31 March 2026

Ref.: CL/4538

Subject: **Certified Copy of the Recommendation on the Ethics of Neurotechnology**

Dear Madam/Sir,

I have the honour of informing you that the Recommendation on the Ethics of Neurotechnology was adopted by acclamation by UNESCO's General Conference at its 43rd session in November 2025.

By adopting this new standard-setting instrument, UNESCO's Member States affirmed their commitment to fulfilling the Organization's fundamental mandate to promote ethics as the compass of scientific and technological advancement. The Recommendation establishes ambitious safeguards to ensure that the benefits of neurotechnology are shared inclusively while preserving the inviolability of the human mind. It sets out a comprehensive framework for the ethical development and deployment of these technologies, supported by targeted policy actions and an implementation plan across key sectors, such as health, education, labour and commercial use.

It is now up to Member States to implement this valuable tool. To this end, please find enclosed a certified copy of the Recommendation in the six working languages of UNESCO's General Conference.

Kindly note that, in accordance with Article IV, paragraph 4, of UNESCO's Constitution, each Member State is required to submit the Recommendation to its competent authorities within a period of one year from the close of the session of the General Conference at which it was adopted, i.e., before 13 November 2026.

As requested by the General Conference, Member States will then be consulted in order to establish a report on the measures taken to implement the Recommendation. This report will be presented at the 45th session of the General Conference, in November 2029.

The Secretariat stands ready to continue supporting Member States in the implementation of the Recommendation and its provisions.

Yours sincerely,

Khaled El-Enany
Director-General

Enclosure: 1

cc: National Commissions for UNESCO
Permanent Delegations to UNESCO

To Ministers responsible for relations with UNESCO

RECOMMENDATION ON THE ETHICS OF NEUROTECHNOLOGY

RECOMMANDATION SUR L'ÉTHIQUE DES NEUROTECHNOLOGIES

RECOMENDACIÓN SOBRE LA ÉTICA DE LA NEUROTECNOLOGÍA

РЕКОМЕНДАЦИЯ ОБ ЭТИЧЕСКИХ АСПЕКТАХ НЕЙРОТЕХНОЛОГИЙ

التوصية الخاصة بأخلاقيات التكنولوجيا العصبية

神经技术伦理问题建议书

United Nations
Educational, Scientific
and Cultural Organization

Recommendation on the Ethics of Neurotechnology

PREAMBLE

The General Conference of the United Nations Educational, Scientific and Cultural Organization (UNESCO), meeting in Samarkand from 30 October to 13 November 2025, at its 43rd session,

Mindful of the current and potential, profound and dynamic positive and negative impacts of neurotechnology on human lives, including the human mind, and on human health and well-being, societies, environment and ecosystems,

Recalling that, by the terms of its Constitution, UNESCO seeks to contribute to peace and security by promoting collaboration among nations through education, the sciences, culture and communication and information, in order to further universal respect for justice, for the rule of law and for the human rights and fundamental freedoms which are affirmed for the peoples of the world,

Recognizing the leading role of UNESCO at the forefront of the international dialogue, knowledge production and standard setting on the ethics of science and technology and bioethics,

Convinced that the Recommendation presented here, as a standard-setting instrument developed through a global approach, based on international law, focusing on human dignity and human rights, as well as gender equality, social and global justice and sustainable development, physical and mental well-being and health, diversity, interconnectedness, global solidarity, fairness, non-discrimination, inclusiveness and environmental and ecosystem protection and sustainability, can guide the whole life cycle of neurotechnology in a responsible direction,

Guided by the purposes and principles of the Charter of the United Nations,

Considering the significant and growing global prevalence of neurological and mental health conditions, along with the profound suffering they cause for individuals and societies worldwide,

Acknowledging the potential of neurotechnology to offer innovative solutions for better preventive, predictive, diagnostic, therapeutic or rehabilitative purposes, benefitting humanity as a whole and providing opportunities for health promotion in all countries,

Also considering that the application of neurotechnology raises ethical, legal and societal issues and questions related to human dignity and human rights such as autonomy, privacy, mental and physical integrity, personal identity, freedom of thought, risk of discrimination, inequality and challenges to democracy, as well as challenges related to taking into account the ethically significant distinction between the medical and non-medical use of neurotechnology, and the distinction between its use as treatment or with the aim of enhancement,

Also recognizing that it is ethically imperative to explore and harness the potential of neurotechnology, particularly for medical and assistive use, and that failure to pursue such beneficial applications would raise significant ethical questions,

Reaffirming the importance of promoting and protecting the right of everyone to share in scientific advancement and enjoy its benefits,

Further recognizing the pivotal role of universal and meaningful connectivity and affordable access in unlocking the full potential of digital and emerging technologies to close all digital divides and accelerate progress across the Sustainable Development Goals,

Underlining that justice, trust and fairness must be upheld so that no country and no one should be left behind, either by having fair and equitable access to neurotechnology throughout its whole life cycle and enjoying its benefits or ensuring protection against its risks, while recognizing the different circumstances of different countries and respecting the desire of some people not to take part in all technological developments,

Also mindful of the fact that digital and emerging technologies can be critical enablers of development, and ***stressing*** the need to close all digital divides with a view to ensuring that the benefits of digital and emerging technologies are available to all, without discrimination of any kind,

Emphasizing that specific attention should be paid to lower-middle-income countries (LMICs), including, but not limited to, least developed countries (LDCs), landlocked developing countries (LLDCs) and small island developing States (SIDS), as they have their capacity but have been underrepresented in the development and access to neurotechnology,

Also underlining that global cooperation and solidarity facilitates fair and equitable access to neurotechnology and enables the realization of the full potential benefits of neurotechnology, while addressing the ethical, legal and societal challenges, mitigating against unintended harmful consequences, risks associated to potential dual use, misuse or malicious use, or unethical practices and ensuring that national neurotechnology strategies are guided by ethical principles in full respect of international law, including international human rights law,

Noting that ethical guidelines and frameworks and open science can promote responsible innovation, development and policies aligned with international law, including international human rights law,

Also recalling that in November 2023, the General Conference of UNESCO, at its 42nd session, adopted 42 C/Resolution 29, by which it mandated the Director-General “to prepare a standard-setting instrument on the ethics of neurotechnology in the form of a recommendation”, which is to be submitted to the General Conference at its 43rd session in 2025,

Bearing in mind the Universal Declaration of Human Rights (1948), the instruments of the international human rights framework, including the International Covenant on Civil and Political Rights (1966), the International Convention on the Elimination of All Forms of Racial Discrimination (1965), the Convention on the Elimination of All Forms of Discrimination against Women (1979), the Convention against Torture and Other Cruel, Inhuman or Degrading Treatment or Punishment (1984), the Convention on the Rights of the Child (1989), and the Convention on the Rights of Persons with Disabilities (2006), relevant international instruments, recommendations and declarations, the Convention relating to the Status of Refugees (1951), the Discrimination (Employment and Occupation) Convention (1958), the Convention against Discrimination in Education (1960) and the Convention on the Protection and Promotion of the Diversity of Cultural Expressions (2005),

Also noting the Declaration on the Responsibilities of the Present Generations Towards Future Generations (1997), the Universal Declaration on Bioethics and Human Rights (2005), the United Nations Declaration on the Rights of Indigenous Peoples (2007), the 2030 Agenda for Sustainable Development (A/RES/70/1) (2015), the Declaration of Ethical Principles in relation to Climate Change (2017), the Recommendation on Science and Scientific Researchers (2017), the Recommendation on the Ethics of Artificial Intelligence (2021), the Recommendation on Open Science (2021), the Human Rights Council’s resolution on “Neurotechnology and human rights” (A/HRC/RES/58/6) (2025), the Human Rights Council’s resolution on “New and emerging digital technologies and human rights” (A/HRC/RES/53/29) (2023), Human Rights Council’s resolution on “The right to privacy in the digital age” (A/HRC/RES/42/15) (2019), the International Labour Organization (ILO) Declaration on Fundamental Principles and Rights at Work, as amended (2022), the United Nations Guiding Principles on Business and Human Rights (2011), the United Nations Guidelines for Consumer Protection (2015), the Pact for the Future and its Global Digital Compact (A/RES/79/1) (2024), the Nuremberg Code (1947) and the Declaration of Helsinki - Ethical Principles for Medical Research Involving Human Participants (1964), as amended in 2024,

Further recalling that the obligation and the primary responsibility to promote and protect human rights and fundamental freedoms lie with the State, and that business enterprises, including

technology companies, have a responsibility to respect human rights, including by carrying out human rights due diligence by, inter alia, assessing actual and potential human rights impacts, integrating and acting upon the findings, tracking responses and communicating how impacts are addressed, in line with the United Nations Guiding Principles on Business and Human Rights,

Further considering the importance of applying the existing human rights framework to address the challenges and realize the opportunities of neurotechnology, while noting that these technologies may lack adequate regulation, and recognizing the need for effective measures to fully address their adverse human rights impacts,

Recalling that the Recommendation on the Ethics of Artificial Intelligence (2021) recognizes ethical questions related to artificial intelligence (AI) powered systems for neurotechnology and brain-computer interfaces, and that the report of UNESCO's International Bioethics Committee on ethical issues related to neurotechnology recommends that UNESCO and Member States take various measures to address the challenges identified,

Taking into account the existing ecosystem of national policies as well as other frameworks and initiatives elaborated by relevant United Nations entities, intergovernmental organizations, including regional organizations, as well as by the private sector, professional organizations, non-governmental organizations, civil society and the scientific community, related to the ethics and governance of neurotechnology,

1. ***Adopts*** the present Recommendation on the Ethics of Neurotechnology on this eleventh day of November 2025;

2. ***Recommends*** that Member States, with the support of UNESCO's Secretariat, apply the provisions of this Recommendation by taking appropriate steps, including whatever legislative or other measures may be required, in conformity with the constitutional practice and governing structures of each State, to give effect within their jurisdictions to the principles and norms of the Recommendation in conformity with international law, including international human rights law;

3. ***Also recommends*** that Member States engage the multi-stakeholder community to ensure that they play their respective roles in the implementation of this Recommendation, and bring the Recommendation to the attention of international, regional and national authorities and bodies, research and academic organizations, and institutions and organizations in public, private and civil society sectors involved in neurotechnology, so that the development and use of neurotechnology are guided by both sound scientific research as well as ethical analysis and evaluation.

