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The Role of Science in Global Crisis Management: Insights from the COVID-19 Pandemic

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ABSTRACT
Science has long been hailed as a transformative force, reshaping our understanding of the world and driving progress in myriad fields. However, amidst the tumult of global crises like the COVID-19 pandemic, questions arise regarding science's ability to thrive under pressure. Traditionally, science has excelled in an environment characterised by patience, caution, and deliberation. Yet, when faced with urgent challenges, the performance of both science and scientists is put to the test. This paper delves into the intricacies of scientific response during times of crisis, shedding light on key factors such as the pace of scientific inquiry, the imperative of transparency, the role of trust in scientific institutions, the dynamics of data sharing, the intersection of science and politics, and the psychological dimensions influencing scientists' decisions and actions. Examining these facets offers valuable insights into the resilience and effectiveness of science as a cornerstone of informed decision-making in times of upheaval. Moreover, it underscores the importance of conducting systematic empirical studies to comprehensively understand the dynamics at play and inform future responses to global crises. By unpacking these complex elements, we gain a deeper understanding of how science can navigate the challenges of uncertainty and adversity while continuing to serve as a beacon of knowledge and progress for humanity.

Keywords: COVID-19; Pandemic; Science; Global Crisis Management.

1. INTRODUCTION

Throughout history, science has wielded considerable influence, reshaping societal beliefs and practices while driving progress across various domains. By debunking traditional misconceptions such as witchcraft and superstitions surrounding illnesses, science has dispelled ignorance that once led to dire consequences (Styers, 2004). Its power lies in the incremental accumulation of knowledge and adherence to methodical principles. Doubt, a fundamental tool in scientific inquiry, fosters a continuous process of questioning and refinement (Bell, et al., 2010). As Bell et al., (2010) aptly notes, science thrives on reevaluation based on fresh experiences rather than blind adherence to past conventions.

However, criticisms have arisen regarding science's perceived detachment from the general populace. Some argue that science has become an esoteric domain, accessible only to a select few initiated into its intricacies. Even fields ostensibly linked to real-world phenomena, like economics, have faced similar criticisms, with accusations of becoming detached from practical implications (Wrigley, 2018). Nobel laureates and prominent economists have voiced concerns about the discipline's failure to address pressing societal issues.

Moreover, science's tendency to guard knowledge within closed circles and its emphasis on specialisation risk isolating researchers from interdisciplinary collaboration and public engagement (Nowotny, et al., 2016). While specialisation enhances knowledge production, excessive narrowness can obscure the broader picture and hinder communication. The convergence of diverse disciplines, however, fosters a deeper understanding of complex phenomena, particularly in times of crises. Adam Smith cautioned against excessive specialisation, advocating for a balanced approach to knowledge acquisition (Sen, 2016). Yet, striking this balance remains a challenge within academia.

The term "science," derived from the Latin "scire," underscores its pursuit of knowledge (Ukwamedua, 2021). Yet, this pursuit begs the question: What purpose should science serve? Some advocate for science's utilitarian role in addressing societal needs (Bernal, 1938), while others emphasise its intrinsic value as a pursuit of knowledge for its own sake. As Sideris (2017) eloquently articulates, science is an ongoing endeavour to expand humanity's understanding of the world. In light of these considerations, it becomes pertinent to evaluate how science performs under pressure, particularly during crises like the COVID-19 pandemic. Such events challenge scientists to prioritise and interpret information swiftly and effectively (Weible, et al., 2020). While science typically operates with patience and caution, crises demand rapid responses, pushing researchers beyond their comfort zones. Consequently, scientists must strike a delicate balance between adaptability and rigour to provide meaningful insights and guidance during tumultuous times.

In this context, the COVID-19 pandemic serves as a compelling case study to assess science's resilience and adaptability. By examining how scientists navigate the complexities of this crisis, we aim to shed light on the capacity of science to inform decision-making and address societal challenges effectively. Through this analysis, we endeavour to contribute to a deeper understanding of science's role and responsibilities in times of adversity.

