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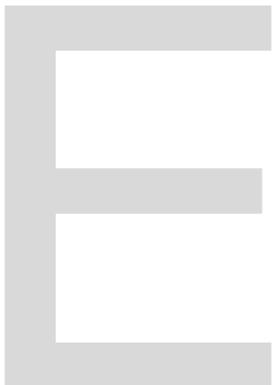
Science, technology, and ethics: Emerging challenges and urgent solutions

Basic science, applied research, innovation and advanced technology are all essential to the progress of humankind. They are linked by a virtuous circle: basic science and fundamental research foster our understanding of the world around us and, by doing so, they generate applied research, innovation and technology; these, in turn, directly improve people's quality of life and provide more and more powerful research tools. For example, science, particularly research into infectious diseases, is at the forefront of international efforts to fight COVID-19, and it is now more important than ever that we count on science for the well-being of humanity.

Parliaments, as the representatives of the people, must be able to identify and understand in depth the potential impact of science and technology on society, determining how it can be translated into concrete initiatives for the benefit of the people, and accompanying their implementation with appropriate legislation and political action. Parliaments and policymakers play a key role in ensuring the development of humanity through scientific progress, while protecting their citizens' human rights from the misuse of technological advances.

Currently, these complex tasks are further complicated by phenomena that in the recent past have acquired more and more significance. These include, inter alia:

- The extremely rapid evolution of scientific knowledge and technology in a globalized society, making it extremely difficult for the parliamentary world to follow constantly changing scenarios and to take effective legislative and political action to shape them.
- The temptation, which is more and more common, to use scientific and technological knowledge in a way that privileges economic interests rather than the interests of human beings, including their right to live a decent life.
- The need for society to establish an ethical dimension to scientific research and to the relevant technological applications. This need has historical precedent but has acquired even more importance today following recent developments in fields such as artificial intelligence and genetics.



Moreover, globalization calls for a more coordinated approach among parliaments for solutions to global problems related to the use of science and technology. Sharing knowledge and best practice, including in the parliamentary world, is necessary if society wants to be successful in dealing with extremely complex and challenging issues such as the implementation of the 2030 Agenda for Sustainable Development and the fight against viral epidemics like the COVID-19 pandemic of 2020. This health crisis has shown the importance of global cooperation in science and medicine, and in particular the importance of putting humanity and human well-being at the centre of the work of the scientific community. Only in this way can the world of science – which is global in its nature, and must always be inspired by ethics – help solve major societal problems and bring people together. A lack of solidarity and unethical approaches demonstrated by individual States must be rejected.

The current pandemic has also highlighted certain concerns related to the use of technology and science for surveillance purposes, putting citizens' privacy and human rights at potential risk. This includes, inter alia, the use of personal data and the need for strict regulation to prevent its misuse. In this regard, legislation should be drafted on internet protection, both during and after this pandemic. To curb the potential negative effects of misuse of science and technology, Speakers of parliament are thus urged to guide their parliaments to draft effective cyber laws in order to curtail cyber criminality on the internet, while ensuring freedom of usage of this powerful and extremely useful tool.

Speakers of parliament have a key role in further developing and consolidating the effort initiated a few years ago by the IPU to increase awareness in parliaments of the importance of science and technology for the sustainable development of society, and the importance of integrating them more regularly into parliamentary action.

Speakers of parliament can encourage the members of their parliaments to engage in a challenging cultural change: transforming science and technology into permanent elements of policymaking. Speakers can also directly contribute to this change by reflecting on the most important global issues related to science and technology and by proposing those which should be prioritized by parliaments. The role of science has been gaining more importance in the IPU, with its governing bodies recently approving the establishment of an IPU parliamentary body dedicated to science, technology and ethics, to serve as the global parliamentary focal point on these issues. This working group will be the instrument through which the IPU can start tackling the reflections outlined in this report.

Topics to reflect upon are manifold, and some, such as those related to climate change and the implementation of the Sustainable Development Goals, are already being extensively addressed elsewhere by the parliamentary community. This report has therefore identified four science- and technology-related topics with a high impact on society for the Speakers of parliament to reflect on and possibly bring to the attention of their parliaments.

1. Ethics and limits of scientific research

Scientific research and related technologies can have a strong impact on the development of society and on the welfare of citizens. Intellectual freedom and freedom of research are essential for science to progress. Research is driven by the need to understand the world around us, its inner workings and its deep nature. This process, which implies the constant investigation of unexplored paths, often leads to discoveries and, in some cases, to disruptive innovation. The need for exploration and the will to know cannot be limited.

However, when scientific research operates at the frontier of knowledge or even sets new frontiers, questions may arise as to whether it goes beyond ethical limits. In particular, this is the case for advanced research in biology, genetics and several other medical domains. This kind of research, and the technological progress it drives, can undoubtedly have beneficial impacts for humanity. However, they can also result in situations that go beyond the levels presently accepted by society.

