvantaged and marginalized individuals and groups are not disproportionately affected; and guarantee the minimum core obligations (see E/C.12/2016/1).

25. States parties are under an immediate obligation to eliminate all forms of discrimination against individuals and groups in their enjoyment of economic, social and cultural rights. This duty is of particular importance in relation to the right to participate in and to enjoy the benefits of scientific progress and its applications because deep inequalities persist in the enjoyment of this right. States must adopt the measures necessary to eliminate conditions and combat attitudes that perpetuate inequality and discrimination in order to enable all individuals and groups to enjoy this right without discrimination, including on the grounds of religion, national origin, sex, sexual orientation and gender identity, race and ethnic identity, disability, poverty and any other relevant status.

26. The duty to eliminate discrimination is a cross-cutting obligation that States should take into account when fulfilling all other obligations. For instance, the duty of States to take steps for the development and the diffusion of science (art. 15 (2)) includes the obligation to make all necessary efforts to overcome persistent inequalities in scientific advancement through culturally and gender-appropriate means of education and communication, with the aim of encouraging the widest participation in scientific progress of those populations that have traditionally been excluded from such progress.

27. The duty to combat discrimination on those grounds has implications for the design and implementation of all policies related to the right to participate in and to enjoy the benefits of scientific progress and its applications. For instance, States have to carefully design and implement quality scientific education programmes in order to allow all persons equal opportunities to gain a basic level of understanding and knowledge of the science and training needed to pursue careers in science, and to ensure access without discrimination to available employment in scientific research fields.

B. Special protection for specific groups

28. Without prejudice to the duty of States to eliminate all forms of discrimination, special attention should be paid to groups that have experienced systemic discrimination in the enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications, such as women, persons with disabilities, lesbian, gay, bisexual, transgender and intersex persons, indigenous peoples and persons living in poverty. Temporary special measures might be necessary to achieve substantive equality and remedy current manifestations of previous patterns of exclusion of these groups. Owing to limitations of space, this general comment focuses on women, persons with disabilities, persons living in poverty and indigenous peoples.

Women

29. Women are frequently underrepresented in scientific activity. Sometimes this is owing to situations of direct discrimination in access to education or professional employment and promotion. In other cases, discrimination is more subtle and is based on stereotypes or professional practices that discourage women’s participation in scientific research. In particular, women’s advancement in scientific careers, both in academia and in industry, is cumulatively limited as they climb the hierarchical ladder.

30. Unequal access between men and women to science implies double discrimination. First, women have the right to participate in scientific research on an equal footing with men; thus, unequal access to scientific education or scientific careers constitutes discrimination in principle. Second, as women are underrepresented in scientific research, it is very common that scientific research and new technologies are gender biased and not sensitive to the particularities and needs of women.

31. States must therefore immediately eliminate barriers that affect girls’ and women’s access to quality scientific education and careers. Furthermore, States must take steps to ensure women’s substantive equality in access to scientific education and careers by, for example, raising public awareness in order to eliminate stereotypes that exclude women from science or adopting policies for both men and women to balance domestic life with scientific careers. Temporary special measures, such as quotas for women in scientific education, might be necessary in order to speed up the attainment of substantive equality in the enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications. The availability of kindergartens and other childcare institutions is also key to the advancement of equality.

32. A gender-sensitive approach is not a luxury for scientific research, but a crucial tool in order to ensure that scientific progress and new technologies adequately take into account the characteristics and needs of women and girls. This approach should not be relegated to the last stages of research, but incorporated from the first stage, such as the choice of the subject and the design of methodologies, and must be present throughout all steps of scientific research and its applications, including during the evaluation of its impacts. Decisions concerning funding or general policies must also be gender-sensitive.

33. A gender-sensitive approach is of particular relevance to the right to sexual and reproductive health. States parties must ensure access to up-to-date scientific technologies necessary for women in relation to this right. In particular, States parties should ensure access to modern and safe forms of contraception, including emergency contraception, medication for

abortion, assisted reproductive technologies, and other sexual and reproductive goods and services, on the basis of non-discrimination and equality, as outlined in general comment No. 22 (2016) on the right to sexual and reproductive health. Special attention should be given to the protection of women's free, prior and informed consent in treatments or scientific research on sexual and reproductive health.

Persons with disabilities

34. Persons with disabilities have suffered deep discrimination in the enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications, either because of severe physical, communication and information obstacles to access basic and higher scientific education and careers, or because the products of scientific progress do not take into account their specificities and particular needs. Persons with disabilities bring their unique perspectives and experiences into the scientific landscape, thus specifically contributing to the promotion of the right to participate in and to enjoy the benefits of scientific progress and its applications.