2. COVID-19 CRISIS

2.1 Challenges Posed by the COVID-19 Crisis: The Need for Rapid Response

Historical epidemics frequently caught authorities off guard, resulting in widespread confusion and chaos, as Snowden (2019) highlighted. The urgency of crises like the COVID-19 pandemic instills a sense of impatience among the public and government officials, who clamour for immediate solutions. This urgency underscores the critical importance of swiftly conducting clinical trials for novel interventions during pandemics, such as COVID-19. These trials play a pivotal role in identifying potential vaccines or therapies and curbing the spread of infectious diseases (Rabaan, et al., 2020)

2.2 *Insights Gained from Historical and Present Events*

Lessons learned from testing Ebola therapies show that research responses were delayed, even though ethical committees quickly approved protocols and developed clear and practical procedures. Bureaucratic and logistical obstacles hindered the progress of the clinical trial phase, as highlighted by Edwards & Kochhar, (2020). Issues such as challenges in staff deployment and delays in contract processing were noted as significant factors contributing to the slowdown. Therefore, it was evident that the world needs to be prepared for the next pandemic by being research-ready (Lang 2015). Lang (2015) proposed establishing an on-call international task force consisting of 100–200 clinical trial professionals, ready for daily investigations and specialising in epidemic research. Contractual agreements are necessary between stakeholders involved in clinical trials and can be prepared in advance by utilising contract templates. Lang (2015) suggested the establishment of an impartial organisation to choose research priorities in times of an epidemic. Lang recommended the WHO but pointed out its deficiencies in funding, authority, and backing. Keusch et al. (2017) recommended global coordination and collaboration for future outbreaks. In developing nations, the lack of local expertise in clinical research and inadequate ability to promptly conduct scientific and ethical reviews or negotiate research agreements, along with varying perspectives on trial designs and responses, have hindered progress. Volunteers may experience fear, vulnerability, stigma, and confusion regarding the objectives, advantages, and risks of the trial. Establishing a reciprocal trust connection between researchers and participants is essential to prevent misunderstandings and resistance from occurring (Van Marrewijk & Dessing, 2019).

The US National Academies of Sciences, Engineering, and Medicine assessed Ebola clinical trials in a special report, offering suggestions to enhance the chances of obtaining crucial new data on treatments and vaccines in future outbreaks (Mooney, 2018). The report highlights the importance of developing sustainable health systems and research capacities in low-income countries, facilitating data collection and sharing, expediting ethics reviews and legal agreements, strengthening local capacity, integrating research into national health systems, emphasising communication in research engagement, response, and training, and promoting community research and international collaboration efforts ((Mooney, 2018)). The paper also highlights the significance of upholding ethical norms. The high death rate caused by Ebola and the unpredictability of the pandemic created a need to promptly discover successful treatments or vaccinations.

Research conducted during an epidemic must adhere to the fundamental scientific and ethical standards that regulate all research involving human participants. The research suggested forming a Coalition of International Stakeholders with representatives from various sectors such as governments, WHO, academia, the commercial sector, humanitarian response organisations, and the countries and populations at risk (Fontainha et al. 2017). The research suggested that the coalition should get financial resources to take the lead and have the authority and means to quickly organise a response.

The World Health Organisation has created guidelines and resources on how to structure cooperation and interactions. The organisation has created a blueprint to expedite research and development in epidemics or health emergencies in response to member states' requests, focusing on circumstances lacking preventive and curative remedies. Hashem et al. (2020) sharply condemn the approach of scientific exceptionalism during the COVID-19 dispute. To maintain a balance between scientific rigor and the risk of haste, they recommend adhering to the five standards of informativeness and social worth of research outlined by Zarin et al. (2019). The study hypothesis should focus on a significant and unanswered scientific, medical, or policy issue. The study design should aim to offer valuable evidence on this issue. It must be feasible, with a practical recruitment plan. The study should be carried out and analysed in a scientifically sound way. Lastly, the study should accurately, comprehensively, and promptly report its methods and results. Trials that do not fulfil all of these characteristics are highly likely to be uninformative.

By May 1 of the year 2020, the amount of research conducted on COVID-19 had surpassed the number of studies done on past pandemics, such as SARS in 2002–2003. A significant portion of the currently published studies on COVID-19 are in the domains of medicine, immunology, microbiology, biochemistry, genetics, and molecular biology.