I. DEFINITIONS AND SCOPE OF APPLICATION

For the purpose of this Recommendation:

1. ***Nervous system.*** The nervous system includes the central (brain, cerebellum, brainstem and spinal cord) and peripheral (somatic, autonomic and enteric) nervous system. Scientific evidence demonstrates that nervous system activity is the basis of sensory, motor, including neuromuscular, and mental states (which include cognitive, affective and conative states) and supports consciousness, sleep and the experience of pain. The nervous system activity and structure provide information that is specific to the individuals as well as inherent to all human beings and the community, regardless of gender, ethnicity, language or religion. The nervous system activity is also instrumental in social and cultural interactions.

2. ***Neurotechnology.*** Neurotechnology refers currently to devices, systems and procedures – encompassing both hardware and software – that directly measure, access, monitor, analyse, predict or modulate the nervous system to understand, influence, restore or anticipate its structure, activity and function. Neurotechnology combines elements of neuroscience, engineering, material science and computing, among others.

3. Neurotechnology spans medical and non-medical applications and includes tools that measure, infer and influence nervous system activity, as well as mental states, whether through direct interaction with the nervous system (both invasive and non-invasive) or by interfacing it with

devices and systems. Of note, both open-loop (e.g. fixed-parameter brain stimulation) and closed-loop (e.g. state dependent stimulation) systems introduce complex ethical issues because they affect both physical and mental processes and may have delayed effects. “Medical use” refers to any application of neurotechnology intended for preventive, predictive, diagnostic, therapeutic or rehabilitative purposes in relation to a health condition, including as classified in the World Health Organization’s (WHO) International Statistical Classification of Diseases and Related Health Problems (ICD), the International Classification of Functioning, Disability and Health (ICF) and International Classification of Health Interventions (ICHI), in accordance with internationally accepted medical standards.

4. Neurotechnology includes, but is not limited to:

(a) Technical tools that measure and analyse physical (e.g. acoustic, electrical, optical, magnetic and/or mechanical), chemical and biological signals associated with the structure of and functional signals from the nervous system (including cell therapy and gene therapy). These may be used to identify, record, predict and/or monitor properties of nervous system activity, understand how the nervous system works, diagnose pathological conditions, or control external devices (brain machine interfaces (BMI), often referred to as brain computer interfaces (BCI)). They may provide real-time feedback and associated stimulation or inhibition based on an open-loop system. Examples include, but are not limited to, electroencephalography (EEG), electroneuromyography (EMNG), magnetoencephalography (MEG), magnetic resonance imaging (MRI), magnetic resonance spectroscopy (MRS), functional magnetic resonance imaging (fMRI), diffusion weighted imaging, focused ultrasound (FUS), positron emission tomography (PET), functional near-infrared spectroscopy (fNIRS), implanted microelectrodes, optogenetics, optical imaging, calcium imaging, voltage dye sensors and microdialysis.

(b) Technical or interventional tools that interact with the structure or functions of the nervous system to change its activity, for example, to restore sensory input, such as hearing (e.g. cochlear implants) or deep brain stimulation (DBS). They are meant to modulate the functions of the nervous system, send signals directly to the nervous system by applying acoustic, electrical, magnetic, ultrasound or optical stimulation. Examples of this neurotechnology include, but are not limited to, implanted microelectrodes, BMI, DBS, optogenetic optical stimulation, transcranial electrical stimulation (TES), transcranial magnetic stimulation (TMS) or ultrasound-targeted drug delivery.

5. ***Neural data*.** Neural data include qualitative and quantitative data about the structure, activity and function of the nervous system gathered through neurotechnology as defined in this Recommendation. These are the most direct measurements or observations of nervous system states, many of which are correlated with mental states. They encompass data relating to a nervous system’s activity, including both direct measurements of neuronal structure, activity and/or function (e.g. neuronal firing or averaged bioelectric signals from EEG) and indirect functional indicators (e.g. blood flow in fMRI and fNIRS).

6. Of note, several technologies collect biometric data indirectly informing about neural activity. Such biometric data are referred to as **indirect neural data and non-neural data allowing mental states inferences** in this Recommendation. Even if these technologies are not neurotechnology per se, their use to generate information that can interpret or predict mental states raises similar ethical and human rights issues as neurotechnology when used to infer mental states. They could include, but are not limited to, eye tracking, video-oculography, typing dynamics, voice recognition and analysis, gait analysis, skin conductance, heart rate variability, sleep movement monitoring, blood pressure measurement, facial emotion recognition systems, or microbiome measurement.

7. ***Whole life cycle***. Neurotechnology should be considered from the early stages starting with its conception, design, algorithm development, decision logic, mining and obtaining raw material for materials, research, prototyping, design and development to deployment and use, including maintenance, operation, trade, financing, monitoring and evaluation, validation, end-of-use,

disassembly, termination, disposal and recycling. The whole life cycle of neurotechnology includes its convergence with other technologies and the diversity of actors who are involved in every stage.

This Recommendation:

8. Acknowledges the rapid advancement in technological developments and, in this context, aims to address those features of neurotechnology that are of central ethical relevance.

9. Addresses ethical issues related to the whole life cycle of neurotechnology, as it can have many positive and adverse impacts on, including, but not limited to, human health, human well-being, individuals, communities, societies, the environment and ecosystems, as well as on the enjoyment and respect of human rights and fundamental freedoms.

10. Considers the whole life cycle of neurotechnology for all, and across various fields, including health, and non-medical direct-to-consumer applications, addressing various settings where neurotechnology may be utilized.

11. Also addresses and responds to the ethical and human rights issues raised by the use of neurotechnology within its whole life cycle, as well as any technology allowing mental states inferences.

12. Focuses on the impact on humans and society but acknowledges important ethical considerations that may apply to animals in research and the environment.

13. Approaches ethics of neurotechnology as a systematic normative reflection based on a holistic, multicultural, multidisciplinary, pluralistic and evolving framework of interdependent human rights-based values, principles and actions aiming at guiding societies in dealing responsibly with the impacts of neurotechnology on human beings, societies and the environment and ecosystems:

(a) It considers ethics as a dynamic basis for the normative evaluation and guidance of neurotechnology, with human rights, human dignity, well-being, the prevention of harm and mitigation of risk, and freedom of research as a compass and foundation.

(b) It draws upon a range of disciplines, including from neuroscience, medicine, engineering, computer science, psychology, ethics, human rights, law, sociology, anthropology and others.

14. Covers the measurement, recording, modification and modulation of the human nervous system, the handling and processing of the data collected throughout their whole life cycle, along with other societal and environmental impacts, including the emergence of new mental states and enhanced mental and physical capabilities.

15. Recognizes that interventions involving the nervous system are particularly sensitive because the highly complex human nervous system is the coordinating centre of behaviour and mental processes. It enables the exercise of individual autonomy including the freedom to make one’s own choices, the capacity to act as moral agents, to be responsible for actions, cooperate with others, deliberate about collective decisions and develop personality.

16. Also recognizes that humans develop and flourish in their interaction with other human beings and a nurturing physical and cultural environment.

17. Further addresses ethical and human rights concerns that arise from the rapid developments and the convergence of neurotechnology with other technologies such as spatial computing, immersive technologies and extended reality (XR), AI and its advancements, sensors and semi-conductors. When processed to infer sensory, motor, autonomic function and mental states, other biometric data raise similar ethical concerns. Therefore, this Recommendation applies to both neurotechnology and the use of neural data, as well as indirect neural data and non-neural data allowing mental states inferences, ensuring that ethical principles and practices are consistently applied across these domains.

18. Addresses the integration of AI with neurotechnology, which improves the performance and cost of neurotechnology systems. Special awareness should be given to human rights impacts and ethical concerns and potential risks, including cybersecurity concerns, lack of transparency, the

potential for algorithmic bias and hallucinations, and risks to autonomy, agency, privacy, including mental privacy, personal identity, and of arbitrary and/or unlawful surveillance, of addiction and other behavioural disorders, and of manipulation.

19. Promotes the peaceful use of neurotechnology and seeks to raise awareness on the profound ethical risks and concerns that may come with a potential dual use, misuse or malicious use of neurotechnology. Urges all concerned to act responsibly with regard to neurotechnology and to respect international law, including international humanitarian law and international human rights law.

II. AIMS AND OBJECTIVES

20. This Recommendation has been created with the aim of guiding the whole life cycle of neurotechnology in ways that are ethical, responsible, safe, secure, transparent, trustworthy and effective for peaceful use and the good of humanity, individuals, communities, societies, the environment and ecosystems, and to prevent harm in the present and the future in compliance with international law, in particular the Charter of the United Nations and international human rights law.

21. The objectives of this Recommendation are:

(a) to ensure the protection, respect and promotion of human rights and fundamental freedoms, human dignity and equality, including gender equality; to safeguard the interests of present and future generations; to preserve the environment, biodiversity and ecosystems, and promote sustainable development; and to respect cultural diversity during the whole neurotechnology life cycle;

(b) to guide the actions of Member States, individuals, groups, communities, institutions, research organizations, private sector companies and every other relevant actor to ensure that ethical principles and international human rights law are upheld in all stages of the neurotechnology life cycle;

(c) to promote the responsible development and use of neurotechnology to provide innovative healthcare and the best possible diagnostic and therapy options;

(d) to ensure that neurotechnology in its whole life cycle is science- and evidence-based, reliable and reproducible, and should be evaluated continuously through research for its safety, effectiveness, efficiency, accessibility and quality, allowing for the anticipation of risk;

(e) to provide a universal framework that not only articulates values and principles but also translates into concrete policy recommendations and effective implementation to guide Member States in their engagement with neurotechnology in its whole life cycle, consistent with their obligations under international law, including human rights law, and international standards;

(f) to foster inclusive multi-stakeholder, multidisciplinary and pluralistic dialogue and consensus building about ethical issues relating to neurotechnology;

(g) to promote justice and equitable access to developments and knowledge in the field of neurotechnology and the equitable sharing of benefits, with particular attention to the needs and contributions of LMICs, including LDCs, LLDCs and SIDS;

(h) to ensure solidarity among all actors involved in different stages of the whole life cycle of neurotechnology and accountability to prevent misuse of neurotechnology and to uphold human rights, fundamental freedoms and ethical standards.

