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Article

Impact of Covid-19 on Science, Technology & Innovation

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Abstract

The COVID-19 pandemic has generated significant uncertainty across all aspects of the global economy and society. Likewise, the pandemic's long term impacts on science, technology and innovation are also substantial. It may also affect the purpose, design and execution of STI policies. Since the onset of the pandemic, demand for a number of health and digital tools and services has increased, while other sectors (e.g. automotive, aerospace) were hit hard, pointing to highly unequal dynamics across sectors. Funding for public universities and research institutions may reduce. The extent of such funding reductions will also depend on the evolution of student intake, philanthropic donations and research contracts in institutions for which those revenues were an important source of income. In countries most severely affected by budget cuts for STI, the risk of brain drain of highly skilled workers. Scientific conferences, training and research collaboration activities may be held virtually. Virtual conferences allow for larger and more diverse audiences than in-person meetings, and reduce transaction costs as well as the carbon footprint incurred by travel. Virtual training tools facilitate access to training for wider audiences and are highly flexible, making training more compatible with work commitments. In this context, increasing digital security and privacy will be critical. Online scams and phishing emails have proliferated, and cybercriminals have launched ransomware attacks against hospitals, research centres and critical infrastructure. The rapid implementation of open science and open data initiatives during the COVID-19 crisis enhance transparency and collaboration, reduce the risk of duplicated research efforts, and foster research and innovation built on the existing research base. In the past two years we have been reminded of the power of scientific innovation to promote and protect health. Yet we have long known that the way we organise medical innovation is far from perfect.

Keywords: Global economy, Research, Brain drain, virtual meetings, cyber crime, health

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1.1 Introduction

The COVID-19 pandemic resulted in lasting changes for science, technology and innovation (STI). It may also affect the purpose, design and implementation of STI policies. This paper briefly, discusses the array of possible future trends for STI and their impact on different sectors, including firms, research organisations, universities, and the current and future STI labour force. These developments will in turn critically affect the speed and direction of future innovation, as well as its impacts on health and education. The emergence of a novel form of Corona virus (2019-nCoV) in Wuhan has created a confused pandemic situation. Comparing the situation to "the end of the world," hospitals were "overwhelmed" and there existed a complete confusion regarding hospital infrastructure, medical advice and treatment. This led to devastation in the medical field and reminded the gaps to be attended in science, Technology & innovation (STI). STI have played a key role in attending the pandemic and unprecedented socio-economic crisis it has triggered. STI was focused entirely on vaccine technology, treatments and digital solutions to address the problem of social distancing. Countries across the world stimulated research and innovation activities to address this critical problem to decrease the devastation.

1.2 Vaccine development

On the 4th of May, 2020, World Health Organisation (WHO) organized a telethon to raise US$8 billion from forty countries to support the rapid development of Covid vaccines. The Coalition for Epidemic Preparedness Innovations (CEPI), which has established a US$2 billion global fund for rapid investment and development of vaccine candidates, indicated in April 2020 that a vaccine could be available under protocols of emergency use in less than 12 months, or by early 2021. Meanwhile, theEuropean Bioinformatics Institute has established a European COVID-19 platform for data/information exchange. The goal is to collect and share readily available research data to enable synergy, cross-fertilization, and use of different data sets with varying degrees of aggregation, validation, and/or completeness. The platform is envisioned to consist of two interconnected components, the SARS-CoV-2 data hubs, which will organize the flow of SARS-Cov-2 outbreak sequence data and enable comprehensive open data exchange for the European and global research community, and a more comprehensive COVID-19 portal. Several civil society organizations and Industries accelerated open Scientific research released their intellectual property rights during the pandemic to help find a cure for the disease. Several countries, industries and research centers pooled their resources for drug discovery. The COVID 19 High-Performance Computing Consortium developed technology to predict the spread of disease, model possible vaccines, and study thousands of chemical compounds to develop a Covid-19 vaccine or therapy.The scientific community has also held several machine learning competitions to identify false information related to the COVID-19 pandemic.

1.3 Covid-19 Apps

Covid-19 mobile apps were developed for identifying persons ("contacts") who may have been in contact with an infected individual - deployed during the covid-19 pandemic. Digital vaccine passports and vaccination certificates were issued for verifying vaccination status. Such certificates were used to regulate access to events, buildings and services such as airplanes, concert venues and travel across borders.