Table 1: Number of Studies Exploring Different Pandemics until May 01, 2020

Field	Ebola	SARS (2002-2003)	SARS (since 2002)	Covid19
Chemistry	189	47	1102	15
Energy	2		46	15
Chemical Engineering	79	20	243	14
Materials Science	68	32	239	13
Physics and Astronomy	78	24	344	13
Economics, Econometrics and Finance	43	7	65	11
Arts and Humanities	107	1	87	9
Decision Sciences	21	3	42	6
Veterinary	128	4	100	5
Earth and Planetary Sciences	30	21	475	1
Undefined	1		15	
Medicine	3747	719	5369	2057
Immunology and Microbiology	1568	38	1840	243
Biochemistry, Genetics and Molecular Biology	1280	151	2911	202
Social Sciences	562	15	523	100
Pharmacology, Toxicology and Pharmaceutics	436	66	1399	93
Environmental Science	291	23	772	92
Health Professions	121	6	114	64

Nursing	223	27	176	60
Neuroscience	70	7	152	53
Engineering	148	54	585	40
Computer Science	119	10	277	37
Agricultural and Biological Sciences	688	88	2133	36
Multidisciplinary	431	34	388	35
Psychology	34		72	32
Mathematics	197	21	264	24
Dentistry	2	2	17	21
Business, Management and Accounting	78	40	204	21

Note: Scopus contribution based on a search conducted May 1, 2020 (Authors compilation).

2.3 Collaborative Endeavors between Government Entities and Scientific Communities

A global pandemic catastrophe necessitates tight collaboration among scientists, government agencies, and politics. Establishing and upholding this relationship has been difficult previously. Duarte, et al., (2015) argues that politicians often hold a negative view and an unjustifiably hostile attitude towards science and scientists. Scientists are skeptical of politicians and frequently charge them with having an action bias (Ioannidis 2020). An egregious instance is Trump's sudden dismissal of prominent US government doctor Rick Bright from his roles as director of the US Health Department's Biomedical Advanced Research and Development Authority and Deputy Assistant Secretary for Preparedness and Response. Bright was dismissed because he refused to support hydroxychloroquine, a malaria treatment endorsed by Trump without scientific backing. He mentioned being coerced to provide funds for that drug by individuals with political ties, emphasizing the need to let science, rather than politics or favoritism, guide our efforts in fighting the virus. M. Granger Morgan, an engineer, policy professor at Carnegie Mellon University, and counselor to previous administrations, was questioned about the assessment he would give Trump. Morgan promptly stated that Trump deserves an F, condemning presidents for prioritizing politics before science.

Steven Chu, the Nobel laureate, the former Energy Secretary during the Obama administration slammed Trump's latest statement on disinfectants, stating that it poses a danger to the public as some individuals may take it seriously (McGarity¸ 2022). This is not scientific. This is extraordinary. Failure to honestly represent limited knowledge can result in dilettantism and quackery, as well as a lack of humility in listening without bias or judgment, which can diminish credibility. Snowden (2019) concludes in his book "Epidemics and Society" that plague restrictions have had a significant impact on political history. They represented a significant expansion of governmental authority into aspects of human existence that had hitherto been beyond its reach. One reason for the inclination in later times to turn to plague rules was because they offered a rationale for expanding authority, whether used to combat plague or, later on, against cholera and other illnesses. The church and influential political and medical figures embraced this extension of power under the pretext of a public health emergency.

The fight against the disease contributed to the rise of absolutism and strengthened the power and legitimacy of the modern state. The Hungarian parliament granted Prime Minister Viktor Orbán the authority to govern without time limits through decrees. Dr. Balazs Rekassy, a former manager of a public health center, questioned Orbán's attempt to consolidate his power for a lasting political benefit (Lendvai¸ 2017). During a podcast with Sam Harris on Making Sense, historian Yuval Noah Harari voiced concerns about the political situation in Israel. He highlighted that, at the onset of the crisis, Israel's unelected prime minister attempted to use the situation as a pretext to dissolve the elected parliament and govern effectively through emergency decrees. He faced sufficient opposition to justify reopening the parliament in order to sustain a democratic equilibrium.