III. VALUES AND PRINCIPLES

22. Values play a powerful role as motivating ideals in shaping policy measures and legal norms. While the set of values outlined below thus inspires desirable behaviour and represents the foundations of principles, the principles unpack the values underlying them more concretely so that the values can be more easily operationalized in policy statements and actions.

23. While all the values and principles outlined below are desirable per se, in any practical contexts, there may be tensions between these values and principles. In any given situation, a contextual assessment will be necessary to manage potential tensions, taking into account the principle of proportionality and in compliance with human rights and fundamental freedoms.

III.1 VALUES

III.1.1 Respect, protection and promotion of human rights, and fundamental freedoms and human dignity

24. The inherent dignity of every human being is the foundation of universal human rights and fundamental freedoms. Respect, protection and promotion of human dignity and rights, as established by international law, including international human rights law, are essential in the whole life cycle of neurotechnology. Dignity relates to the recognition of the intrinsic and equal worth of each person. Neurotechnology should never be used in ways that undermine the dignity or rights of any individual, including those living in vulnerable situations.

III.1.2 Promoting human health and well-being

25. The research, development and application of neurotechnology that promotes comprehensive human health and well-being should be prioritized, viewing health as a holistic state of physical, mental and social well-being.

26. The responsible allocation of resources for neurotechnology should prioritize preventative, diagnostic, therapeutic, assistive and rehabilitative purposes that benefit the largest number of people. In addition, resources for neurotechnology should be prioritized for people in underserved areas and who are least well off.

III.1.3 Ensuring and respecting diversity and fairness

27. Respect for diversity and fairness should be upheld in the whole life cycle of neurotechnology.

28. Given that widely recognized neurotechnological innovation largely occurs in urban, well-resourced contexts, specific attention to underserved and marginalized people is crucial to prevent bias, ongoing disparities in and beyond healthcare, stigma, neglect and disrespect. Cultural diversity and heritage should be promoted and protected.

29. Equitable access to evidence-based and reliable neurotechnology should be prioritized globally, ensuring that its benefits are accessible to all, regardless of socioeconomic status or geographical location or any other grounds. Special attention should be given to LMICs, resource-constrained settings, as well as to the specific needs of different groups, ages, cultural systems, languages, communities, persons in vulnerable situations, persons with disabilities, neurological disorders and mental health conditions.

30. The use of neurotechnology should be particularly scrutinized to avoid uses that segregate, discriminate, stigmatize, objectify or subordinate individuals or communities, reduce social cohesion by exacerbating pre-existing inequalities or generating novel inequalities that divide and antagonize individuals or communities against each other, and thereby threaten the coexistence between humans, other living beings and the natural environment.

III.1.4 Consideration for cross-cultural perspectives on human knowledge and its sharing

31. Respectful and accessible knowledge sharing across communities and cultures on the human nervous system and its functions fosters trust and strengthens social bonds as well as global cohesion in the pursuit of health and quality of life.

32. It is essential that any research and development involving diverse groups and communities is done with their permission and guidance and conducted with their prior, free and informed consent as well as that of their legal representatives as appropriate and in partnership in ways that serve their interests and respect their traditional knowledge and epistemic contributions.

III.1.5 Global solidarity and international cooperation

33. This Recommendation should guide all actors in the whole life cycle of neurotechnology to act in solidarity and call for accountability in instances where neurotechnology may be used in ways that threaten, violate and abuse international law, including international human rights law. Moreover, international cooperation is essential to addressing cross-border issues related to neurotechnology.

III.1.6 Sustainability

34. Neurotechnology should be developed and used with a deep respect for environmental stewardship, ensuring that ecological harm is minimized throughout the life cycle of the materials used. This includes mining extraction, data processing and storage, recycling and disposal practices and avoiding disproportionate consumption of resources and energy and waste production.

35. Neurotechnology, throughout its whole life cycle, should be guided by a profound respect for the rights of Indigenous Peoples, as set forth in the United Nations Declaration on the Rights of Indigenous Peoples (2007) in particular in activities related to resource extraction and waste disposal practices.

III.1.7 Integrity and responsibility

36. Integrity means that all actors in the whole life cycle of neurotechnology adhere to ethical standards, taking responsibility for their actions, being accountable for their outcomes, and taking corrective actions when necessary. It includes ensuring that all actions are ethical, respect human rights and align with both professional standards and societal values.

37. Scientific integrity throughout the whole life cycle of neurotechnology means committing to the rigorous pursuit of truth through science- and evidence-based, objective and transparent research practices as well as transparent evaluation of research outputs.

III.2 PRINCIPLES

38. This Recommendation embraces a human rights-based and human-centred approach through fundamental ethical principles as elaborated below.

III.2.1 Beneficence, proportionality and do no harm

39. Neurotechnology should promote health and well-being and empower individuals to make free and informed decisions concerning their nervous system and mental health while fostering a better understanding of themselves.

40. Neurotechnology should contribute to human health and well-being without causing avoidable harm, whether physically, economically, socially, politically, culturally or mentally. The “do no harm” principle must guide the whole life cycle of neurotechnology, in order to promote and protect the quality of life.

41. Any restrictions on the exercise and enjoyment of human rights must meet all applicable requirements under international law, including international human rights law.

42. The principles of proportionality, balance and legitimacy should govern the use of neurotechnology and the data it enables, to ensure their use is: (a) appropriate and proportional to the objective and expected benefits that are aimed to be achieved both in medical and non-medical fields; (b) not inconsistent with the foundational values of this Recommendation; (c) appropriate to the context and target user group; and (d) based on safety principles and rigorous scientific evidence.

III.2.2 Autonomy and freedom of thought

43. Throughout the whole life cycle of neurotechnology, the protection and promotion of the rights of autonomy and freedom of thought must be secured and mental and physical integrity should be protected from any unwanted and harmful interference.

44. For the purpose of this Recommendation, autonomy is understood to be both individual and relational. It reflects a person’s own self-determination as well as their community ties that support and give meaning to their choices. As neurotechnology evolves and increasingly interacts with the

human nervous system, it must account for the individual and relational nature of autonomy throughout its whole life cycle.

45. Individuals are entitled and should be empowered to make free, informed and voluntary decisions about their engagement with neurotechnology throughout the whole life cycle, in accordance with international law, including international human rights law, and in line with ethical principles and legal standards for informed consent and other international standards. It is important to safeguard against any implicit and explicit coercion to use neurotechnology. Special attention should be given to children and adolescents and persons in vulnerable situations.

46. The procedures for expressing consent are those determined by frameworks, including national law and applicable international law. Consent should be prior, free and informed. Informed consent procedures should guarantee the free and informed nature of the consent (opt-in) and be affirmative, dynamic, iterative, comprehensive transparent and adequately documented. These should provide, in all the neurotechnology application domains, understandable, detailed and accessible information about the purposes, risks, benefits, alternatives and outcomes of the use of neurotechnology. Informed consent and assent should be adapted to and respectful of the individual's age, decision-making capacity, culture, language, education level and mental and physical condition. In cases of persons who are unable to give consent, the authorization of their legal representatives or guardians is to be sought. The will and preferences of the person being represented must be respected. Informed consent must always include the entitlement to refuse or withdraw from using neurotechnology at any time, particularly when individuals are in a power imbalance situation.

47. Neurotechnology should never be used to exert undue influence or manipulation, whether through force, coercion, perception of disadvantage, social pressure or other means that compromise autonomy and freedom of thought. This protection should cover both the internal processing of thoughts and their external expression.

III.2.3 Protection of neural data as well as indirect neural data and non-neural data allowing mental states inferences

48. Neurotechnology and other technologies that collect indirect neural data and non-neural data allowing mental states inferences raise issues pertaining to the right to privacy due to their increasing ability to collect direct and indirect data about the nervous system that is uniquely sensitive.

49. Privacy, including mental privacy, is fundamental for personal identity and agency, as well as for the protection of human dignity. The collection, processing, modification and sharing of neural data, as well as indirect neural data and non-neural data allowing mental states inferences require prior, free and informed consent of the person concerned, with the exception of life-threatening medical emergency situations, as recognized in international frameworks, in ways that safeguard and respect international law, including international human rights law, and the values and principles outlined in this Recommendation.

50. There should be clear safeguards against the collection and misuse or unauthorized access or processing of neural data, as well as indirect neural data and non-neural data allowing mental states inferences, including prior, free and informed consent, data minimization and purpose limitation, autonomy over data, including to access, correct, erase and suspend processing of data, as well as data security and protection, particularly in contexts where such data might be aggregated with other sources.

III.2.4 Non-discrimination and inclusivity

51. All actors involved in the whole life cycle of neurotechnology, particularly in its interface with other technologies such as AI, have a shared responsibility to ensure that these technologies do not perpetuate or amplify existing or new forms of inequalities or discrimination based on neurological or mental characteristics, or any other grounds in accordance with international law, including international human rights law.

52. The development and definition of standards for neurotechnology should be inclusive in order to preserve human dignity and guarantee the protection of cultural and collective identities and to

prevent homogenization and respect neurodiversity. No-one may be discriminated against because they do not use or refuse to use neurotechnology.

53. In order to contribute to the definition of the common good and to the social acceptance of neurotechnology, governments and neurotechnology stakeholders should engage in a transparent and concrete public dialogue with citizens, public organizations and other stakeholders and include them in the decision-making process. Social acceptance regarding uses of neurotechnology should not replace individuals' prior, free and informed consent to such uses.