35. States parties should, at the least, adopt the following measures and policies to overcome discrimination against persons with disabilities in the enjoyment of this right: (a) promote the participation and contributions of persons with disabilities, including women with disabilities who face multiple discrimination, in decision-making procedures concerning science; (b) develop statistics on access to science and its benefits disaggregated by disability; (c) implement universal design; (d) promote technologies that facilitate access to scientific education and employment for persons with disabilities; (e) ensure that reasonable accommodation is provided for persons with disabilities to enable them to have access to scientific education and employment and to ensure that they benefit from the products of scientific development, including its diffusion and dissemination in adapted formats; (f) adopt appropriate measures to raise awareness of the capabilities and contributions of persons with disabilities and to combat stereotypes and harmful practices relating to these persons; and (g) ensure that persons with disabilities have given their free, prior and informed consent when they are subjects of research.

Persons in living poverty, inequality and science

36. In the last few decades, the growth of inequalities has undermined the rule of law and has had negative effects on the enjoyment of economic, social and cultural rights (see A/HRC/29/31). Economic inequality hinders equal access to scientific education and to the benefits of scientific progress for low-income households and especially for persons living in poverty. This in turn reinforces economic inequalities because upper-income households can enjoy better scientific education and can access the latest and most expensive scientific innovations, allowing affluent persons to become more technologically productive than poor people, perpetuating inequalities and providing an apparent justification for them.

37. As equality is at the core of human rights, States must make every effort to break this vicious circle between substantive inequality and unequal access to the right to participate in and to enjoy the benefits of scientific progress and its applications. This implies a threefold strategy: first, States parties should adopt policies to reduce inequalities, a subject that goes beyond the scope of this general comment but is at the centre of current discussions on democracy and human rights. Second, States parties need a specific strategy to strengthen access to good scientific education for persons living in poverty. Third, States should prioritize scientific and technological innovations that serve especially the needs of persons living in poverty and ensure that these people have access to the technological innovations.

38. States should adopt measures to ensure that children living in poverty, particularly those with disabilities, have full access to the enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications, as they are entitled to special care and assistance, especially through pedagogical tools and quality scientific education that allow the development of the child's personality, talents and mental and physical abilities to their fullest potential.

Traditional knowledge and indigenous peoples

39. Local, traditional and indigenous knowledge, especially regarding nature, species (flora, fauna, seeds) and their properties, are precious and have an important role to play in the global scientific dialogue. States must take measures to protect such knowledge through different means, including special intellectual property regimes, and to secure the ownership and control of this traditional knowledge by local and traditional communities and indigenous peoples.

40. Indigenous peoples and local communities all over the globe should participate in a global intercultural dialogue for scientific progress, as their inputs are precious and science should not be used as an instrument of cultural imposition. States parties must provide indigenous peoples, with due respect for their self-determination, to both the educational and technological means to participate in this dialogue. They must also take all measures to respect and protect the rights of indigenous peoples, particularly their land, their identity and the protection of the moral and material interests resulting from their knowledge, of which they are authors, individually or collectively. Genuine consultation in order to obtain free, prior and informed consent is necessary whenever the State party or non-State actors conduct research, take decisions or create policies relating to science that have an impact on indigenous peoples or when using their knowledge.

C. Specific obligations

41. States parties have an obligation to respect, protect and fulfil the right to participate in and to enjoy the benefits of scientific progress and its applications.

Obligation to respect

42. The obligation to respect requires that States parties refrain from interfering directly or indirectly in the enjoyment of this right. Examples of the obligation to respect are: eliminating barriers to accessing quality science education and to the pursuit of scientific careers; refraining from disinformation, disparagement or deliberate misinformation intended to erode citizen understanding of and respect for science and scientific research; eliminating censorship or arbitrary limitations on access to the Internet, which undermines access to and dissemination of scientific knowledge; and refraining from imposing, or eliminating, obstacles to international collaboration among scientists, unless such restrictions can be justified in accordance with article 4 of the Covenant.

Obligation to protect

43. The obligation to protect requires States parties to adopt measures to prevent any person or entity from interfering with the right to participate in and to enjoy the benefits of scientific progress and its applications by, for example, preventing access to knowledge or discriminating on the grounds of gender, sexual orientation or gender identity or other circumstances. These persons or entities could include universities, schools, laboratories, cultural or scientific associations, patients in hospitals and volunteers participating in scientific experiments. Examples of this duty to protect are: ensuring that scientific associations, universities, laboratories and other non-State actors do not apply discriminatory criteria; protecting people from participating in research or tests that contravene the applicable ethical standards for responsible research and guaranteeing their free, prior and informed consent; ensuring that private persons and entities do not disseminate false or misleading scientific information; and ensuring that private investment in scientific institutions is not used to unduly influence the orientation of research or to restrict the scientific freedom of researchers.