Politicizing scientific approaches can pose a risk. Science is neither a panacea that can eliminate the challenges we face nor can it address all global issues effortlessly with its tools. It can enlighten and offer many ideas and solutions to problems, which could be viable, and anticipate their potential repercussions. Science often does not address inquiries on ethics, morality, fairness, or social acceptability. The social sciences may provide insights into their current status. Science's function is to provide advice, not to govern or dictate, which is the responsibility of decision-makers, whether democratically elected or not. Politicians have recognized the influence that scientifically supported facts may have on public opinion and its capacity to persuade or prevail in an issue. Politicians prioritize policy-based evidence above evidence-based policy (Henderson, 2012). When science is manipulated for political purposes rather than societal advancement, such as selecting evidence that aligns with preconceived beliefs instead of considering all evidence to develop effective policies, it can erode public trust in science. This is especially true for individuals who are unfamiliar with the scientific terminology and methods used to ensure that science is testable, repeatable, and falsifiable (Popper 1992).

Feynman (1998) contends that we are not in an unscientific era, suggesting that history may view this period as a significant change from ignorance to a vast increase in knowledge. However, if you are suggesting that this century is dominated by science in art, literature, people's views, and overall understanding, then I disagree that it is truly a scientific age. Richard Dawkins offers an insightful analysis of scientific nomenclature, highlighting the confusion caused by those who suggest replacing "theory of evolution" with "law of evolution." Evolution is not definitively considered a law in the same way as Newton's Laws, Kepler's Laws, Boyle's Law, or Snell's Law. These are mathematical connections that are generalizations about the real world and have been verified to be accurate by measurements. Evolution is not a strict law; however, certain generalizations like Dollo's Law and Cope's Law have been questionably included in Darwinian theory. Furthermore, the term "Law of Evolution" evokes negative connections with exaggerated generalizations that connect biological, cultural, linguistic, economic, and universal evolution. Avoid exacerbating the situation by treating evolution as a law. The misuse of science in politics and the insufficient scientific knowledge among politicians can lead to significant policy failures, as demonstrated by the eruption of the Eyjafjallajökull volcano in Iceland in March 2010 (Henderson, 2012). Immediately after the eruption was identified, a no-fly zone was established throughout Europe due to the potential damage volcanic ash can cause to jet engines. However, no one conducted tests to assess the quantities of ash in the atmosphere, which were found to be significantly lower than in earlier examinations. Swiftly, the industry assessed the ash levels and adjusted the safety limit for ash in the air, leading to the resumption of flights. However, significant economic harm had already occurred.

The government's reaction to the threat was a heavy-handed and immediate response to safety concerns, resulting in an estimated £2.2 billion loss for the airline sector (Henderson, 2012). The select committee concluded that although science is effectively used to assist in emergency responses, the government tends to view scientific advice as a last resort rather than a crucial consideration from the beginning of the planning process. This is similar to the automatic lockdown procedures implemented in response to COVID-19. Scientists often face challenges when politicians do not demonstrate tolerance or comprehension for the reliable assumptions and facts underpinning policy decisions. During a worldwide crisis, it can be difficult to find a scientific equilibrium between simplicity and conciseness versus entire comprehensiveness and inclusivity. Political pressure can result in biases, including optimistic predictions based on unrealistic assumptions. Manski (2013) emphasizes that when researchers overstate their findings, they not only damage their own credibility but also erode public trust in science as a whole. Such damages can be especially significant during a crisis. There is a lack of knowledge or naivety in managing human decisions in rare situations, leading to issues with planning and decision-making.

Partnerships between government agencies might face challenges during a crisis because of the unrealistic and shortened time constraints on forming alliances that often demand significant efforts, resources, and modifications to create an efficient framework (Doe-Anderson et al., 2016). Social science research faces challenges due to the inability to observe counterfactual results during a crisis, and the constraints of time or the desire to carry out randomized field experiments hinder the ability to gain causal insights. Investigating pandemics empirically is difficult because of the intricate nature of social connections. Therefore, the likelihood of clear-cut policy suggestions rises. It is common for concerned people, civil servants, journalists, and politicians to have a limited understanding of the prediction methods needed to evaluate imminent hazards during a crisis. Obtaining trustworthy conclusions during a pandemic necessitates a continuous interaction between theoretical concepts and actual evidence from real-life experiences. Denying uncertainty, perplexity, or lacking versatility might impact the quality or even the presence of such an interaction. While individual studies may be internally consistent, research undertaken at the onset of a crisis is often based on unreliable data, which compromises the validity of its results. Crises require more certainty and less acceptance of uncertainty about the outcomes of different policies, which poses a challenge for science since policy forecasts are frequently uncertain (Manski 2013). Maslow (1969) views the willingness to acknowledge ignorance as a key trait of an empirical or scientific mindset. Rarely do we come across policy papers that document interval projections of policy outcomes, even in ordinary circumstances. Manski (2007) references President Lyndon B. Johnson's dismissal of a range of projected values as being suitable only for cattle. Ioannidis (2020) examines the consequences of an action bias, when the implementation of measures in one institution, jurisdiction, or country leads to demand for comparable actions elsewhere to avoid accusations of inaction. Furthermore, numerous countries enact laws that assign significant resources and financing to the coronavirus response. This is justified, but the specific allocation priority may become irrational.

