Global Challenges Foundation

Stockholm, May 2017

Global Challenges Foundation's Annual Report
Global Catastrophic Risks 2017

Summary

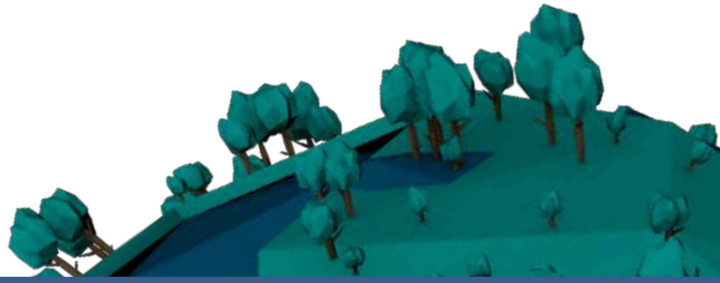
Global Catastrophic Risks 2017 is an annual analysis of the greatest threats to humanity produced by the Global Challenges Foundation in Stockholm. The report is based on the latest scientific research and features contributions from leading experts at think tanks, university departments and other institutions worldwide. As well as exploring the risks themselves, it summarises the current status of global efforts to manage them.

Today's risks are interconnected. We cannot view them or manage them in isolation. Leaders can ignore them because they fall outside the limited scope of their mandates, but silos will not offer protection from the consequences. Many critical challenges today, such as climate change and political conflict, are not contained within national borders, nor do they fit into the silos of separate government agencies or academic specialties.

For the first time in human history, we have reached a level of scientific knowledge that allows us to develop an enlightened relationship to risks of catastrophic magnitude. Not only can we foresee many of the challenges ahead, but we are in a position to identify what needs to be done in order to mitigate or even eliminate some of those risks. Our enlightened status, however, also requires that we consider our own role in creating those risks, and collectively commit to reducing them.

This report focuses on the greatest of our present risks with potential for catastrophic damage. The decisions and actions we take today will shape our future for years to come. If we consider environmental risks alone, the last 50 years of human activity have pushed us away from the environmental stability of the past 12,000 years. As global temperatures continue to rise, the possibility that they may trigger catastrophic disasters increases. The need for decisive leadership and citizen initiatives to shift businesses, politics and society onto a sustainable path has never been greater. The extent to which we protect our natural environment and transform harmful patterns of consumption in the next 50 years will shape our far future, over the next 10,000 years and beyond.

Yet, the institutions we rely on to ensure peace, security, development and environmental integrity are woefully inadequate for the scale of the challenges at hand. The global community needs to collaborate across scales and sectors to manage the threat of nuclear conflict, avert climate change or deal with the emerging risks such as those associated with Artificial Intelligence. Global Catastrophic Risks 2017 is intended to incite deeper understanding of global risks and promote more urgent discussion of how they are collectively managed. The following is a summary of the risks detailed in the report.



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Weapons of Mass Destruction

Nuclear warfare

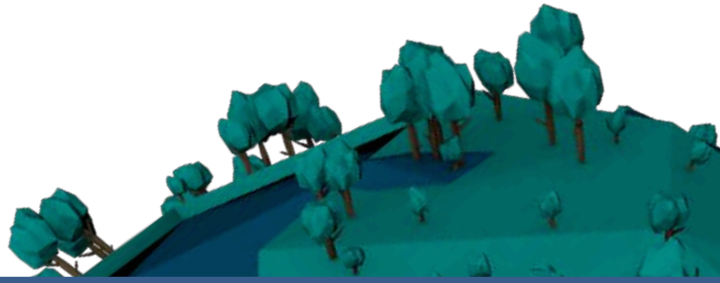
The US and Russia currently control approximately 7,000 warheads each. The UK, France, China, India, Pakistan, North Korea and Israel are also know or widely believed to hold nuclear weapons. Tensions over North Korea have brought the prospect of nuclear conflict back into the spotlight but nuclear weapons could also be released by accident, and trigger an inadvertent nuclear war – a scenario that has almost happened a number of times since 1945. As well as the immediate destruction at point of impact, nuclear explosions could cause a 'nuclear winter', dramatically lowering global temperatures, potentially leading to mass famine, and chaos. To date, the spread of nuclear weapons has been curtailed by the 1970 Nuclear Non-proliferation Treaty, which is enforced by the UN Security Council in partnership with the International Atomic Energy Agency (IAEA). However, the difficulties of enforcing the treaty are illustrated by the example of North Korea which withdrew in 2003 and has since conducted several nuclear tests.