44. Sometimes, States parties may have to protect people within their own familial, social or cultural context when their right to participate in and to enjoy the benefits of scientific progress and its applications is affected. Persons who, owing to their age or capacity, cannot choose for themselves, must receive special protection. For instance, when parents decide not to have their children vaccinated on grounds the scientific community considers false, the parents' decision entails risks for the child and sometimes for society, resulting from the possible resurgence of infectious diseases that were previously under control. In these cases, the best interests of the child must be a primary consideration. In some contexts, people may be subject to great pressure from their social environment to undergo traditional treatment instead of benefiting from the best available medical attention. States parties must guarantee everyone the right to choose or refuse the treatment they want with the full

knowledge of the risks and benefits of the relevant treatment, subject to any limitations that meet the criteria of article 4 of the Covenant. States must also establish protective measures in relation to messages from pseudoscience, which create ignorance and false expectations among the most vulnerable sectors of the population.

Obligation to fulfil

45. The duty to fulfil requires that States adopt legislative, administrative, budgetary and other measures and establish effective remedies aimed at the full enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications. They include education policies, grants, participation tools, dissemination, providing access to the Internet and other sources of knowledge, participation in international cooperation programmes and ensuring appropriate financing.

46. The duty to fulfil is reinforced and specified by article 15 (2) of the Covenant, which provides that States parties must take steps for the conservation, the development and the diffusion of science. States parties not only have a duty to allow persons to participate in scientific progress; they also have a positive duty to actively promote the advancement of science through, inter alia, education and investment in science and technology. This includes approving policies and regulations that foster scientific research, allocating appropriate resources in budgets and generally creating an enabling and participatory environment for the conservation, the development and the diffusion of science and technology. This implies, inter alia, protection and promotion of academic and scientific freedom, including freedom of expression and freedom to seek, receive and impart scientific information, freedom of association and freedom of movement; guarantees of equal access and participation of all public and private actors; and capacity-building and education.

47. The obligation to fulfil is particularly important in creating and guaranteeing access to the benefits of the applications of scientific progress. States should use the maximum of their available resources to overcome hurdles that any person may face to benefit from new technologies or other forms of applications of scientific advancements. This is particularly relevant for disadvantaged and marginalized groups. Scientific progress and its applications should be, as far as possible, accessible and affordable to persons in need of specific goods or services. Public institutions in different sectors should be provided with a clear mandate to actively overcome exclusion from such progress and applications, especially in the health and education sectors. Knowledge about scientific progress and its applications should be made broadly available and accessible to the general public through schools, universities, technical colleges, libraries, museums, print and electronic media and other channels. Specific programmes are needed to overcome problems of access to scientific knowledge and its applications related to age, language or other aspects of cultural diversity.

48. All States should contribute, to the maximum of their available resources, to this common task of developing science. Recommending that poor States focus exclusively on applied science actually increases the gap and unfair distribution of knowledge and power between States.

49. The importance of the duty of States to disseminate science and to foster citizen participation cannot be underestimated. Basic knowledge of science, its methods and results, has become an essential element for being an empowered citizen and for the exercise of other rights, such as access to decent work. States must exert every effort to ensure equitable and open access to scientific literature, data and content, including by removing barriers to publishing, sharing and archiving scientific outputs. However, open science cannot be achieved by the State alone. It is a common endeavour to which all other stakeholders should contribute, nationally and internationally, including scientists, universities, publishers, scientific associations, funding agencies, libraries, the media and non-governmental institutions. All these stakeholders play a decisive role in the dissemination of knowledge, especially when it comes to outcomes of research financed with public funds.

50. As a consequence of the right to freedom of research and the duty of States to disseminate science, scientists have, in principle, the right to publish the results of their research. Any restriction on this right should be compatible with article 4 of the Covenant. In particular, States should ensure that any contractual restriction placed on this right is consistent with the public interest, is reasonable and proportionate, and that it provides for the appropriate crediting and acknowledging of the contributions of scientific researchers to the research outcomes.

D. Core obligations

51. States parties have to implement, as a matter of priority, core obligations. If a State party fails to satisfy these core obligations, it must demonstrate that it has made every reasonable effort to comply with them, taking into account the totality of the rights enshrined in the Covenant, and in the context of the maximum of its available resources, individually and through international assistance and cooperation.