For instance, researchers have developed techniques that allow human DNA to be modified. Such techniques open many doors and raise hopes of the possibility of "repairing" the DNA of patients affected by serious diseases, giving them the possibility to live a normal life. However, these kinds of techniques can also be applied in controversial cases, such as the use by a scientist in 2018 of the gene-editing tool CRISPR to modify the genome of twin babies in order to make them resistant to HIV.

New fast-developing technologies based on artificial intelligence, electronics, robotics, and implant techniques can now “repair” parts of the human body. Some of them are so advanced that they can directly interface with the human brain, change the biology of the body, and make the “replacing parts” more solid, more resistant and higher performing than the replaced parts in a healthy body. The temptation may arise to integrate such technologies in a healthy body, thus reaching a sort of “augmented humanity”, a concept that evidently poses a lot of ethical questions.

What is the role of parliaments in addressing these issues? Scientists and bioethicists agree that a more ethical approach to research can limit the risks related to potential misuse of derived technologies, and that it is crucial to find the right balance between pursuing research for the benefit of society and respecting socially acceptable ethical boundaries. However, establishing boundary conditions and rules and monitoring their proper application cannot be left exclusively in the hands of the scientific community.

Parliaments, as the institutions that represent the peoples of the planet, and hence all human beings, must therefore take the lead by taking well-informed decisions through regular consultation and hearings with independent and non-partisan scientific and technical experts. They must develop legislation which, whilst leaving the necessary space for freedom and autonomy of scientific research, establishes adequate ethical limits in the sole interest of humanity.

An ethical approach to research cannot be fully achieved by adding up national legislations. Science is a universal discipline and the knowledge it produces, together with the technology it generates, spreads beyond borders. Speakers of parliament should not only encourage their parliaments to work on science and ethics, but also promote inter-parliamentary collaboration on these topics, including through and with the IPU.

2. Science, technology and ethics in preventing conflicts and dealing with crises

Scientific progress and advanced technologies are sometimes perceived as direct or contributory causes of conflict, in particular insofar as they are the bases of powerful weapons and other modern military applications such as satellite observation, spying, military intelligence, electronic warfare systems, unmanned aerial vehicles, and so on.

It is extremely difficult to establish ethical boundaries to the use of scientific and technological progress in applications that may be regarded as defensive or offensive instruments, depending on the point of view of the parties involved. However, a key factor to determine the nature of the application is the advantage a country (or a group of countries) may draw from the results of specific research programmes.

Military research programmes are secret by nature, as secrecy is the main way to gain advantage in terms of knowledge and know-how that can strengthen countries that invest heavily in these programmes. The lack of competitive military advantage would make it much less worthwhile to invest large amounts of money in these applications.

Secrecy is extraneous to the principles and the foundations of scientific research, in particular basic scientific research, where results are made available to the whole scientific community for validation, thus eliminating any competitive advantage.

Speakers of parliament may wish to promote in their parliaments the culture to support, with suitable legislation and programmes, basic scientific research and inter-parliamentary collaboration on these initiatives. In this way, the knowledge and technology resulting from research programmes can be used to lower the risk of conflict.

Science and technology, if used in the right way, can also be powerful tools to directly prevent conflicts and deal with existing crises. Conflicts and crises are often generated by political interests. Among the justifications for such political interests are deficiencies in people’s quality of life (e.g. access to water or decent food; housing problems; access to electricity or sanitation; access to education). Science and technology may help reduce or even eliminate such deficiencies, and hence address some of the drivers of conflict and crisis. Properly harnessing science and technology to deal with crises requires a two-step action plan:

- an honest, and as objective as possible, identification of the drivers of the crisis and of the technology required to eliminate or mitigate those drivers
- the commitment of the parties involved to take concrete action.

Parliaments can promote a cultural change which will lead to science and technology being seen as powerful tools capable of transforming elements of conflict into reasons for co-existence. This includes the positive role science can have in intercultural dialogue and peaceful cooperation. The success of inter-governmental scientific organizations like CERN¹ or SESAME² (could motivate other sectors – including the parliamentary sector – to adopt the scientific “coopetition” model of collaborating without excluding competition. This requires that all parties identify a common goal, and work towards it, being openly collaborative. In the case of parliaments, the common goal would be to avoid conflict in areas of political tension, and the collaboration would include intercultural dialogue and transboundary projects for the benefit of the local population.

3. Artificial intelligence: Boundary conditions for ethical development

Artificial intelligence (AI), one of the main fields of research in computer science, has made spectacular advancements in recent years. Giving machines the capability to “learn” and to develop a human-like “intelligence” leads to a universe of possible applications that will certainly improve people’s well-being.

AI and machine learning already provide innovative solutions to important societal problems and are likely to become more and more present in our lives. Their fields of application range from human health to security, commerce, transportation, and more. It is therefore not difficult to imagine that, in the near future, autonomous vehicles could become the standard mode of transportation.