54. Care should be taken to evaluate neurotechnology solutions promoted through governments or other stakeholders for essential services.

III.2.5 Accountability

55. All actors in the whole life cycle of neurotechnology should adhere to ethical principles in order to prevent, anticipate and address potential harms – whether short-term, long-term or arising from unintended use and impact. They should commit to taking due diligence steps to identify, prevent, mitigate and account for how they address and redress any adverse impacts. They should also commit to adjusting practices in response to new evidence or ethical concerns, to remaining open to feedback, and to clear and transparent communication.

56. Member States should ensure that those who suffered harm by neurotechnology have timely access to justice and effective remedy. They should work together with all stakeholders to ensure that those responsible for these harms are held accountable.

III.2.6 Trustworthiness and transparency

57. Trustworthiness implies that people should have good reason to trust that neurotechnology applications can bring individual and shared benefits, while adequate measures are taken to mitigate risks. An essential requirement for trustworthiness is the monitoring of the whole life cycle of neurotechnology by all the stakeholders, as appropriate.

58. All actors throughout the whole life cycle of neurotechnology should ensure that their activities are transparent, safe and secure, grounded in scientific evidence, and aligned with international principles of responsible conduct and scientific integrity, regardless of whether neurotechnology is used in medical contexts or non-medical contexts, or when devices infer or interfere with mental states. This includes preventing the replication or amplification of biases, reinforcing the traceability and explainability of neurotechnology and ensuring its capacities and limitations are accurately portrayed, the conditions for accountability are clearly defined, adhering to ethical guidelines in research and development, including in the use of neurotechnology for medical purposes, the registration of trials, fair participant selection and review or approval by independent ethics committees.

III.2.7 Epistemic justice, inclusive engagement and public empowerment

59. Fair and equitable distribution and creation of knowledge about neurotechnology should be promoted, and participation of all individuals and communities in its creation, sharing and applications should be encouraged.

60. Open and accessible education, along with public and community engagement should be promoted to ensure that diverse populations can gain and exchange knowledge about nervous system functioning, mental health, medical and non-medical applications and tools of neurotechnology, and to foster active participation of the society.

61. Effective public and community engagement throughout the whole life cycle of neurotechnology requires respect for diversity, including linguistic, social, cultural, heritage and identity. This respect for diversity aims to ensure that the knowledge and perspectives of diverse communities are valued and included in decision-making processes, and that autonomy is respected.

62. All communities should have a voice in decisions that concern them when it comes to neurotechnology, at all stages of its life cycle.

III.2.8 Best interests of the child and protection of future generations

63. When neurotechnology is used on children, it is essential to uphold the rights of the child, understood to be persons under 18 years, as enshrined in relevant international law, in particular the right to privacy, freedom of thought and the right to express their views freely in all matters affecting them, while respecting, as applicable, the responsibilities, rights and duties of parents or legal guardians. This includes a firm commitment to the holistic development of every child – intellectually, emotionally, socially and physically. Neurotechnology must be deployed in ways that nurture children's autonomy, protect their mental and physical integrity, foster meaningful human relationships and promote well-being through balanced, healthy lifestyles. In the case of children with disabilities or cognitive conditions, the use of neurotechnology must be rigorously assessed to ensure that it consistently serves the best interests of the child, supports their healthy development, well-being and autonomy, while respecting human diversity and internationally accepted ethical and clinical protocols. Likewise, it must be rigorously evaluated to ensure full inclusion in society, equal opportunities, participation in cultural life and accessibility, especially in education, inclusive sports, para-sports, communication and information.

64. The nervous system is rapidly evolving from gestation, during childhood and critically changing during adolescence, which makes it crucial to preserve the rights of children and adolescents. The use of neurotechnology in children, understood as persons under 18 years, should be limited for medical and therapeutic purposes, as well as other well-justified scientifically proven applications that can be demonstrably shown to serve the best interests of the child. This includes applications that guarantee children with disabilities and cognitive conditions inclusive access to culture, communication, information and sports. Such uses must be grounded in sound scientific research, subject to rigorous evidence-based assessment and ethical scrutiny, and must ensure full respect for the rights and best interests of the child.

65. In advancing responsible development and use of neurotechnology, particular attention should be paid to the needs of future generations and to preserve their interests.

III.2.9 Global and social justice, enjoying the benefits of scientific progress and its applications

66. Access to and benefits arising from research and development in neurotechnology should be shared equitably among all stakeholders, with a particular focus on ensuring global distribution that promotes fairness and reduces disparities, in accordance with international obligations.

67. Neurotechnology developments should be leveraged to reduce global health inequities and to improve the quality of life, particularly in resource-limited settings.

68. Efforts, including international cooperation, should be made to overcome, and never take advantage of, the lack of necessary technological or medical infrastructure, education and skills, as well as ethical and legal frameworks in neurotechnology, particularly in LMICs, LDCs, LLDCs and SIDS, affecting communities.

69. The development and impact assessment of neurotechnology applications should consider the implementation of human rights-based and human-centred paradigms to ensure that end users are not merely passive recipients of the technologies but actively participate in the whole life cycle.

IV. AREAS OF POLICY ACTIONS

70. UNESCO recognizes that Member States are at different stages of readiness to implement this Recommendation, in terms of scientific, technological, economic, educational, legal, regulatory, infrastructural, societal, cultural and other dimensions. It is noted that "readiness" here is a dynamic status.

IV.1 GOVERNMENT INVESTMENT, USE AND REGULATION

71. Member States, national and international institutions and private actors should actively support research of high-quality and science-based development, deployment and responsible use neurotechnology for the public good. Investments should be directed to applications that foster human health and well-being, the use of which respects, protects and promotes human rights. This

should include funding for interdisciplinary research that not only advances neurotechnological innovation but also studies the ethical, safety and security, legal, social, psychological, environmental and cultural implications of these technologies, and supports the implementation and clinical translation of technological prototypes. Particular attention should be given, also by the private sector, to the development and implementation of adequate technical, institutional, procedural and other safeguards to mitigate risks of neurotechnology and to ensure that it equitably benefits society and that human rights and the rule of law are upheld.

72. Member States should establish or strengthen, as necessary, the oversight and enforcement capacity relevant to neurotechnology development and deployment, and sectors where neurotechnology is being applied to allow more effective measures to protect against human rights risks relating to neurotechnology.

73. Member States should ensure that ethical and human rights due diligence, including regular, comprehensive human rights impact assessments are conducted for the neurotechnology that they develop, design, deploy, use, sell, operate or procure, in order to prevent or mitigate their possible adverse human rights impacts, in the short and long run.

74. Member States should ensure that any use of neurotechnology in the justice system, including its consideration by the judiciary, should be grounded in scientific evidence and implemented ethically in accordance with human rights and the rule of law. In this context, Member States should guarantee due process and fair trial, including the presumption of innocence, and that individuals are not compelled to testify against themselves or confess guilt. Any use of neurotechnology, in judicial proceedings should have strong and robust oversight mechanisms, including strong data protection, privacy, consent and freedom of thought protection, fair trials or hearings and human rights standards.

75. Neurotechnology shall not be used for any kind of social control, attempts at coercive behavioural conformity based on personal beliefs or thoughts, political or other opinions, gender, or arbitrary and/or unlawful surveillance of mental states, as well as for torture or cruel, inhuman or degrading treatment or punishment.

76. Member States should ensure that neurotechnology is developed and deployed responsibly, with respect for international human rights law, with robust independent oversight mechanisms to foster adherence to these restrictions and protect privacy, including mental privacy, and freedom of thought for all individuals. These policies should be developed in inclusive dialogue with diverse actors, including civil society, end users, neurotechnology experts, ethicists and human rights defenders, to ensure broad consensus and respect for international law, including international human rights law.

77. Member States should ensure transparency and accountability in their support, oversight and regulation of neurotechnology, particularly in publicly funded initiatives such as research in the field of mental health, brain and brain health and overall health research and development programmes. Governments should require, as appropriate, neurotechnology projects to publicly disclose the objectives, methodologies, intended uses, results, potential risks, identified risks and societal impacts of their neurotechnology initiatives as soon as this information is suitable for public disclosure. This transparency is crucial for fostering public trust and ensuring that neurotechnology advances are aligned with ethical standards as set forth in this Recommendation, and with international law, including international human rights law.

78. Member States should apply a comprehensive approach to regulatory and policy measures to protect against human rights related harms of neurotechnology developed, marketed, operated or used by the private sector and public sector. The private sector should apply the United Nations Guiding Principles on Business and Human Rights, and States should establish a national framework, including oversight mechanisms, with respect to neurotechnology companies. This comprehensive approach includes regulatory measures and accompanying guidance, ongoing risk monitoring and assessment, incentives and transparency requirements, meaningful public and community engagement, and transparent communications. States should ensure access to timely and effective remedy for those affected by human rights violations in the context of neurotechnology.

79. Member States should consider establishing comprehensive incentive structures, such as tax incentives, grants and awards, to promote and enable innovation ecosystems participatory and transparent for neurotechnology development for medical applications, and to strengthen capabilities within public research institutions to contribute to societal benefits.

80. Member States should establish a coordinated, comprehensive, transparent, multi-stakeholder, cross-sectoral and multidisciplinary approach to assessing the impacts of neurotechnology as a general technology class across its whole life cycle. This technology assessment should be conducted, managed and/or overseen by relevant competent entities, including international bodies, as appropriate. This approach involves meaningful public, stakeholder and community engagement, and could include, but is not limited to:

(a) Human rights impact assessments: to identify, prevent and mitigate potential adverse impacts of neurotechnology on human rights, with particular attention to vulnerable people and those living in vulnerable situations;

(b) Economic and social impact assessments: to assess how neurotechnology impacts economic growth, decent work, social justice and environmental sustainability;

(c) Benefit-risk assessments: to evaluate the risks and benefits associated with the whole life cycle of neurotechnology, including research, clinical applications and consumer products, including risks that manifest after withdrawal of technology and guarantee access to medical care, when appropriate;

(d) Privacy impact assessments: to evaluate and mitigate risks to individuals' right to privacy posed by neurotechnology, including ensuring appropriate safeguards to protect neural data as well as indirect neural data and non-neural data allowing mental states inferences in compliance with applicable national and international privacy standards and the data policy actions set forth in this Recommendation;

(e) Ethical assessments: to identify and respond to ethical concerns.