52. Core obligations related to the right to participate in and to enjoy the benefits of scientific progress and its applications require States parties to:

Eliminate laws, policies and practices that unjustifiably limit access by individuals or particular groups to facilities, services, goods and information related to science, scientific knowledge and its applications;

Identify and eliminate any law, policy, practice, prejudice or stereotype that undermines women's and girls' participation in scientific and technological areas;

Remove limitations to the freedom of scientific research that are incompatible with article 4 of the Covenant;

Develop a participatory national framework law on this right that includes legal remedies in case of violations, and adopt and implement a participatory national strategy or action plan for the realization of this right that includes a strategy for the conservation, the development and the diffusion of science;

Ensure that people have access to the basic education and skills necessary for the comprehension and application of scientific knowledge and that scientific education in both public and private schools respects the best available scientific knowledge;

Ensure access to those applications of scientific progress that are critical to the enjoyment of the right to health and other economic, social and cultural rights;

Ensure that in the allocation of public resources, priority is given to research in areas where there is the greatest need for scientific progress in health, food and other basic needs related to economic, social and cultural rights and the well-being of the population, especially with regard to vulnerable and marginalized groups;

Adopt mechanisms aimed at aligning government policies and programmes with the best available, generally accepted scientific evidence;

Ensure that health professionals are properly trained in using and applying modern technologies and medicines resulting from scientific progress;

Promote accurate scientific information and refrain from disinformation, disparagement and deliberately misinforming the public in an effort to erode citizen understanding and respect for science and scientific research;

Adopt mechanisms to protect people from the harmful consequences of false, misleading and pseudoscience-based practices, especially when other economic, social and cultural rights are at risk;

Foster the development of international contacts and cooperation in the scientific field, without imposing restrictions on the movements of persons, goods and knowledge beyond those that are justifiable in accordance with article 4 of the Covenant.

V. Special topics of broad application

A.Participation and transparency

53.The principles of transparency and participation are essential to make science objective and reliable, and to ensure that it is not subject to interests that are not scientific or are inconsistent with fundamental human rights principles and the welfare of society. Secrecy and collusion are in principle contrary to the integrity of science at the service of humanity. Thus, States should take measures to avoid the risks associated with the existence of conflicts of interest by creating an environment in which actual or perceived conflicts of interest are adequately disclosed and regulated, especially those involving scientific researchers who give policy advice to policymakers and other public officials.

54.A clear benefit of scientific progress is that scientific knowledge is used in decision-making and policies, which should, as far as possible, be based on the best available scientific evidence. States should endeavour to align their policies with the best scientific evidence available. They should, furthermore, promote public trust and support for sciences throughout society and a culture of active citizen engagement with science, particularly through a vigorous and informed democratic debate on the production and use of scientific knowledge, and a dialogue between the scientific community and society.

55.With due respect to scientific freedom, some decisions concerning the orientation of scientific research or the adoption of certain technical advancements should be subjected to public scrutiny and citizen participation. As far as possible, scientific or technological policies should be established through participatory and transparent processes and should be implemented with accompanying transparency and accountability mechanisms.

B.Participation and the precautionary principle

56.Participation also includes the right to information and participation in controlling the risks involved in particular scientific processes and its applications. In this context, the precautionary principle plays an important role. This principle demands that, in the absence of full scientific certainty, when an action or policy may lead to unacceptable harm to the public or the environment, actions will be taken to avoid or diminish that harm. Unacceptable harm includes harm to humans or to the environment that is: (a) threatening to human life or health; (b) serious and effectively irreversible; (c) inequitable to present or future generations; or (d) imposed without adequate consideration of the human rights of those affected. Technological and human rights impact assessments are tools that help to identify potential risks early in the process and the use of scientific applications.

57.The application of the precautionary principle is sometimes controversial, particularly in relation to scientific research itself, as limitations on the freedom of scientific research are compatible with the Covenant only in the circumstances set out in article 4. On the contrary, this principle is more broadly applied for the use and application of scientific outcomes. The precautionary principle should not hinder and prevent scientific progress, which is beneficial for humanity. Nonetheless, it should be able to address available risks for human health and the environment, inter alia. Thus, in controversial cases, participation and transparency become crucial because the risks and potential of some technical advances or some scientific research should be made public in order to enable society, through informed, transparent and participatory public deliberation, to decide whether or not the risks are acceptable.

C.Private scientific research and intellectual property

58.In the contemporary world, a significant proportion of scientific research is carried out by business enterprises and non-State actors. This is not only compatible with the Covenant, but can also be instrumental in the enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications. However, large-scale privatization of scientific research without any other consideration might sometimes have negative effects on the enjoyment of this right.