Conversely, a pandemic has the potential to alter scientific standards. Many scientists steer clear of unclear, indeterminate, or unmanageable topics. A crisis may lead to the acceptance and adoption of the mindset that doing what needs to be done, even if not done perfectly, is still valuable. Initial attempts to investigate a new issue are frequently unrefined, lacking precision, and rudimentary (Maslow 1969). These endeavors assist in elucidating areas that require enhancement to progress knowledge in the field. If researchers openly share their uncertainty and ambiguity, it can lead to quicker feedback for enhancing knowledge. As to Maslow, someone must take the lead in navigating through the mine fields.

2.4 The dangers of a contest over priority

Science, like other institutions, can be influenced by many illnesses that emerge from the incentive system and are typically a reflection of human nature. Merton (1973) highlights that our religion, moral values, and foundation of life revolve around the concept of reward. The debate over priority is a crucial topic that has been extensively examined by sociologists like Merton (1973). Prominent scholars in the history of science have faced intense conflicts over credit for their work, highlighting the importance of innovation in driving scientific progress. Newton engaged in disputes with Robert Hook regarding precedence in optics and celestial mechanics, as well as with Leibniz over the creation of calculus. Even brotherly affection cannot prevent the vicious attacks between Jacob and Johannes Bernoulli, as seen in their recurring feuds. Merton (1973) stated that Faraday, despite being sensitive and modest, was hurt by others claiming credit for some of his important discoveries. Similarly to other fields, science can draw individuals who are self-centred and want fame or acknowledgment as indicators of their successful work. Merton references Darwin, who highlighted that his passion for natural science was greatly influenced by his desire to be respected by other naturalists.

Scientists in all fields are naturally eager and ready to contribute their efforts to understanding and managing the global pandemic. Excessive focus on achieving success in scientific endeavours during a crisis like COVID-19 can have adverse impacts on academic standards. Competition in the field of journal publication may motivate scientists to promptly share their findings, but ongoing scientific evaluation will lead to revisions in what is considered significant. Most scientists, like artists, writers, surgeons, financiers, and bookkeepers, have limited potential for significant and groundbreaking creativity. For many researchers, publishing their work is tantamount to achieving a scientific breakthrough (Merton 1973). Ioannidis (2020) has warned about the risks of overstated information and measures that lack evidence. He cites publications from the New England Journal of Medicine and the Lancet to demonstrate that even prestigious journals can include sensationalism. He also critiques the idea that peer review may be ineffective when there is insufficient data and strong opinions. Opinion-based peer review could potentially strengthen a body of literature containing false information.

Ioannidis (2020) criticises the dissemination of overstated estimations by reputable scientists, citing pandemic projections related to fatalities and rapid community spread as instances. He opposes the adoption of severe methods with undetermined effectiveness, emphasising the absence of proof for the most radical approaches. The author references review research by Jefferson et al. (2011), which found inadequate data about the effectiveness of entry port screening and social distancing for prior events. He also mentions the negative consequences of impulsive behaviours like panic purchasing of face masks, which leads to shortages for medical staff. He was one of the first to highlight the dangers of resource misallocation and economic and social inequality, unlike many economists. If some of the money used for harsh COVID-19 measures had been allocated to improving influenza vaccination rates, many influenza deaths could have been prevented. He is also worried that certain political decisions may be confused with ulterior objectives. Lockdowns used by oppressive governments might set a precedent for future use, as noted by various experts, such as the case in Hungary (Eichenberger et al., 2020). Dean et al. (2020) propose the need to weigh the significance of releasing the outcomes of all finished clinical trials with the potential negative outcomes if the disclosed results do not offer dependable solutions to the concerns the trials were meant to tackle.