Biological and chemical warfare

Unlike nuclear weapons, biological and chemical weapons can be developed at a comparatively low cost, placing them within the reach of most states as well as non-state groups. Toxic chemicals can be aerosolised or placed in water supplies. Biological weapons possess even greater catastrophic potential as released pathogens might spread worldwide and cause a pandemic. Recent developments in synthetic biology and genetic engineering are of particular concern as technology has the potential to create highly lethal and highly infectious agents. Such pathogens could be released accidentally from a lab or intentionally in large population centres. These kinds of weapons are banned by the 1975 Biological Weapons Convention and the Chemical Weapons Convention of 1997. However, in both cases, the issue of 'dual use' presents a particular difficulty as the same substances can be used for beneficial and harmful purposes. The recent use of chemical weapons in Syria illustrates the challenge of enforcing these treaties.

Catastrophic climate change

Discussions of climate change usually focus on limiting temperature rises to 1-3 ˚C above pre-industrial levels. A rise of 3 ºC would have major impacts, with most of Bangladesh and Florida under water, major coastal cities – Shanghai, Lagos, Mumbai - swamped, and potentially large flows of climate refugees. While the 2015 Paris Agreement on climate change sought to keep global temperature rises below a threshold of 1.5 - 2 º C, national pledges have fallen short and set the world on a 3.6°C temperature rise track. There is also now scientific consensus that, when warming rises above a certain level, self-reinforcing feedback loops are likely to set in, triggered by the pushing of the Earth's systems – ocean circulation, permafrost, ice sheets, rainforests and atmospheric circulation – across certain tipping points. The latest science shows that tipping points with potential to cause



catastrophic climate change could be triggered at 2 ºC global warming. These include the risk of losing all coral reef systems on Earth and irreversible melting of inland glaciers, Arctic sea ice and potentially the Greenland ice sheet. As well as the immediate risk to human societies, the fear is that crossing these tipping points would have major impacts on the pace of global warming itself. Although climate change action has now become part of mainstream economic and social strategies, too little emphasis is put on the risk of catastrophic climate change.

Ecological collapse

Since the mid-1950s, many elements that ensure the habitability of the planet, whether greenhouse gas concentration, forested areas or the health of marine ecosystems, have been degrading at an accelerating pace. Human factors that affect ecosystem vitality include changes in the balance of local biodiversity, alteration of the chemical balance in the environment, climate change-induced modifications in the local temperature and water cycle and habitat loss. Global governance mechanisms to preserve ecosystems and reduce pollution are of particular importance, as many ecosystems do not overlap with national boundaries. Governments crafted the institutional architecture for managing global ecological risks in the 1970s with the creation of the United Nations Environment Program, now known as UN Environment. At the national level, governments have established ministries and authorities to deal with environmental concerns, advocate for ecologically informed decision making, and improve national capacity. There is, however, no overarching judicial system that could ensure effective enforcement. One approach to global performance assessment that has proven effective is the influence of global rankings, otherwise known as scorecard diplomacy.

Pandemics

Outbreaks occur when a micro-organism is able to spread across the population. At times and under certain conditions, such as failure of water or sanitation systems, an outbreak is caused by a micro-organism known to be circulating at low levels in human populations. At others, an outbreak is caused by a micro-organism that has crossed the animal/human species barrier to infect humans, and spreads to new and more densely populated areas. There remains a serious risk that the emergence of a new infectious disease in humans could cause a major outbreak, with particularly high mortality and rapid spread in our densely populated, urbanised and highly interconnected world. The outbreak of SARS in 2003, where 8,000 were people infected and 774 died, is testament to this. The governance of pandemics typically involves collaboration between the World Health Organization (WHO), ministries of health and public health institutions. Some nations have established Centres for Disease Control (CDC) whose role is to monitor transmissible public health events. Some of those, including the US CDC and Public Health England, provide international support to developing countries, helping them strengthen their capacity to better detect and respond to public health events. International Health Regulations (IHR) have also been developed by the WHO to act as a binding agreement under international law and to provide a framework for national legislation and responsible national and international action. But, like all international law and treaties, there is no enforcement mechanism.

Asteroid impact

Asteroids are small rocks left over from the formation of our solar system about 4.6 billion years ago. They can occasionally intersect with the Earth's orbit and result in collisions. The collision of larger asteroids could potentially cause a global cooling, resulting in large-scale disaster. Based on historical evidence, an asteroid large enough to cause a global catastrophe is estimated to likely occur every 120,000 years. Although currently there are no known large objects expected to hit the earth, existing data on the probability of small objects colliding with earth is only about 30 per cent complete. Further monitoring is needed to properly establish risk levels. Whilst unlikely to directly cause a global catastrophe by cooling the climate, smaller objects could have significant local impact and indirectly disrupt social and economic systems. There is currently a worldwide effort underway to search the sky for near-earth objects. While the bulk of discoveries are made by ground-based telescopes funded by the US National Aeronautics and Space Administration (NASA) and operated in the United States, other recent discovery sites include Morocco, Brazil, China and Japan. NASA is a signatory to the International Asteroid Warning Network (or IAWN), and, as such, it is part of a United Nations-endorsed effort. Membership in the IAWN is non-binding and voluntary, but it enables data to be collected worldwide, consolidated and analysed.