81. Member States should promote equitable access to science- and evidence-based, safe and reliable neurotechnology worldwide that fosters health and the common good. To achieve such goals, efforts should be made to support the reduction of final costs for end users, pursue the development, adoption and continuous support of non-proprietary software solutions, and explore reimbursement strategies or subsidization commensurate with conventions in local jurisdictions.

82. Member States should consider intellectual property (IP) development strategies that incentivize innovation and promote open science and access to and dissemination of neurotechnology, as well as the sharing of its benefits. The impact of IP policies on the neurotechnology sector should be holistically and continuously monitored, paying particular attention to the risks associated with the commodification and commercialization of living organisms and the human body.

83. Member States should consider adopting agile and risk-based tiered regulatory frameworks. These may include the use of regulatory sandboxes – controlled environments for designing, developing, testing, evaluating, verifying and validating neurotechnology – in response to rapid advancements in neurotechnology and its convergence with other technologies such as AI, spatial computing and immersive technologies. These frameworks should facilitate innovation, ensure ethical data processing, prevent harm and safeguard rights by incorporating mechanisms for regular monitoring, evaluation and dynamic policy adjustments in line with technological and ethical developments.

84. When Indigenous Peoples are involved or impacted at any stage during the whole life cycle of neurotechnology, Member States and other actors should take measures in line with the United Nations Declaration on the Rights of Indigenous Peoples to ensure that their rights are respected and protected to safeguard their meaningful participation with prior, free and informed consent through processes that are accessible in their languages and contexts, and to prevent interference with their traditional or ancestral knowledge systems or cultural sovereignty. When Indigenous

knowledge is involved, open science processes and IP management strategies should be developed in collaboration with Indigenous Peoples from the beginning.

IV.2 DATA POLICY

85. Member States should develop robust, fair and agile regulatory and legal frameworks to govern the collection, processing, sharing and all other uses of neural data as well as indirect neural data and non-neural data allowing mental states inferences, as appropriate. New and existing frameworks should consider both neural data as well as indirect neural data and non-neural data allowing mental states inferences as sensitive personal data.

86. Member States should ensure that their existing privacy policies comprehensively cover stringent safeguards for individuals' neural data as well as indirect neural data and non-neural data allowing mental states inferences. If current policies do not adequately address these areas, Member States should adopt targeted safeguards in existing or new legislation or regulatory frameworks to secure these protections. Such legislation or frameworks should prohibit the practice of tying access to goods or services to the disclosure of neural data as well as indirect neural data and non-neural data allowing mental states inferences, require explicit opt-in or a legal basis for any data sharing, and forbid the use of such data for targeted advertising without the individual's prior, free and informed consent.

87. Member States should develop and implement specific policies that ensure that the ecological footprint of neurotechnology is sustainable, particularly in relation to large-scale data centres and computing resources used for processing and storage of neural data as well as indirect neural data and non-neural data allowing mental states inferences. These policies should emphasize data minimization, to ensure that only the necessary amount of data is collected and processed, and promote the proportional use of neurotechnology, aligning its deployment with genuine needs and minimizing unnecessary environmental impact. These policies should include optimizing energy efficiency, using renewable energy sources, promoting the recycling and sustainable disposal of neurotechnology-related equipment, and ensuring the rehabilitation of affected environments.

88. Member States should support and incentivize the development and implementation of technological innovations and design standards for neurotechnology that improve the protection of neural data as well as indirect neural data and non-neural data allowing mental states inferences, such as state-of-the-art encryption, secure databases with multi-factor authentication, cutting-edge anonymization techniques, and edge-processing and storage (processing and storing data closer to where they are generated).

89. Member States should incentivize neurotechnology manufacturers to prioritize privacy and a code of ethics by design, facilitating the incorporation of privacy-preserving technologies as default features in their devices.

90. Member States should encourage data sharing in compliance with relevant data protection law, and in line with principles set forth in this Recommendation, by establishing safe and secure data repositories for neural data as well as indirect neural data and non-neural data allowing mental states inferences used in research. These repositories should meet stringent cybersecurity, data privacy and ethical use standards (including data minimization and purpose limitations), tiered access and other privacy-enhancing approaches. Appropriate funding mechanisms should be established for the curation and maintenance of data, and data governance processes should be streamlined.

91. Member States should prioritize efforts to facilitate cross-border data sharing in neurotechnology research, in compliance with relevant data protection law, working towards greater alignment of data protection standards, particularly concerning neural data as well as indirect neural data and non-neural data allowing mental states inferences, by establishing clear protocols for data transfer for secure, risk-based and compliant data exchanges across borders, and standards for interoperability of data, including governance frameworks for data sharing, while taking into account existing mechanisms and guidelines for privacy protection and data governance, including adequate information and prior, free and informed consent.

92. Member States should consider specific guidelines for the ethical use of neural data as well as indirect neural data and non-neural data allowing mental states inferences in AI development and research, including ethics and privacy by design approaches and consent procedures for their uses in the training and application of AI models, if current policies do not adequately address these areas, ensuring transparency and respecting individual and community rights and IP, as applicable.

IV.3 SECURITY

93. Member States should collaborate internationally to establish comprehensive standards for cybersecurity across all neurotechnology domains. These standards should encompass hardware, software and data security measures to protect against potential cyber threats and information and communication technology threats. By establishing uniform cybersecurity standards, Member States should enable an environment that fosters and promotes the integrity, confidentiality, security and availability of neural data as well as indirect neural data and non-neural data allowing mental states inferences, and enhance user trust and confidence in neurotechnology devices, including applying a secure by design approach. Additionally, these standards should evolve in tandem with technological advancements and emerging cyber threats to maintain robust protection against evolving risks.

94. Member States should adopt and maintain a cybersecurity standards framework for neurotechnology, as applicable, that implements existing international frameworks and leading methodologies from industries, the public and private sectors, academia and civil society to model, predict, avoid and mitigate cybersecurity threats. Such a framework should employ, but not be limited to, policy protocols, risk assessment prioritization, security controls, data encryption, key performance indicator (KPI) optimization and privacy compliance for cybersecurity effectiveness.

95. Member States should encourage and facilitate, as appropriate, red-teaming exercises – adversarial challenges to test the efficacy of security systems – as a proactive measure to assess and enhance the safety, security and resilience of neurotechnology systems. By conducting regular red-teaming exercises, Member States should seek to proactively identify and address security gaps, test incident response procedures, and strengthen the overall safety and cybersecurity posture of neurotechnology devices.

IV.4 COMMUNICATION, ENGAGEMENT AND INFORMATION

96. Member States should promote communication and develop engagement policies for neurotechnology throughout its whole life cycle that foster informed, inclusive and respectful dialogue between researchers, developers, diverse users, media and the broader public to respect individual and community rights, promote public trust and harness the collective intelligence and diversity of communities.

97. Member States should collaborate with national and international organizations, educational institutions, media, private and non-governmental entities, and public and civil society organizations to develop and disseminate science-based, accessible and engaging educational materials that are age, contextually, culturally and linguistically appropriate, and establish transparent platforms to inform the public about possible societal or individual adverse effects. These should be tailored to diverse audiences to bridge knowledge gaps, particularly in underserved regions, about the nervous system functioning and mental and brain health, as well as the functionality, safety, benefits and risks of neurotechnology. These programmes should aim to empower individuals to make informed decisions and to enable their ethical reflection about their use of neurotechnology, including their supportive use at home, both for the users and for caregivers and family members.

98. Member States should implement public and community engagement processes that facilitate genuine mutual learning and collaboration throughout the whole life cycle of neurotechnology. These processes should include regular and inclusive consultations with a wide array of actors. The aim of these engagements should be to inform policy development, shape ethical guidelines, increase public awareness and understanding, shape investment priorities, and ensure that neurotechnology deployment aligns with public interests and values. Special attention should be given to involving groups traditionally underrepresented in technological policymaking, thereby fostering responsible innovation in the field of neurotechnology.

99. Member States should collaborate in the co-creation and dissemination of accurate, precise and understandable language and terminology for discussing neurotechnology that involves actors from diverse backgrounds so that the language used is inclusive, non-stigmatizing and accurately reflects the technologies' capabilities and limitations. Regulatory frameworks should address fraudulent or misleading reporting of capabilities, risks and limitations across all applications to avoid exaggeration of claims including, but not limited to applications in sleep, attention, memory and emotional regulation. Member States should encourage evidence-based communications, including with the media, about early-stage research and capabilities, risks and limitations across all neurotechnology applications.

100. Member States should foster effective collaboration between end users, researchers and innovators throughout the whole life cycle of neurotechnology product development, for example through establishing platforms for ongoing dialogue and feedback between researchers, developers and representatives from various user groups, especially persons with disabilities, while respecting all diversities, including neurodiversity, and involving them in the process of developing and testing new neurotechnology products to optimize device efficacy, safety and quality, usability, longevity and sustainability.

IV.5 GENDER EQUALITY

101. Member States should adopt and enforce comprehensive policies that promote and respect gender equality in the whole life cycle of neurotechnology. The policies should prioritize inclusive research for addressing gender-specific needs and differences, require targeted sex-disaggregated data collection and analysis, include education and training programmes on inclusive research practices, ensure public and community engagement with gender health experts and advocacy groups and incentivize gender-responsive technology design. Targeted policies are necessary to close gender gaps in these fields and increase representation, engagement and leadership.

102. Member States should establish clear guidelines and legal frameworks to ensure that workplaces and research environments, throughout the whole life cycle of neurotechnology, are gender inclusive, representative and free from harassment and discrimination. These should include robust mechanisms for reporting and addressing incidents of gender-based harassment, discrimination and violence to ensure accountability and support.