However, despite these promising expectations, AI also poses a number of sensitive ethical questions, ranging from the concern that intelligent machines could become sorts of humanoids, which could perhaps one day challenge humans, to the consequences that may derive from decisions that humans could delegate to machines. The decisions taken by an autonomous vehicle just before an imminent road accident that cannot be avoided, or the developments in a war in which important decisions are taken by AI entities, are just two of the many potential scenarios.

Leveraging the power of artificial intelligence is key to dealing with some of the major challenges facing humanity, but only an appropriate and ethical implementation of AI technologies can avoid creating risks.

Parliaments are being required to intervene on these complex and delicate matters, and their intervention should be effective, global and rapid. Our globalized world requires that the legislation needed for an ethical implementation of AI be homogeneous across parliaments and based on common ethical principles. Furthermore, this legislation is needed now, as innovation in this field progresses incredibly fast and society cannot afford for it to develop further without regulation. This becomes critical when we think that, currently, 100 per cent of AI is in the hands of the private sector: big companies have the know-how, train young people, and own the market. Nothing is in the hands of parliaments, which should therefore take back control and ensure that the process of developing AI is not run entirely by private companies, and that the public sector can monitor its development and possibly limit it, if required, for the benefit of the people.

Parliaments need to act swiftly to formulate legislation that oversees an ethical implementation of AI technologies, and at the same time exchange knowledge on AI and its ethical implications with other parliaments and parliamentary assemblies (such as the NATO Parliamentary Assembly, which discussed AI at its 2019 spring session), in order to reach an adequate level of legislative homogeneity. Parliaments should also take action to increase the benefits of AI for the peoples they represent. Speakers of parliament should encourage their parliaments to address a few important questions:

¹ CERN (European Laboratory for Particle Physics) is an international scientific research institution and inter-governmental organization located in Geneva, Switzerland (<https://home.cern>).

² SESAME (Synchrotron-light for Experimental Science and Applications in the Middle East) is an international scientific research institution and inter-governmental organization located in Amman, Jordan (<https://www.sesame.org.jo>). Its convention is largely based on that of CERN.

- What strategies can be implemented to harness AI development for positive and inclusive societal change?
- Are AI solutions and equitable access to their benefits scalable?
- How can policymakers encourage progress on safe and reliable AI systems?
- How can other key actors contribute to this?

4. The Fourth Industrial Revolution: How to make it inclusive

Thanks to very rapid and impressive progress in information technology, in recent years society has witnessed a global industrial revolution, known as the Fourth Industrial Revolution (or Industry 4.0). This industrial revolution affects many areas of global importance, such as artificial intelligence, quantum computing, medicine, robotics, big data, and the internet of things. Artificial intelligence and robotics are gradually replacing humans in many activities, and it is possible that, in the near future, many industrial sectors will be managed by only a few people, seconded by “intelligent” machines.

This major ongoing societal change is undoubtedly favoured by the availability of new and more powerful technologies. However, it is predominantly driven by competitive economic imperatives. The resulting business and social models will significantly change people’s everyday lives; the impact is not yet fully understood by society at large.

Replacing workers’ existing jobs in many sectors with computational and robotic systems will certainly generate economic gains for industry but will very likely also cause massive disruption in employment, with a major social impact if corrective actions are not taken in time. Furthermore, the creation of new jobs may not be sufficient to balance out this disruption in employment and its impact on society, if not adequately managed. It would be a societal disaster to have an excess of unemployed people with the wrong skills, and a critical shortage of people with the required new skills, in particular in computer science and artificial intelligence.

Governing the innovation brought by the Fourth Industrial Revolution and its impact on society requires a so-called “triple-helix” approach, entailing collaboration and joint planning and implementation actions from the academic, industrial and political sectors. Parliaments have a major role to play in making this “triple-helix” approach a success – securing not only economic benefits for industry, but also benefits for their constituents, and putting in place social protection for those workers who lose their jobs and need to retrain. Legislation and policy should be introduced to fill the gap between the skills youth are learning in the academic sector and the skills required in industry. Parliaments have the vision to bridge this gap. To enhance the utilitarian role of science and technology in our digital age, Speakers of parliament are encouraged to urge their parliaments to enact education laws that embrace science and technology in the context of Fourth Industrial Revolution, in particular by fostering education in science, technology, engineering and mathematics (STEM) for young people, with a particular focus on girls who, in certain countries, are underrepresented in science and technology faculties.

Speakers of parliament are therefore encouraged to drive their parliaments to engage in constructive dialogue with the academic and industrial worlds, to devise strategies which will translate into effective legislative action. Legislation should favour the deployment of all the innovative potential of the Fourth Industrial Revolution, while ensuring that the price is not paid by the population, in particular the most vulnerable. Parliaments should strive for a certain level of homogeneity among the national legislations brought in to govern the Fourth Industrial Revolution, as a disparate approach would likely disadvantage developing countries.