59.In some cases, scientific research conducted or financed by private actors can create conflicts of interests, for instance, when business corporations support research related to the type of economic activities in which they are involved, as happened in the past with some tobacco companies. Mechanisms should be established for the disclosure of these actual or perceived conflicts of interest.

60.Private scientific research has been associated with the development of international and national intellectual property legal regimes, which have complex relationships with the right to participate in and to enjoy the benefits of scientific progress and its applications. On one hand, intellectual property enhances the development of science and technology through economic incentives for innovation, such as patents for inventors, which stimulate the involvement of private actors in scientific research. On the other hand, intellectual property can negatively affect the advancement of science and access to its benefits, in at least in three ways. It is necessary to tackle these three problems in order to ensure that intellectual property promotes the research and innovation crucial to the full enjoyment of economic, social and cultural rights without undermining these rights.

61.Firstly, intellectual property can sometimes create distortions in the funding of scientific research as private financial support might go only to research projects that are profitable, while funding to address issues that are crucial for economic, social and cultural rights might not be adequate, as these issues do not seem financially attractive for business. This has been the case with the so-called neglected diseases. Second, some intellectual property regulations limit the sharing of information on scientific research for a certain period, as is the case with data exclusivity for patent holders included in some of the "trip-plus" treaties. Furthermore, the excessive price of some scientific publications is an obstacle for low-income researchers, especially in developing countries. All those restrictions hinder the advancement of science. Third, although intellectual property provides positive incentives for new research activities and thus plays an important role in contributing to innovation and the development of science, it may, in some cases, pose significant obstacles for persons wishing to access the benefits of scientific progress, which may be crucial for the enjoyment of other economic, social and cultural rights, such as the right to health. Patents give patent holders a temporary exclusive right to exploit the product or service they have invented. Thus, they can determine a price for these products and services. If prices are set very high, access to these products and services becomes impossible for low-income persons or developing countries, as has happened with new medicines that are essential for the health and life of persons with certain diseases.

62.States should take appropriate measures to foster the positive effects of intellectual property on the right to participate in and to enjoy the benefits of scientific progress and its applications, while at the same time avoiding its possible negative effects. Firstly, to counter distortions of funding associated with intellectual property, States should provide adequate financial support for research that is important for the enjoyment of economic, social and cultural rights, either through national efforts or, if necessary, by resorting to international and technical cooperation. States could also resort to other incentives, such as so-called market entry rewards, which delink remuneration of successful research from future sales, thus fostering research by private actors in these otherwise neglected fields. Second, States should make every effort, in their national regulations and in international agreements on intellectual property, to guarantee the social dimensions of intellectual property, in accordance with the international human rights obligations they have undertaken (E/C.12/2001/15, para. 18). A balance must be reached between intellectual property and the open access and sharing of scientific knowledge and its applications, especially those linked to the realization of other economic, social and cultural rights, such as the rights to health, education and food. The Committee reiterates that ultimately, intellectual property is a social product and has a social function and consequently, States parties have a duty to prevent unreasonably high costs for access to essential medicines, plant seeds or other means of food production, or for schoolbooks and learning materials, from undermining the rights of large segments of the population to health, food and education.

D.Interdependence with other rights

63.The right to participate in and to enjoy the benefits of scientific progress and its applications is a human right with an intrinsic value, but it also has an instrumental value, as it constitutes an essential tool for the realization of other economic, social and cultural rights, particularly the right to food and the right to health.

Right to food

64. Scientific and technological advancements have increased agricultural productivity, contributing to higher availability of food per person and reduction of famine. Nevertheless, the environmental impacts of certain technologies associated with the Green Revolution and the risks associated with increased dependency on technology providers has led, inter alia, the General Assembly to acknowledge that peasants and other people working in rural areas have the right to determine their own food and agriculture systems, recognized by many States and regions as the right to food sovereignty. Thus, the right to participate in and to enjoy the benefits of scientific progress and its applications in agriculture should preserve, not violate, the right of peasants and other people working in rural areas to choose which technologies suit them best. Low-input eco-friendly agronomic techniques that increase organic matter content in soil, carbon sequestration and protect biodiversity should also be supported.

65. In addition, States parties should take appropriate measures to ensure that agricultural research and development integrates the needs of peasants and other people working in rural areas and to ensure their active participation in the determination of priorities and the undertaking of research and development, taking into account their experience and respecting their cultures. Every policy or action taken on biofuels and pesticides should consider all their interconnected complexities and the best available scientific knowledge.