2.5 *Trust in scientists*

Trust in science can benefit society by providing information to politicians, therefore validating political actions, and enabling individuals to develop opinions on significant political matters. Research suggests that when complexity grows, individuals tend to depend more on trusted representation (Stadelmann and Torgler, 2013). Having trust in science can enhance readiness and response capacity (Balog-Wag and McComas, 2020) and impact adherence to preventive measures (Plohl and Musil 2020). According to a UK poll, trust in scientists has increased as bogus news about the coronavirus has spread. Research in science depends on the public's willingness to engage in studies and on public funding (Neureiter, et al., 2021). If society lacks trust in science, it can lead to problems. Rousseau et al. (1998) define trust as a psychological state involving the willingness to be vulnerable based on positive expectations of another's intentions or behavior. Gambetta (1988) describes trust as the likelihood that someone will act in a way that benefits us, making us willing to cooperate with them. Simply put, trust is based on the goodwill of others, but according to Mayer et al. (1995), it also involves elements like expertise, integrity, and compassion. The issue of trustworthiness among scientists is a controversial one.

From a British sample in a European Commission (2013) poll, 52% of participants said that the information they hear about science is generally accurate. Among those participants, 40% mentioned that they had no grounds to question the scientists. 66% of participants believed that university scientists were qualified to explain the impact of scientific and technological advancements on society, whereas only 35% thought the same about scientists employed by private companies. In a recent study conducted in the United States, participants exhibited greater trust in scientists compared to corporate executives and political politicians (Douglas, et al., 2019). 86% of participants expressed at least a "fair amount" of confidence in scientists acting in the public's interest. Researchers have discovered that trust levels in specific subjects, like climate change, are lower compared to trust in science as a whole (Hamilton et al. 2015). Research conducted by the Pew Research Center in 2015 revealed that individuals exhibit skepticism towards climate change, with only 50% of participants in an American sample acknowledging that climate change is caused by human activity. In a different American survey called the Nationwide POLE survey conducted after the 2015 Zika virus outbreak, participants were questioned about their trust in information provided by agencies like the Centers for Disease Control. 73% of respondents stated that they trusted science agencies for information regarding the Zika virus (Hamilton and Safford 2020).

The connection between science and religion seems to be deteriorating to levels reminiscent of the persecution of Galileo by the Catholic Church in 1633. The Church declared Galileo suspected of heresy for believing the false doctrine that the sun is the centre of the world and that the earth moves (Sutton¸1982). The new divide appears to be fueled by a return to a significantly lower standard of general education and a lack of comprehension regarding the nature of science. Many less educated individuals in contemporary culture perceive science as witchcraft and technology as indistinguishable from magic. Religion and pseudo-science are increasing, accompanied by a significant growth in fundamentalist anti-science ideologies and belief in scientific conspiracies. Flat Earth societies, anti-vaccination groups, and various space fraud societies all propagate the belief that anything related to space and NASA is fake news. Alexander (2018) emphasises that the issue lies not in what is achievable. The issue lies elsewhere. The issue pertains to what is likely and now occurring. Repeatedly demonstrating the inability to disprove that this object could be a flying saucer serves no use. We must anticipate in advance whether we need to.

In 2020, the intersection of science and religion faced a crucial moment due to the COVID-19 pandemic. Some individuals are content with the peaceful coexistence of science and faith. Tsamakis (2020) references a caricature in his British Medical Journal response piece that is being shared on Greek social media. The cartoon shows a scientist examining something through a microscope, with religious leaders standing next to him, looking very worried. One of them exclaims, "Please, son, hurry. We must inform the group that our prayers have been answered." However, there are religious radicals who reject scientific advancements and atheist individuals who refuse to follow steps aimed at containing the pandemic. Some religious leaders persisted in holding religious services in crowded churches, saying that their faith would protect them.

Richard Feynman (1999) used the term "cargocult" science to refer to antiscience or pseudo-science views. This term was inspired by the Papua New Guinean tribes, who watched American planes bring important cargo during the Second World War. After the conflict, the tribes constructed fake landing strips in hopes of attracting planes back to provide valuable supplies. Modern anti-science hoaxers and non-believers are akin to 'cargo-cultists' who utilise technology such as computers, phones, and TV without comprehending its functionality. Regrettably, they are hesitant to apply this to vaccinations or scientific principles that can save lives. It is not surprising to witness armed protests against pandemic health measures in the United States, particularly in regions like the Bible Belt and the South, where religion holds more influence than science and education. Most US states allow religious exemptions from social distancing restrictions, indicating that religion often takes precedence over the science of COVID-19.