103. Member States should adopt a range of measures that prioritize ethical and equitable research and innovation and support programmes that promote gender equality in neurotechnology, encouraging participation throughout its whole life cycle. This should include policies and initiatives to close the gender gap in neurotechnology through targeted education and mentorship programmes, networking and employment opportunities, entrepreneurship support, leadership development and public awareness-raising campaigns within the sector and developing indicators to evaluate the impact of these measures. Member States should also actively work to eliminate the barriers that hinder or prevent women from participating or succeeding in the neurotechnology field.

HEALTH AND RESEARCH ETHICS

IV.6 HEALTH

104. Member States should support the development of health applications for unmet medical needs in the provision of neurological and mental health. This should include establishing and supporting research programmes specifically targeted at addressing identified gaps in nervous system care.

105. Member States should build and maintain international solidarity and foster dialogue and cooperation to address global health risks and uncertainties and ensure that their implementation of healthcare for the nervous system is consistent with international law, including international human rights law, as well as medical and scientific standards.

106. Member States should establish oversight mechanisms, if they do not already exist, to evaluate the physical and mental health impacts as well as the socialization effects of long-term use of neurotechnological devices, with special attention to invasiveness and reversibility of neurotechnology interventions and to the potential harm caused by the removal of invasive

neurotechnology. This should include implementing regulatory measures requiring long-term follow-up studies for approved neurotechnology devices and establishing clear criteria for continued approval based on these studies results.

107. Member States should consider the significant cost and impact associated with pathologies related to the nervous system, as well as the potential benefits of early diagnosis and access to preventive, assistive and rehabilitative neurotechnology. Public policies should promote access to these technologies and aim to ensure health cost coverage for individuals in need.

108. Member States should promote the development of reliable, safe and durable neurotechnology for healthcare applications. This should include the design of devices and systems that require minimal maintenance, to ensure they remain safe, functional and effective under varying conditions. Regulatory bodies or designated authorities should oversee the enforcement of standards for quality, safety and longevity, and address obsolescence, thereby reducing the burden on users and enhancing the dependability and sustainability of neurotechnological solutions, as well as continuity of access to these solutions when developers and suppliers cease to provide access or can no longer do so.

109. Member States should develop or strengthen existing comprehensive neurotechnology medical device reporting systems that track and address adverse effects. These systems should pool pertinent observations from health personnel and patients alike. In contexts where such systems do not exist, Member States should establish them. Where systems are already in place, they should be updated to specifically include neurotechnology. These systems should be interoperable and, where appropriate, contribute to a centralized, public and transparent international database in case it is permitted by their national laws, managed in collaboration with international organizations and accessible for public knowledge, oversight and research, while ensuring that patient privacy, data security and IP rights are protected. Member States should consider the establishment of national registries of neurotechnology interventions supported by policy and infrastructure mechanisms.

IV.7 RESEARCH ETHICS

110. Member States should reinforce the ethical frameworks governing neurotechnology research to ensure robust protection and the non-exploitative participation of all individuals involved. Special attention should be given to ensure that those contributing to research and development have their fair share of the benefits and do not bear disproportionately the risks. Individuals participating in research should, along with other informed consent requirements, be informed of potential side effects, including in the long term, and given the opportunity to disclose if they have contraindications for the procedures used. Furthermore, due consideration should be given to the potential dual use, misuse or malicious use of neurotechnology research to avoid its use for malign purposes.

111. Member States should adopt clear guidelines or policies that define the qualifications required to ensure that research is conducted by professionals with appropriate knowledge about the nervous system structure, including information about brain disorders as well as knowledge of the communities where they are working, and is performed in adequate research settings. Furthermore, research protocols, public or private, in the medical as well as the non-medical domain, should be carefully evaluated by independent, multidisciplinary and pluralist research ethics committees with specific consideration for individuals with diminished or without capacity to give informed consent or to make decisions, including the objection to participate, and for those in vulnerable situations. Member States should seek to ensure that all research institutions require their staff to be appropriately trained and experienced to perform their tasks ethically and responsibly.

112. Member States should encourage multi-centre international research that involves various cultures and ethnic groups. Member States should promote international cooperation to develop common reporting standards and protocols for interoperability, particularly for implantable neurotechnology devices. This cooperation should aim to enhance the comparability and utility of research globally, improving both the efficacy and ethical integrity of research.

113. Member States should ensure that the whole life cycle of neurotechnology is considered in the design of a trial, including policies to protect participants in case of cessation of activities of the trial

sponsor or promoter, as well as post-trial support for continued access for participants, where needed. Member States should establish requirements for clinical trials to be included in relevant nationally or internationally approved registries and encourage registration with community and participant registries. Also, trials should report on appropriate medical device reporting systems developed within Member States.

114. Technology developers should ensure that the validation of AI algorithms in neurotechnology research include rigorous testing and monitoring for biases, as well as measures to ensure human oversight and enhance fairness, explainability and transparency, including the provenance of training datasets. Suitable techniques should be employed to mitigate any biases present in AI models used in neurotechnology applications.

115. Member States should promote research efforts that do not only focus on biomedical risks associated with neurotechnology. Understanding how neurotechnology may impact aspects of self-perception, consciousness, agency identity and interpersonal relationships is essential for addressing safety and ethical concerns and ensuring the well-being of individuals using these technologies. Social and societal effects of a widespread use should also be considered. Member States should encourage and support longitudinal studies into the long-term impacts of the uses of neurotechnology.

116. Member States should, as appropriate, ensure that those engaged in neurotechnology research implement regular and independent auditing and monitoring of research practices to ensure adherence to ethical standards. This should include evaluating the adequacy of prior, free and informed consent, particularly concerning reuse of neural data as well as indirect neural data and non-neural data allowing mental states inferences.

117. Member States should require researchers in neurotechnology to establish clear and transparent protocols for communicating clinically significant and actionable incidental findings to participants. These protocols should ensure that such findings are conveyed promptly, respecting participants' rights and autonomy. The informed consent process should clearly outline what these findings might entail, the participants' option to choose whether they wish to be informed about such findings, and guarantee that their decisions, or the decision of the relevant legal representatives, as appropriate, in this regard will be respected throughout the study or treatment. Additionally, Member States should mandate that researchers provide the necessary support and coordination with healthcare providers to address any health concerns that arise from these findings.

SPECIFIC DOMAINS OF APPLICATION OUTSIDE OF HEALTH

IV.8 EDUCATION

118. Neurotechnology for the purpose of non-therapeutic performance optimization should not be used for children with full health and cognitive function, as defined by WHO, understood as persons under 18 years. The use of neurotechnology in education could be permitted for certain legitimate pedagogical purposes such as assisting students with learning difficulties, including persons with disabilities or cognitive conditions, or promoting technological literacy, provided that it is compatible with the human rights, health, well-being and non-discrimination of students, as well as their prior, free and informed consent or assent, as appropriate. Such uses must also be evidence-based, evaluated in advance, correspond to legitimate educational objectives and be limited to what is necessary to achieve such objectives. Member States should be encouraged to develop national guidelines to that end.

119. Member States should approach with caution the integration of neurotechnology in education, ensuring that its use is science- and evidence-based, assessed ex-ante, aligned with the education goals and complements traditional learning methods. If neurotechnology is integrated into education, emphasis should be placed on promoting the holistic and inclusive development of students, focusing not just on academic performance but also on mental health, well-being and overall interests. It is also important to train educators properly so that they are able to deploy neurotechnology appropriately in educational environments.

120. To ensure inclusivity, Member States should develop age-appropriate guidelines for neurotechnology use across different educational stages, taking into account individual differences

in cognitive development and learning needs. Regular assessments of neurotechnology's impact on student development, including mental and brain health, should be conducted, with ethical review processes established to oversee deployment. The primary focus should be on fostering critical thinking, creativity and social-emotional skills rather than solely improving academic performance or guiding young people strictly according to the specific needs of the labour market.

121. Member States should adopt policies ensuring that the voluntary deployment of neurotechnology in education are grounded in prior, free and informed consent. Policies governing the use of neurotechnology in education should include clear, age-appropriate information about the technology's purpose, benefits and risks, with adequate consideration periods. Consent and assent procedures for minors should involve children, adolescents, parents, guardians and all actors necessary. Ethical oversight mechanisms should be established, including regular informed consent renewal and immediate cessation of neurotechnology use upon withdrawal, and ensure anonymous feedback channels. Policies should prohibit undue incentives or academic penalties for non-participation and take measures to avoid creating or reinforcing inequalities among students. Policies should also prohibit the use of neurotechnology in performance evaluation of students and educators. Additionally, Member States should support student and educator involvement in decision-making about neurotechnology integration, and fund training programmes on its ethical use, empowering educators and students to critically assess its application.

122. Member States should establish a unified, robust and independent oversight mechanism for neurotechnology use at all levels of educational settings, incorporating regular audits, public and community feedback, culturally appropriate and strict adherence to safety, human rights and ethical standards, including an assessment of reversibility on the nervous system. Continuous research should be conducted to assess the short-term and long-term psychological and cognitive impacts of these technologies. Oversight should involve periodic reviews based on empirical evidence to adjust neurotechnology usage as needed, to ensure it serves student development and addresses risks such as dependency or de-skilling. This comprehensive approach can help maintain the safety, effectiveness and alignment of neurotechnology with best practices for student well-being and learning outcomes.

123. Member States should support the inclusion of ethics related to the whole life cycle of neurotechnology into all relevant educational curricula and professional development programmes. This should ensure that all concerned actors, including innovators and business leaders, involved in the whole life cycle of neurotechnology are equipped to critically evaluate the implications of their work.