66. Inadequate diets have become a major contributing factor to the increase of non-communicable diseases in all regions. Given the proven long-term effects of adequate nutrition during pregnancy and before a child's second birthday, States should do more to regulate the marketing of breast milk substitutes, to disseminate information about the benefits of adequate feeding practices, and to create an enabling environment for breastfeeding. They should also redirect investments in agricultural development away from the exclusive focus on boosting the production of cereal crops – rice, wheat and maize – towards support for healthy diets, including adequate measures to reduce the excessive intake of sugar. Cereal crops are mainly a source of carbohydrates and contain relatively few proteins and other nutrients essential for adequate diets.

Right to health

67. The links between the right to participate in and to enjoy the benefits of scientific progress and its applications and the right to health are clear and diverse. Firstly, scientific progress creates medical applications that prevent diseases, such as vaccinations, or that enable them to be more effectively treated. The right to participate in and to enjoy the benefits of scientific progress and its applications is therefore instrumental in realizing the right to health. States should promote scientific research, through financial support or other incentives, to create new medical applications and make them accessible and affordable to everyone, especially the most vulnerable. In particular, in accordance with the Covenant, States parties should prioritize the promotion of scientific progress to facilitate better and more accessible means for the prevention, control and treatment of epidemic, endemic, occupational and other diseases (art. 12 (2) (c)).

68. In this respect, scientific research is impaired for some substances under the international conventions on drug control, which classify these substances as harmful for health and with no scientific or medical value. However, some of these classifications were made with insufficient scientific support to substantiate those classifications, as credible evidence exists regarding the medical uses of a number of them, such as cannabis for the treatment of certain epilepsies. Thus, States parties should harmonize the fulfilment of their obligations under the international drug control regime with their obligations to respect, protect and fulfil the right to participate in and to enjoy the benefits of scientific progress and its applications, through regular revision of their policies in relation to controlled substances. The prohibition of research on those substances is in principle a limitation of this right and should meet the requirements of article 4 of the Covenant. Moreover, given the potential health benefits of these controlled substances, the restrictions should also be weighed up in relation to States parties' obligations under article 12 of the Covenant.

69. Second, some applications of scientific progress are protected under intellectual property regimes. The right to participate in and to enjoy the benefits of scientific progress and its applications assists States in making sure that these property rights are not realized to the detriment of the right to health. This right becomes a significant mediator between a human right – the right to health – and a property right. As stated in the World Trade Organization Doha Declaration on the TRIPS Agreement and Public Health (2001), the intellectual property regime should be interpreted and implemented in a manner supportive of the duty of States "to protect public health and, in particular, to promote access to medicines for all". Thus, States parties should use, when necessary, all the flexibilities of the TRIPS Agreement, such as compulsory licences, to ensure access to essential medicines, especially for the most disadvantaged groups. States parties should also refrain from granting disproportionately lengthy terms of patent protection for new medicines in order to allow, within a reasonable time, the production of safe and effective generic medicines for the same diseases.

70. Third, States parties have a duty to make available and accessible to all persons, without discrimination, especially to the most vulnerable, all the best available applications of scientific progress necessary to enjoy the highest attainable standard of health. States parties should fulfil this duty to the maximum of their available resources, including those available through international assistance and cooperation, and taking into account the full range of economic, social and cultural rights. Safe and effective generic medicines should be prioritized over brand-name medicines in national health plans in order to make better use of the available resources for the fulfilment of economic, social and cultural rights.

71. Fourth, some scientific research can carry health-related risks, both for the participants in the research and as a result of the impact of the applications of the relevant research. States parties should prevent or mitigate these risks through careful application of the precautionary principle and the protection of participants in scientific research. In particular, States should make every effort to ensure that medicines and medical treatments, including in the field of drug dependency, are evidence-based, and that the risks involved have been properly evaluated and communicated in a clear and transparent manner, so that patients can provide properly informed consent.

E. Risks and promises of new emerging technologies

72. Technological change is now so intense and rapid that it is blurring the boundaries between the physical, digital and biological worlds, because of the growing fusion of scientific and technological advancements in areas such as artificial intelligence, robotics, 3D printing, biotechnology, genetic engineering, quantum computers and management of big data. These innovations might change not only society and human behaviour, but even human beings themselves, through genetic engineering or the incorporation in human bodies of technological devices that transform some biological functions.

73. These emerging technologies might, on the one hand, enhance the enjoyment of economic, social and cultural rights. For instance, applications of artificial intelligence in industry or services can lead to enormous gains in productivity and efficiency, and biotechnology can enable the cure or treatment of many diseases. On the other hand, these changes might intensify social inequalities by increasing unemployment and segregation in the labour market, and algorithms incorporated in artificial intelligence can reinforce discrimination, and so forth.