Supervolcano eruption

A supervolcanic eruption happens when over 500km cubed of magma (molten rock) is expelled from a volcano. To put this into context, when Mount Vesuvius erupted and devastated Pompeii, it released approximately 4km cubed of magma. Existing data suggest that a supervolcanic eruption will occur every 30,000 - 50,000 years on average – with the last known event occurring 25,000 years ago in New Zealand. We are currently unable to anticipate volcanic eruptions beyond a few weeks or months in advance, but scientists are monitoring a number of areas which have been identified as potential sites of a future supervolcanic eruption, such as Yellowstone in the US. There is no current prospect of reducing the probability of a supervolcanic risk, but there may be ways to mitigate its impact, including improvements in the ability to identify volcanoes with potential for future super-eruptions and ensuring that food stockpiles are available to mitigate a temporary collapse of agricultural systems. Monitoring volcanoes is largely a responsibility of national institutions that operate Volcano Observatories. The World Organisation of Volcano Observatories plays a coordinating role among 80 of these organisations. Internationally, bilateral and multilateral agreements support scientific investigation and volcanic risk management which commonly involve developed nations supporting developing nations.

Geoengineering

In the face of the threats posed by global warming, scientists have been developing new technologies to try to manipulate the atmosphere to lessen the impacts of climate change while the root cause of the problem is tackled. Geoengineering refers to two new sets of technologies, one that directly removes carbon dioxide from the atmosphere, and the other, known as solar radiation management, that involves reflecting the light and heat from the sun back into space, particularly through the injection of particles into the stratosphere. This technique is now ready for testing, but along with hope, it brings concern that its deployment could have dramatic impacts on climate stability.

Very little is known about its precise effects on the climate and various elements of the global ecosystem. There is also the risk that it solar radiation management could be deployed unilaterally by a country or individual with harmful effects. There are currently no governance frameworks to manage the risks associated with climate geoengineering.

Artificial Intelligence

After decades of slow but continuous progress, the last few years have seen an explosion in Artificial Intelligence (AI) capabilities. While there are huge potential benefits, sudden technological breakthroughs could exacerbate AI risk, especially if the development of global governance frameworks to manage them lags behind. In particular, the critical process of controlling or aligning advanced AI with human goals may take decades to solve. Most experts agree that a super-intelligent AI is unlikely to become malevolent on its own accord; rather it could unleash catastrophic consequences for humanity as a side effect of its actions. This could happen if an AI programmed to kill falls into the wrong hands - or if an AI that is programmed to do something beneficial develops a destructive method for achieving its goal. The risks could be exacerbated by geopolitical tensions leading to an AI development arms race, cutting corners on safety or leading to ineffective governance of powerful AI. Concerns about AI are currently managed by the many existing laws and institutions applying to the fields where AI plays a part; however, its governance will present a unique challenge requiring special consideration, some of it on a short timescale. Since 2016, governments, businesses and non-profits have started to take action with the formation of the Partnership on AI and the 2017 release of the Asilomar AI Principles, endorsed by over 1,000 AI researchers from around the world, aimed at ensuring AI development benefits humanity as a whole.

Unknown risks

Rapid economic, scientific and technological development brings unforeseen new risks. The fast rate of technological change increases the chances of a risk rising to global concern before proper global governance mechanisms can be put in place. We now have the capacity to develop better methods for scanning and monitoring unknown risks. At the global level, the only attempts to prepare for new challenges before they have been identified have been initiated by the European Union which asked global experts to create wild card scenarios about unexpected opportunities and risks. One core insight from these projects has been the role of ‘weak signals’, hints of future risks that could be tracked by government analysts. To date, this kind of future watching has largely been carried out by private and public organisations, some of whom crowd source information and identify so called super-forecasters. These organisations constantly sniff for subtle hints and weak signals and are able to alert governments when a wild card becomes more plausible. However, many governing bodies are unaware of such organisations or even try to curtail their activities. The only way to prepare for the unexpected is to construct scenarios ahead of time and harness collective energies to highlight the more plausible ones as they come closer to fruition.