3. PSYCHOLOGY OF SCIENTISTS

Pandemics present challenges in understanding decision-making processes due to the lack of empirical knowledge available. Emerging facts about the actual world are often difficult to apply systematically and rigorously, given the uncertainties inherent in such crises. Media coverage during pandemics tends to be extensive, presenting challenges in distinguishing between informative policy analysis and sensationalism. Furthermore, pandemics can evoke impulsive and emotional responses from scientists, who are not immune to such feelings.

Kong and Chan (2020) provide insights into the emotional struggles faced by scientists during the COVID-19 pandemic. The sense of being directly affected by potential risks can trigger emotional responses that may influence a scientist's judgment. Despite their professional competence, scientists are not always detached or rational, as emotions play a significant role in decision-making processes. Maslow (1969) highlights the complexities of human cognition, emphasising the need to confront fears and anxieties to perceive oneself truthfully.

During crises, scientists may experience a mix of anxiety and a desire for safety, leading to varying cognitive responses. While scientists are driven by a pursuit of knowledge, they may also harbor fears associated with it. The cost-benefit analysis adopted by economists like Justin Wolfers underscores the overwhelming nature of decision-making during crises. March (1978) discusses the concept of the "optimal sin problem," suggesting that individuals may deviate from their values when seeking solutions. Institutional and career pressures further compound the challenges faced by scientists. The "publish or perish" culture prevalent in academia demands regular publication in prestigious journals, often at the expense of scholarly integrity. This pressure to maintain productivity while avoiding controversy or unpopularity creates a precarious balance for scientists, who must navigate career concerns alongside their research pursuits.

In a recent open letter addressed to the Prime Minister and Members of the National Cabinet, signed by 265 Australian economists, there was a notable presence of scholars from prestigious universities, particularly from the Go8 universities, including the University of Melbourne (which includes the Melbourne Institute). Among the signatories were individuals who had received prestigious Australian awards and recognitions, as well as scholars from esteemed overseas institutions such as the University of Oxford, the University of Chicago, the University of Toronto, and the University of Michigan (Tooze, 2021). The letter criticised the notion of a trade-off between public health and economic considerations as a false dichotomy, asserting that a functioning economy relies on addressing the public health crisis comprehensively (Tooze, 2021). It emphasized that while the measures taken to date have had economic costs, these are outweighed by the lives saved and the economic damage averted by containing the contagion.

Interestingly, both the open letter and a complementary article published in The Conversation lacked the typical economic analyses or justifications one might expect from economists. Instead of employing the usual array of evaluations or economic reasoning, the documents relied on emotional appeals, departing from the traditional approach associated with the discipline often referred to as "dismal science." The narrative employed focused on minimising losses, although it remained unclear whether this approach also maximised social welfare. Some economists advocated for a cost-benefit analysis to better inform decision-making processes. Walter Scheidel, an economic historian at Stanford, questioned the reluctance to quantify the economic costs of pandemic-related measures against the lives saved, highlighting the discipline's capacity for such analysis (Chrystal, 2021). Similarly, economists like Casey Mulligan and Kip Viscusi emphasised the importance of considering both the lives saved and the economic consequences of restrictive measures. Gigi Foster, a professor from the University of New South Wales, stood out for openly discussing the trade-offs associated with lockdown measures on national television, sparking controversy within the economic community (McLaughlin & Mulligan, 2022). While some economists supported the need to balance economic and public health concerns during pandemics, others underscored the potential long-term consequences, such as delayed infrastructure projects, reduced access to healthcare, and societal disruptions (Or¸et al., 2022).

While pandemics pose significant challenges, economists have varied perspectives on how to address them. Some advocate for a balanced approach that considers both economic and public health concerns, while others highlight the potential negative externalities of restrictive measures. A nuanced understanding of the trade-offs involved is essential for informed decision-making during crises.