IV.9 LABOUR AND EMPLOYMENT

124. Member States should establish new or adapt existing policies to govern the use of neurotechnology in the workplace, to promote and protect internationally recognized workers' rights in line with the ILO principles and instruments, especially through tripartite approaches, to safeguard workers' privacy and safety, and to ensure that all deployment of neurotechnology is evidenced-based and has been scientifically validated to promote worker health and well-being. Deployment must be strictly voluntary, and workers must opt in actively and in an informed manner and must have the option to opt out at any time and report abusive use without facing any negative consequences or discrimination. Particular attention must be paid to the relationship of subordination between worker and employer, which leads to high requirements for ensuring prior, free and informed consent. The processing should only be carried out if there is a legal basis, for a legitimate purpose and only to the extent necessary. In principle, consent per se should not constitute a sufficient sole legal basis for intrusive processing using neurotechnology. It is also essential that workers be consulted and able to participate in decisions about the introduction of neurotechnology applications affecting their working conditions. Member States should require employers who use neurotechnology in the workplace to adopt transparent policies that disclose the purpose of the use and limit the scope and location of its use to legitimate purposes in the interest of the worker and third parties (e.g. safety, monitoring fatigue in commercial drivers or tracking attention in air traffic controllers). Under no circumstances should neurotechnology be used for performance evaluation, for punitive measures, in ways that could compromise worker health, to allow profiling or when the risks outweigh potential benefits.

125. Member States should ensure that employers protect the privacy rights of workers if their personal data are processed by their employer using neurotechnology. Employers should be prohibited from collecting and using neural data as well as indirect neural data and non-neural data allowing mental states inferences for any non-agreed or illegitimate purposes, particularly those that could negatively impact a worker's working conditions or privacy. Unauthorized access to or processing of such data that may be collected incidentally during routine workplace monitoring should be prohibited. Employers should not share workers' neural data as well as indirect neural data and non-neural data allowing mental states inferences outside the employer's business and employer's agents without workers' explicit prior approval and only within the scope of a legal basis. Employers should also work to mitigate the risks and comply with relevant laws related to the collection and retention of information regarding workers' disabilities or genetic information, including any worker's family medical history.

126. Member States should, if neurotechnology is used, require employers to clearly provide workers and job seekers with comprehensive training and information, for example, about how neurotechnology used in their workplace works, the benefits it offers, transparency about what data are collected, how they are used and who has access to them, and to clearly disclose any potential risks of its use. Workers should be able to refuse the use of the data collected that concern them personally.

127. Member States should require employers to adopt best practices for data minimization and secure storage of neural data as well as indirect neural data and non-neural data allowing mental states inferences, ensure that data are stored securely, with access limited to authorized personnel only, and are deleted once their intended purpose has been fulfilled or the worker has the option to opt out. Additionally, upon a worker's departure, all related records should be fully and automatically deleted or individual data released to the worker, ensuring that no data are retained after the termination of employment.

128. Member States should ensure that when workers are issued multifunctional devices (e.g. earbuds or headphones that also include neural sensors) that can be used at work or at home, employers should be prohibited from collecting neural data as well as indirect neural data and non-neural data allowing mental states inferences outside of workplace settings and working hours and ensure that any data collected during work are used exclusively for legitimate and agreed-upon purposes with the prior, free and informed consent of the worker. Employers should implement technological safeguards to automatically disable data collection outside working hours.

129. Member States should ensure that employers provide workers, upon their request, with a copy of any neural data as well as indirect neural data and non-neural data allowing mental states inferences collected about them, along with any interpretations drawn from it in an accessible and comprehensible manner.

130. Member States should require, through stringent regulations, that any use of neurotechnology in the workplace require worker's explicit, prior, free and informed consent, and only within the scope of a legal basis and for legitimate purposes that demonstrably enhance workplace safety, worker well-being as required by dignity, and not for enhancing productivity or at the expense of worker integrity and health, in particular mental and brain health.

131. Member States should guard against the exploitation of and discrimination against workers and job seekers, by limiting to legitimate purposes the use of neurotechnology for hiring and maintaining employment and by adapting existing or developing new regulations regarding the use of neural data as well as indirect neural data and non-neural data allowing mental states inferences for profiling in the workplace, ensuring that hiring practices and workplace policies are fair, inclusive and healthy, particularly regarding mental and brain heath.

IV.10 CONSUMER AND COMMERCIAL DOMAINS

132. Member States should proactively establish a regulatory framework that balances innovation in the recreational consumer and commercial domains with protecting individual rights and well-being, taking into account the United Nations guidelines for consumer protection (2015). This framework should be dynamic, allowing for timely updates as technology evolves and as new

insights are gained about its impacts on society. This includes providing adequate oversight to ensure that neurotechnology does not cause harm, is used consensually, and includes robust mechanisms to protect users from different types of risks, including psychological risk or manipulation.

133. Member States should strengthen comprehensive consumer protection laws to include clear labelling on commercial neurotechnology products, detailing their effects, limitations and risks to prevent misleading claims and ensure transparency, and provide detailed instructions for use. This should also include prohibiting practices of “tying” or requiring the disclosure of neural data as well as indirect neural data and non-neural data allowing mental states inferences as a condition to access goods or services, and prohibiting third party data sharing or the uses of these data without an affirmative opt-in option based on clear and understandable information.

134. Member States should foster an environment that ensures all claims about consumer, non-medical technologies are supported by robust scientific evidence. They should, by regulation, require that any such product claiming to treat, prevent or diagnose diseases or medical conditions be validated through rigorous safety, toxicity and efficacy testing, under appropriate medical supervision. The consumer should be informed of the non-medical nature of the products concerned.

135. Member States should enforce consent processes that are thorough and transparent across all neurotechnological interventions and apply these uniformly in various domains such as sports and arts, where robust standards should safeguard against coercive use and respect athletes’ and artists’ individual autonomy, community interests and IP rights.

136. Member States and international organizations should raise public awareness about the potential advantages, including unfair ones, that neurotechnological applications could provide in competitive domains such as sports and certain artistic disciplines, and consider the potential for such technologies to introduce new inequalities. Member States and international organizations should also consider the positive role neurotechnological applications may play in fostering inclusion for persons with disabilities in these domains and guard against the possibility of these technologies to introduce new inequalities. Member States and international organizations should encourage the creation of systems that require full disclosure of neurotechnology use in any kind of competitive activity.

137. If neurotechnology is used in the arts, Member States should encourage all actors concerned to promote critical and creative reflection, and enhanced cultural learning without compromising individual autonomy or leading to cultural homogenization.

138. Member States and other relevant actors should adopt policies and regulations to prevent the misuse or abuse of neurotechnology for consumers, especially neurogaming and gambling and other devices that exploit the dopamine reward system or seek to induce problematic and unhealthy use and overconsumption. Such regulations should mandate clear labelling of risks as well as disclosures on their effects on the nervous system, and enforce game design standards and safety, privacy and age-appropriate design standards that prevent taking advantage of a person’s physical, mental and emotional vulnerability to lead to compulsive use or addiction of gaming or digital recreational platforms combined with neurotechnology, to promote healthy, balanced use, especially among children.

139. Member States should ensure that devices capable of multiple functions, such as XR glasses or smart earbuds with neural sensors, include hardware-based controls that allow users to selectively disable neurotechnology features while maintaining basic functionality. Regulations should ensure that opt-out features are accessible and straightforward, promoting healthy, balanced use especially among children and persons in vulnerable situations.

140. Member States should address the profound ethical and human rights related questions regarding autonomy, consent, privacy and the potential for manipulation raised by neurotechnology that arise in contexts that include, but are not limited to, recommender systems, priming and nudging, marketing during sleep and dream, neuromarketing and closed-loop environments, by adopting comprehensive policies and regulations that:

(a) Recommender systems: explicitly prohibit the use of neural data as well as indirect neural data and non-neural data allowing mental states inferences in recommender systems for manipulative or deceptive purposes, including in political, medical and commercial contexts. These regulations should require that any use of such data that may in principle be authorized within these systems be based on explicit, informed opt-in consent from users.

(b) Priming and nudging: govern the use of neural data as well as indirect neural data and non-neural data allowing mental states inferences for priming and nudging – influencing individuals' decisions or behaviours, often without their explicit awareness and understanding. This is particularly critical in sensitive areas such as political messaging and commercial advertisement where its use is not acceptable. If used in healthcare, the frameworks should require prior, free and informed consent for any use of such data to influence decisions or behaviour, the option to opt out of these systems, and transparency and clear disclosures at the point of data collection, with strict limitations on using data for purposes beyond those explicitly disclosed.

(c) Marketing during sleep and dream: prohibit the use of neurotechnology that influences or manipulates individuals during sleep, such as marketing during sleep and dream. Regulations should strictly prohibit commercial, marketing or political applications that target individuals during sleep, using neurotechnology or neural data as well as indirect neural data and non-neural data allowing mental states inferences. Additionally, robust oversight mechanisms should be required to ensure that any research or application of such technologies prioritizes the well-being, privacy and autonomy of individuals, with particular attention to the potential long-term psychological and cognitive impacts of manipulating sleep states.

(d) Decision neuroscience of consumer behaviour (commonly labelled as "neuromarketing"): safeguard against unethical aims and practices in neuromarketing, including by requiring comprehensive disclosures to ensure that all neuromarketing activities are conducted transparently, with participants' prior, free and informed consent. This includes ensuring that participants in neuromarketing research or campaigns are fully aware of methods, risks and intentions and affirmatively opt into participation. The use, storage and potential reuse of the collected data should be strictly regulated.

(e) Closed-loop environments: provide clear regulatory guidelines on the design and use of closed-loop environments, such as immersive computing devices that adjust experiences based on detected neural data as well as indirect neural data and non-neural data allowing mental states inferences. These policies should require clear and accessible disclosure about how neural data as well as indirect neural data and non-neural data allowing mental states inferences are used in these environments, prohibit real-time behavioural modification or manipulation without prior, free and informed consent. Additionally, these policies should implement safeguards specifically designed to prevent abuses such as unauthorized surveillance, manipulative interventions and practices that could influence ways of thinking, decision-making processes or behaviour, ranging from political to commercial choices, or exploit psychological and emotional vulnerabilities in real-time.

IV.11 CONSIDERATION FOR SPECIFIC USERS

141. The development of neurotechnology should bring benefits to all. Traditional population segmentation is presented below with the caveat that the ethical recommendations benefit all.

