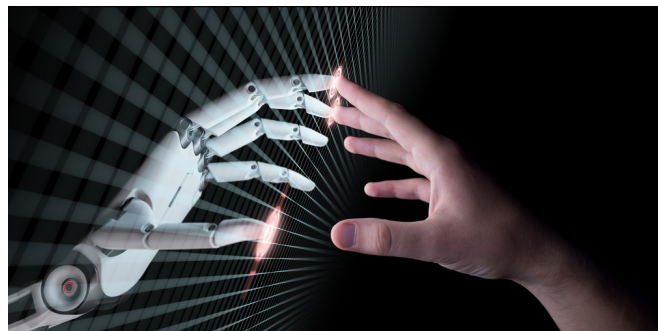


## What if policy anticipated advances in science and technology?

What if blockchain revolutionised voting? What if your emotions were tracked to spy on you? And what if we genetically engineered an entire species? Science and policy are intricately connected. Via monthly 'What if' publications, the Scientific Foresight Unit (STOA; part of the European Parliamentary Research Service) draws Members of the European Parliament's attention to new scientific and technological developments relevant for policy-making. The unit also provides administrative support to the [Panel for the Future of Science and Technology \(STOA\)](#), which brings together 25 Members from nine different parliamentary committees who share a strong interest in science and technology in the context of policy-making.

Science, policy and society influence each other in many ways. For instance, scientific developments often give us new ideas about ourselves and our place in the world. These new ideas might change our expectations and moral standards, and might therefore call for a revision of established policies. Furthermore, new technological innovations and possible solutions to societal challenges put forward by scientists can only be implemented through policy. Scientific results and technological innovations could also spark new problems, dangers or ethical concerns. It is up to policy-makers (in interaction with scientists and societal actors) to address, mitigate and regulate those cases. Policy-makers however do not only deal with the products of scientific endeavour, they also have the power to prioritise certain fields of research and development, and to steer scientific practice by (binding) rules or (voluntary) ethical codes. The decisions made in all these types of science–policy interaction can be highly political.



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Science and policy mainly meet at the agenda-setting and consultation stages of policy-making. In the agenda-setting phase, scientists (or others) highlight new scientific and technological developments that call for legislation or ethical regulation; the need for mitigation of certain rules limiting scientific freedom; or a detected pressing issue in society or nature, such as the need for new work skills or strategies to combat climate change. In the consultation phase, policy-makers might turn to scientific advisors for policy advice concerning research topics scientists are working on, such as the safety of artificial colorants in food. Looking to science for inspiration and information contributes to evidence-informed policy-making. It should however be noted that evidence-informed decisions are in the end always the result of a negotiation between such scientific input on the one hand, and the societal/political context on the other.

To support Members' work in the agenda-setting phase, the [Scientific Foresight Unit \(STOA\)](#), prepares, among other things, monthly 'What if' publications to help Members detect new and interesting developments in the fields of science and technology. These publications cover both current developments that might spark immediate policy action and possible future developments that demand reflection today. Such considerations about future possibilities could, for instance, elucidate current debates, or make sure the first elements of an ethical framework are in place when a potentially disruptive new technology actually arrives, or they could be used to decide if a developing technology or strand of research should preferably be stimulated or even halted. To create the 'What if' publications, the Scientific Foresight Unit investigates the current state of a development and employs [foresight methodology](#) to map potential impacts on society and wider developments, and to list possible anticipatory policy options for Members.

# What if policy anticipated advances in science and technology?

## Potential impacts and developments

As mentioned above, each 'What if' publication includes an overview of potential societal impacts and wider developments of the scientific or technological innovation in question. These include, for example, possible future advances, existing and future applications, ethical and societal concerns, normative challenges and probable consequences for daily life, uncertainties, risks and dangers, philosophical considerations, and new types of questions, specific to the particular technology. Both intended and possible unintended applications of a new technology are listed. Unintended applications could for instance include cases of dual-use, of the technology 'falling into the wrong hands', of unexpected side effects relevant to some stakeholders, or of creative uses in new domains, such as [the use of drones to deliver commercial goods](#). By examining the potential impacts of a scientific or technological development from many angles (from social, technological, economic, environmental, political/legal, ethical and demographic viewpoints), and by taking many stakeholders' perspectives into account, the Scientific Foresight Unit tries to make the analyses as complete as possible. Of course, some impacts and developments will always remain unforeseen.

Taking for instance the three 'What if' publications referred to in the introduction of this paper: each of the technologies mentioned would bring both opportunities and risks. Applying [blockchain technology](#), for example, can speed up elections and reduce the risk of fraud, which would reduce costs and possibly lead to higher voter turnouts. However, to build a strong democracy, the whole electorate – even those disappointed with the result – must accept that the voting process was legitimate and reliable. It is not yet clear whether an intricate blockchain process can inspire enough public confidence. Moving on to the next kind of innovation, [facial recognition technology](#) can have many kinds of applications in many different fields, especially when it is combined with emotion recognition: it could identify potential shoplifters, track mental health, personalise marketing, facilitate faster entrance to events, or provide a patient's medical history in emergency situations. The technology comes, however, with many ethical dilemmas, for example: what if it were used by state authorities or malicious employers to carry out mass surveillance, tracking peoples' moves and emotions without their consent? And, finally, [gene-drive technology](#) – the technology that could be used to genetically engineer an entire species, by introducing a modified gene that easily spreads through a population – could be used to eradicate malaria, to fight invasive species that cost the European economy billions of euros, or to decrease resistance to pesticides or herbicides in pests and weeds. However, at the same time, hostile nations could turn gene-drive technology into a biological weapon by targeting species key to European ecosystems, such as bees.

## Anticipatory policy-making

As impact and development analyses show: the introduction of a new scientific idea or a new technology can lead to many different futures, depending on the way in which the innovation is implemented and spread. The Scientific Foresight Unit (STOA) maps these different futures and identifies policy options for stimulating desirable futures and avoiding undesirable ones. Of course STOA analysts remain neutral, and it is up to Members to decide which futures they consider desirable or undesirable. Returning to our three examples: for blockchain voting procedures, the 'What if?' publication illustrated that the process would have to comply with various areas of European law, such as data protection for voters; to secure transparency and fairness in facial recognition technology, the paper underlined the option for Parliament's Members and committees to play an active role in EU institutions' efforts to formulate regulations and guidelines for artificial intelligence; and on gene-drive technology, the 'What if?' paper highlighted scientists' calls for an appropriate risk assessment framework and a ban on for-profit exploitation.

To facilitate Members' and committees' preparations for policy action, STOA offers a wide range of services. Members can, for instance, apply for an extensive technology assessment or foresight study, or request a workshop on their topic of interest. Experience during the eighth parliamentary term proves that these services can be very effective: the STOA foresight study on the ['Ethics of cyber-physical systems'](#) contributed substantially to the February 2017 Parliament resolution on ['Civil law rules on robotics'](#).

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