74. States parties have to adopt policies and measures that expand the benefits of these new technologies while at the same time reducing their risks. Nevertheless, there are no easy solutions given the varied nature of these new technologies and their complex effects. The Committee will therefore constantly monitor the impact of these new technologies on the enjoyment of economic, social and cultural rights. For the Committee, three elements remain very important: firstly, international cooperation should be enhanced in this field as these technologies need global regulations in order to be effectively managed. Fragmented national responses to these transnational technologies would create governance gaps detrimental to the enjoyment of economic, social and cultural rights and would perpetuate technological divides and economic disparities.

75. Second, decisions concerning the development and use of these technologies should be taken within a human rights framework and from a holistic and inclusive perspective. All cross-cutting human rights principles, such as transparency, non-discrimination, accountability and respect for human dignity, become crucial in this field. For instance, States parties should develop mechanisms so that autonomous intelligent systems are designed in ways that avoid discrimination, enable their decisions to be explained, and allow accountability for their use. In addition, States parties should establish a legal framework that imposes on non-State actors a duty of human rights due diligence, especially in the case of big technology

companies (see A/74/493). This legal framework should include measures that require companies to prevent discrimination at both the input and output levels of artificial intelligence systems and other technologies.

76.Third, some aspects related to these new technologies deserve special attention because of their particular impact on the enjoyment of economic, social and cultural rights. For instance, States parties should adopt policies to ensure that those vulnerable to temporary and long-term job loss as a result of scientific and technological advances are provided with and encouraged to pursue vocational training and other job placement opportunities. Moreover, taking into account that many of the emerging inequalities are strongly linked to the capacity of some business entities to access, store and exploit massive data, it is crucial to regulate the ownership and control of data according to human rights principles.

VI.International cooperation

77.The duty to cooperate internationally towards the fulfilment of all economic, social and cultural rights, established in article 2 of the Covenant and in articles 55 and 56 of the Charter of the United Nations, is reinforced in relation to the right to participate in and to enjoy the benefits of scientific progress and its applications, as article 15 (4) of the Covenant specifically provides that States parties recognize the benefits to be derived from the encouragement and development of international contacts and cooperation in the scientific and cultural fields. States need to take steps through legislation and policies, including diplomatic and foreign relations, to promote an enabling global environment for the advancement of science and the enjoyment of the benefits of its applications.

78.This reinforced duty of international cooperation has several important justifications and dimensions. Firstly, as certain fields of science necessitate universal endeavour, international cooperation among scientists should be encouraged in order to foster scientific progress. Thus, States should take steps to promote and enable scientific researchers to participate in the “international scientific and technological community”, especially through facilitating their travel in and out of their territory and implementing policies that enable scientific researchers to freely share data and educational resources internationally, for example, by means of virtual universities.

79.Second, international cooperation is essential because of the existence of deep international disparities among countries in science and technology. If it is necessary, owing to financial or technological constraints, developing States should resort to international assistance and cooperation, with a view to complying with their obligations under the Covenant. Developed States should contribute to the development of science and technology in developing countries, adopting measures to achieve this purpose, such as allocating development aid and funding towards building and improving scientific education, research and training in developing countries, promoting collaboration between scientific communities of developed and developing countries to meet the needs of all countries and facilitating their progress while respecting national regulations. Access to research results and their applications should be regulated in a form that allows developing countries and their citizens adequate access to these products in an affordable manner, such as access to essential medicines. While respecting the right of scientists to decide on their own careers, developed States should also implement reasonable policies for identifying and countering, rather than fostering, the effects of brain drain.

80.Third, the benefits and applications resulting from scientific progress should be shared, with due incentives and regulations, with the international community, particularly with developing countries, communities living in poverty and groups with special needs and vulnerabilities, especially when the benefits are closely related to the enjoyment of economic, social and cultural rights.

81.Fourth, international cooperation is essential because the most acute risks to the world related to science and technology, such as climate change, the rapid loss of biodiversity, the development of dangerous technologies, such as autonomous weapons based on artificial intelligence, or the threat of weapons of mass destruction, especially nuclear weapons, are transnational and cannot be adequately addressed without robust international cooperation. States should promote multilateral agreements to prevent these risks from materializing or to mitigate their effects. States should also take measures in cooperation with other States against biopiracy and against illicit trafficking of organs, tissues, samples, genetic resources and genetic-related materials.