IV.11.1 Children and adolescents

142. Member States and other stakeholders should safeguard children and adolescents from implicit and explicit coercion to use neurotechnology. Member States and other stakeholders should respect the opinions, rights and best interests of the child, and pay attention to the autonomy of children and adolescents through prior, free and informed consent and assent that is adapted to and

respectful of age and decision-making capacity, while also taking into account the rights and duties of parents and legal guardians to protect children and adolescents in their care.

143. Member States should facilitate research and development grants focused on creating user-friendly risk-mitigated assistive neurotechnology tailored for children and adolescents with disabilities. These projects should respect the rights and best interests of the child and involve children, adolescents, parents and caregivers throughout the whole process, including the design, to ensure that the technologies meet their specific needs.

144. Member States should ensure that research involves strict oversight and close follow-up of all neurotechnology research involving children and adolescents. This oversight is crucial during the developmental phases of childhood to address and mitigate any unforeseen long-term effects. Such research must include comprehensive monitoring protocols and periodic evaluations to ensure the ongoing safety and well-being of young participants, respecting their rights, their best interest and their unique developmental needs and vulnerabilities. In the framework of research involving children and adolescents in medically vulnerable situations (e.g. children in epilepsy monitoring units), special attention will be given to consent and assent processes, particularly considering specific aspects of research (time, iterations) to mitigate against any form of instrumentalization. Research conducted on persons under the age of 18 years may only be conducted in accordance with relevant human rights law provisions under international and domestic law.

145. Member States should enact specific regulations to prevent the use of marketing techniques – such as neuromarketing, biometric emotional analytics, immersive advertising and virtual or augmented reality advertising – that rely on neural data as well as indirect neural data and non-neural data allowing mental states inferences collected from children and adolescents. Recognizing the rights and heightened vulnerability of children and adolescents in digital environments, and with regards to children's and adolescents' developing brains, especially in areas related to decision-making, these regulations should explicitly forbid any practices that use such data to influence or exploit children and adolescents.

IV.11.2 Older persons

146. Member States should promote healthy aging and support older persons by funding and implementing science- and evidence-based programmes that integrate neurotechnology into routine care. These programmes should involve the entire support ecosystem, including family, caregivers and medical teams, throughout the whole process, including in the design, to ensure that the technologies meet their specific needs. Priority should be given to developing and implementing tools that prevent, delay, treat or assist individuals to overcome age-related health conditions, impairments and neurodegenerative diseases. Member States should ensure that access to these neurotechnology programmes is equitable and does not exacerbate socioeconomic and other existing inequalities.

147. Member States should establish guidelines for neurotechnology design sensitive to the needs of older persons, carefully considering human-computer interface factors for usability (such as fonts, buttons and colours) and experience for enhanced visual and auditory cues.

148. Member States should preserve, support and promote autonomous decision-making for older persons using neurotechnology for sensorimotor and cognitive support. The consent process should accommodate potential cognitive challenges faced by older persons to ensure that consent is prior, free and informed, ongoing and adaptable to changing health conditions. Policies should be in place to ensure that assistive neurotechnology recognizes changing cognitive capacities over time and respects users' preferences.

IV.11.3 Persons with disabilities

149. Member States should adopt policies that harness the potential of neurotechnology by removing barriers experienced by persons with disabilities and providing support, thereby contributing to achieving full enjoyment of human rights. They should implement regulatory frameworks that ensure the participation and consultation of persons with disabilities to prioritize their needs and preferences. These frameworks should require accessibility assessments for all neurotechnology products to ensure that these products do not perpetuate existing disparities related

to disabilities or health. Member States should encourage schools and education systems to promote digital literacy, ensure special needs and inclusive education and promote lifelong learning opportunities.

150. Member States should create incentive programmes to promote the development or deployment of neurotechnology for persons with disabilities to improve their quality of life and independence. These programmes could include tax incentives, research grants and expedited regulatory reviews aiming at advancing effective, affordable and accessible neurotechnology solutions.

151. Member States should work towards making advanced neurotechnology affordable and integrating neurotechnology coverage into, as applicable, national health insurance and other reimbursement schemes for persons with disabilities, for example through public-private partnerships. A national database of available neurotechnology resources and support services should be interoperable, privacy preserving and culturally accessible, and developed to facilitate access and information sharing.

IV.11.4 Persons with mental health conditions

152. Member States should foster research and promote awareness-raising initiatives to address the increasing prevalence and special needs of persons with mental health conditions, including victims and survivors of trauma and violence, and the relevance of neurotechnology for them.

153. Member States should consider allocating funding for long-term advocacy and efficacy studies, post-market oversight and tiered scrutiny with special attention to invasiveness and reversibility of neurotechnology interventions. Research and development should be guided by feedback and engagement with persons with mental health conditions and their advocates and consider risks of treatment with neurotechnology.

154. Member States should support the development and deployment of neurotechnology that is affordable and designed to improve quality of life and daily functioning of individuals with mental health conditions. This should include technologies that assist in managing symptoms, improving cognitive functions and providing emotional support at home, in the workplace, in their communities and in society. It is important to ensure that persons with mental health conditions are rigorously informed and have reasonable expectations about the process.

155. When neurotechnology is applied to the study and treatment of mental disorders, research design, intent and outcomes must be approached with caution to avoid deepening societal discrimination against people with mental disorders.

IV.12 ENHANCEMENT

156. The use of neurotechnology to improve mental (e.g. memory, attention) or physical (e.g. through controlled BCI-based prostheses or devices) human capacities beyond medical need introduces additional complex ethical, social and legal challenges, which can create new kinds of disparities in the world. When neurotechnology is used in these contexts, it raises crucial questions about equity, consent, individual and community autonomy, societal impact and the nature of enhancement of the nervous system itself. Member States should ensure that any policies, law and regulatory frameworks that govern the whole life cycle of neurotechnology in these contexts do not exacerbate social inequalities or lead to discrimination, address the potential risks (including to reversibility, invasiveness and risks to autonomy), uphold human dignity and comply with international law, including international human rights law. Member States should encourage research regarding the potential risks and significant ethical implications of such use of neurotechnology both for individuals as well as society as a whole.

V. IMPLEMENTATION

157. Member States and all other actors as identified in this Recommendation should respect, promote and protect the ethical values, principles and standards set forth in this Recommendation, and should take all appropriate steps to give effect to its implementation.

158. Member States should – according to their specific contexts, governing structures and constitutional provisions – credibly and transparently advance the ethics of neurotechnology, in line with this Recommendation. Member States should, as appropriate, monitor and evaluate policies, programmes and mechanisms related to neurotechnology and its ethics. Progress monitoring could rely on a combination of quantitative and qualitative approaches.

159. Member States should develop capacities in governmental institutions and support government officials to ensure that the technological is developed responsibly and ethically as well as in ways that fully protect, respect and promote human rights.

160. Member States should establish or designate national bodies responsible for overseeing and coordinating the regulation, vigilance and oversight of neurotechnology across relevant government agencies. These coordinating bodies should be tasked with ensuring that legal and regulatory frameworks are consistently applied, that public health and safety are protected, and that ethical standards and human rights are upheld throughout the whole life cycle of neurotechnology. This includes facilitating inter-agency collaboration, monitoring compliance with national and international standards, and ensuring that data and insights from different regulatory domains are shared effectively to inform decision-making and policy development. These bodies should also help coordinate public and community engagement.

161. Member States should strive to extend and complement their own actions in respect of this Recommendation, by cooperating with all relevant national and international governmental and non-governmental organizations, as well as transnational corporations and scientific organizations, whose activities fall within the scope and objectives of this Recommendation. Civil society will be an important actor to advocate for the public sector's interests and therefore UNESCO needs to ensure and promote its legitimacy.

162. UNESCO should publicize and disseminate this Recommendation widely through all available means, and share it with Member States, National Commissions for UNESCO, relevant international and regional partners, human rights institutions where they exist, as well as with UNESCO ethics advisory bodies for dissemination to all levels and actors in this field.

163. To support Member States implementing this Recommendation by developing concrete programmes and policies and developing institutional capacities in the ethics of neurotechnology, UNESCO can contribute by:

(a) developing a UNESCO readiness assessment methodology (RAM) to assist Member States in identifying their status at specific moments of their readiness trajectory along a continuum of dimensions;

(b) developing a UNESCO methodology for Ethical Impact Assessment (EIA) of neurotechnology based on rigorous scientific research and grounded in international human rights law, along with specific guidance for its implementation in the whole neurotechnology life cycle, and capacity-building tools and materials to support Member States' efforts to train government officials, policymakers and other relevant actors on the methodology;

(c) developing a UNESCO methodology to evaluate ex ante and ex post the effectiveness and the efficiency of the policies for neurotechnology ethics and incentives against defined objectives;

(d) strengthening the research- and evidence-based analysis of and reporting on policies regarding neurotechnology in the framework of existing UNESCO forums;

(e) collecting and disseminating progress, innovations, research reports, scientific publications, data and statistics regarding policies for neurotechnology, including through existing initiatives, to support sharing best practices and mutual learning, and to advance the implementation of this Recommendation.

164. Processes for monitoring and evaluation should ensure broad participation of all actors, including, but not limited to, under-represented, vulnerable people or those in vulnerable situations and ensuring social and cultural diversity and gender equality. The monitoring and assessment of

the impact of neurotechnology and related ethics policies and practices should be carried out continuously in a systematic way proportionate to the relevant risks. This should be based on internationally consented frameworks and involve evaluations of private and public institutions. Data collection and processing should be conducted in accordance with international law and national legislation on data protection and data privacy, and in line with the values and principles outlined in this Recommendation.

VI. FINAL PROVISIONS

165. This Recommendation needs to be understood as a whole, and the foundational values and principles are to be understood as complementary and interrelated.

166. Nothing in this Recommendation may be interpreted as replacing, altering or otherwise prejudicing Member States' obligations or rights under international law, including international human rights law, or as approval for any State, other political, economic or social actor, group or person to engage in any activity or perform any act contrary to human rights, fundamental freedoms, human dignity and concern for the environment and ecosystems.