1.4 Technology

Software came into existence to manage vaccine distribution, including verifying the cold chain, and to record vaccination events. Web-technologies were used to direct individuals to appropriate resources.

Infrared thermal cameras are used to detect individuals with fever. Machine learning has been used for diagnosis and risk prediction. Electronic monitoring has been used to manage quarantine adherence. Nextstrain an open- source tool for pathogen genomic data was used for research about novel variants and their evolution. Software models and simulations for SARS-CoV-2 were developed by governments, universities, and companies to study the spread, transmission risks and potential treatment. Software models were also used to evaluate impact on the Economy and environment. Since the onset of the pandemic, however, demand for a number of health and digital tools and services has increased, while other sectors (e.g. automotive, aerospace) were hit hard, pointing to highly unequal dynamics across sectors.

Virtual communication and conferencing tools enabled new forms of research collaboration, knowledge exchange and the provision of training during the pandemic.

Working from home allowed for more flexible work engagements and increased diversity in STI, enabling greater involvement of those located in more remote areas. Savings from reduced office space also provided more resources for innovation activities but may also be used in other ways.

Scientific conferences, training and research collaboration activities held virtually. Virtual conferences allow for larger and more diverse audiences than in-person meetings, and reduce transaction costs as well as the carbon footprint incurred by travel. Virtual training tools facilitate access to training for wider audiences and are highly flexible, making training more compatible with work commitments. They could also facilitate more tailored training by pooling expertise across institutions and enabling students to participate remotely in training offered by partner institutions.

1.5 Drug Research

Countries across the world, their medical Agencies, academic and industry researchers collaborated for the development of vaccines, antiviral drugs and post-infection therapies. In March 2020, the United States Centre for Disease Control and Prevention (CDC) issued a physician advisory concerning remdesivir for people hospitalized with pneumonia caused by COVID-19. Passive Immunization with convalescent plasma has been proposed as a potential treatment for COVID-19. As of May 2021.

1.6 Digital security and privacy

Digital security and privacy became critical during and after pandemic. Remote work during COVID-19 made systems more vulnerable to cyber-attacks. Online scams and phishing emails have proliferated, and cybercriminals have launched ransomware attacks against hospitals, research centres and critical infrastructure. Such risks increase incentives to accelerate the implementation of cybersecurity practices across organisations, and encourage investments in the development of related technology.

1.8 Scientific career

The prominence STI gained during the COVID-19 crisis offers opportunities for students of scientific background. More students may be attracted to pursue scientific career paths after the pandemic, including those from groups that have been historically under represented, such as women and minorities. The crisis has also allowed for large-scale experimentation with remote working. Such arrangements became more common among the STI workforce after the crisis, which increased the involvement of women with young children, and allowed those located in remote areas to engage in research and innovation networks.

1.9 Scientific Publications

The active engagement of the scientific community is also reflected in the explosion of scientific publications related to the virus. By mid-April 2020, more than 3 500 COVID-19-related articles had been published in medical academic journals. By the end of November 2020, articles related to COVID-19 on PubMed numbered around 75 000 (Chapter 2 provides a detailed breakdown of publications on COVID-19). Other evidence of the massive and rapid engagement comes from an international survey of researchers in different disciplines conducted by Springer Nature and Digital Science from 24 May to 18 June, which found that 43% of the 3,436 surveyed had already or were likely to repurpose their grants for COVID-19 research. United States and the People's Republic of China (hereafter, China) are among the two major contributors to COVID-19 publications on PubMed. Other countries with high engagement in international research collaborations on COVID-19 include the United Kingdom, Germany, France, Italy, Australia, Canada and India.

1.10 The future orientation of STI policies

STI policy is shaped by the key uncertainties above, but it also influences them. Compared to the situation during the 2008-09 global financial crisis, STI lies at the heart of solutions to the COVID-19 crisis and has a highly visible part in shaping policies to contain the virus's spread. The role played by STI in this context is therefore likely to influence the positioning of STI policy in the future. However, there are also uncertainties on the future goals and practices of STI policies and the resources they will have at their disposal. This section considers future levels of government support for STI, in light of the highly visible contributions STI is making to solve the pandemic, but also the public sectors' growing indebtedness. It also considers whether STI policy will become more directional to enact sustainability and digital transitions over the medium and longer term.

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