82.Pandemics are a crucial example of the need for scientific international cooperation to face transnational threats. Viruses and other pathogens do not respect borders. If adequate measures are not taken, a local epidemic can very quickly become a pandemic with devastating consequences. The role of the World Health Organization in this field remains fundamental and should be supported. Combating pandemics effectively requires stronger commitment from States to scientific international cooperation, as national solutions are insufficient. Enhanced international cooperation could increase the preparedness of States and of international organizations to face future pandemics, for instance by sharing scientific information about potential pathogens. It should also improve early warning mechanisms, based on timely and transparent information provided by States on emerging epidemics that have the potential to transform into a pandemic, which would allow early interventions, based on the best scientific evidence, aimed at controlling the epidemics and preventing them from becoming a pandemic. If a pandemic develops, sharing the best scientific knowledge and its applications, especially in the medical field, becomes crucial to mitigate the impact of the disease and to expedite the discovery of effective treatments and vaccines. After the pandemic is over, scientific research should be promoted to learn lessons and increase preparedness for possible pandemics in the future.

83.States also have extraterritorial obligations with regard to the full realization of the right to participate in and to enjoy the benefits of scientific progress and its applications. In particular, States parties, when negotiating international agreements or adopting their domestic intellectual property regime, should ensure that traditional knowledge is protected, contributions to scientific knowledge are appropriately credited and that intellectual property regimes foster the enjoyment of this right. These bilateral and multilateral agreements should enable developing countries to build their capacity to participate in generating and sharing scientific knowledge and benefiting from its applications. The Committee recalls that States parties participating in decisions as members of international organizations cannot ignore their human rights obligations (see E/C.12/2016/11). Thus, States parties should direct their efforts and exercise their voting powers in these organizations towards ensuring respect, protection and fulfilment of the right to participate in and to enjoy the benefits of scientific progress and its applications.

84.States parties also have an extraterritorial obligation to regulate and monitor the conduct of multinational companies over which they can exercise control, in order for the companies to exercise due diligence to respect the right to participate in and to enjoy the benefits of scientific progress and its applications, also when acting abroad. States parties should provide remedies, including judicial remedies, for victims of these companies.

VII.National implementation

85.While States parties have a wide margin of discretion in selecting the steps they consider most appropriate to achieve the full realization of all economic, social and cultural rights, including the right to participate in and to enjoy the benefits of scientific progress and its applications, at least four types of measures should be implemented.

86.Firstly, States parties should put in place a normative framework that ensures the full enjoyment of the right to participate in and to enjoy the benefits of scientific progress and its applications, without discrimination, and that creates an enabling and participatory environment for the conservation, the development and the diffusion of science and technology. This framework should include, inter alia, the protection of access, without discrimination, to the benefits of scientific progress, especially when other economic, social and cultural rights are at stake for those most in need; the protection of freedom of research with limits compatible with article 4 of the Covenant; measures to ensure that ethics and human rights are respected in scientific research, including the establishment of committees on ethics when necessary; measures to harmonize intellectual property with the right to participate in and to enjoy the benefits of scientific progress and its applications; and adequate protection against all forms of discrimination.

87.Second, States parties should develop a national plan of action to promote scientific progress and to disseminate its results and products to all persons, without discrimination. Such a plan will help ensure that various scientific endeavours

are not carried out in a fragmented and uncoordinated manner, but are part of an integrated effort for the promotion, the conservation and the diffusion of science. This plan of action should include, inter alia: measures to facilitate access without discrimination to the applications of scientific progress, especially when these applications are needed for the enjoyment of economic, social and cultural rights; measures to strengthen human and institutional scientific capacities in the State; adequate public funding, especially for research that is relevant to meet the needs of the population and for the promotion of access to scientific education, particularly for groups that traditionally face discrimination in this field; mechanisms to promote a culture of scientific inquiry, public trust and support for sciences in society, particularly through a vigorous and informed democratic debate on the production and use of scientific knowledge, and a dialogue between the scientific community and society; mechanisms to protect the population from false, misleading and pseudoscience-based practices, especially when other economic, social and cultural rights are at risk; measures to ensure ethics in science, such as the establishment or promotion of independent, multidisciplinary and pluralist ethics committees to assess the relevant ethical, legal, scientific and social issues related to research projects; and measures to enhance the professional and material conditions of scientific researchers.

88. Third, States parties should identify appropriate indicators and benchmarks, including disaggregated statistics and time frames, which allow them to monitor effectively the implementation of the right to participate in and to enjoy the benefits of scientific progress and its applications.

89. Fourth, like all other rights, the right to participate in and to enjoy the benefits of scientific progress and its applications is enforceable and is therefore also justiciable. States parties should establish effective mechanisms and institutions, where they do not already exist, to prevent violations of the right and to ensure effective judicial, administrative and other remedies for victims if such violations occur. As this right can be threatened or violated not only by actions of the State but also through omissions, remedies must be effective in both cases.