4. COLLECTIVE INITIATIVES' INFLUENCE

The Royal Society of London recognized William Whewell's contributions to the study of ocean tides in 1837 by awarding him the Royal Medal for his participation in the "great tide experiment." This ambitious project, conducted in June 1835, enlisted the efforts of numerous individuals residing in coastal communities, resulting in nearly a million observations gathered from 650 tidal stations over a two-week period (Russell, 1985, p. 4). Recent years have witnessed significant advancements in data collection efforts through collective initiatives. Projects like the Human Connectome Project and the Genome Aggregation Database aim to aggregate and standardise data related to brain structure and genetic sequencing, respectively. Similarly, the Earth Microbiome Project and the Long-Term Ecological Research Network in Australia involve extensive collaboration among researchers to study microbial life and ecological dynamics.

The success and sustainability of such projects hinge on researchers' willingness to share data, a topic that has garnered substantial attention in the scientific community (Tenopir et al., 2015). Despite growing acceptance and readiness to share data, challenges persist, particularly concerning data publication. Recognising this, international scientific organisations, including the European Commission and the US Office of Science and Technology, have been actively involved in developing policies to enhance public access to research (Gewin, 2016). Various organizations and journals have also reaffirmed their commitment to facilitating data sharing, as evidenced by their endorsement of the 2016 Statement on Data Sharing in Public Health Emergencies, which enables timely access to critical information for organizations like the World Health Organization (WHO) during global health crises like COVID-19. The WHO's initiatives, such as ZikaOpen, underscore the importance of streamlined data-sharing platforms in addressing public health emergencies.

In times of crisis, such as pandemics, collaborative efforts become paramount in addressing shared challenges and empowering stakeholders with relevant information (Arslan et al., 2021). Noteworthy examples of data sharing during the COVID-19 pandemic include projects like Nextstrain, which leverages pathogen genomic data for epidemiological analysis, and platforms like Singapore's COVID-19 UpCode SG dashboard and the COVID-19 Dashboard developed by the Centre for Systems Science and Engineering (CSSE) at Johns Hopkins University, which provide real-time updates on pandemic-related data. However, the proliferation of such dashboards raises concerns about privacy infringement, highlighting the need to balance data transparency with individual privacy rights (Patel, 2020).

Despite the benefits of international collaboration, there are risks associated with groupthink, whereby excessive emphasis on a single perspective may stifle diverse viewpoints and hinder scientific progress. For instance, the dominance of string theory in physics, despite its untestable nature, underscores the potential pitfalls of overcommitting to a particular scientific paradigm (Smolin, 2006). Furthermore, the tendency to prioritise medical implications during pandemics may overlook the broader societal impacts, leading to inadequate solutions and responses (Chi, et al., 2020). Therefore, maintaining a balance between adhering to established norms and embracing diversity is essential for fostering innovation and resilience in scientific endeavours.

Collective initiatives play a crucial role in advancing scientific knowledge and addressing global challenges. However, it is imperative to address barriers to data sharing and mitigate the risks of groupthink to ensure that scientific endeavours remain robust, inclusive, and responsive to the evolving needs of society.

5. CONCLUSION

Science has undergone remarkable advancement since humanity embraced what Eiseley (1961) refers to as a transformative "magic pill": the pill of science. Following significant historical events such as the plague and the Great Fire of London in September 1666, inquiries into their causes yielded attributions to divine displeasure, with figures like Hobbes, author of Leviathan, being scapegoated by the House of Commons Committee (Gilman, 2009). Great thinkers like Francis Bacon played pivotal roles in fostering the experimental method, laying the groundwork for scientific progress (Jalobeanu, 2015). However, even notable figures like Aristotle demonstrated lapses in scientific inquiry, as exemplified by his failure to verify claims about women's dental anatomy through empirical observation (Russell, 1985).

Scientific endeavours ideally guide policy choices through research findings and analytical tools. Like any social institution, science contends with defensive, conservative, and stabilising forces (Phillips, 2000). This paper has explored science's readiness to confront global crises, offering insights into the health and adaptability of scientific practices. The COVID-19 pandemic serves as a compelling case study, illuminating how human factors influence scientific responses during crises. Both positive and negative aspects of science's performance amidst the pandemic have been discussed, highlighting the influence of human values on scientific endeavours (Bates et al., 2021).

The discussion has underscored the importance of addressing philosophical assumptions underlying scientific practices, including notions of detachment, objectivity, and reliability of knowledge (Evans, et al., 2010). Acknowledging scientists' inherent goals and purposes can facilitate the development of new methods for understanding human elements within science. Transparency and accountability are essential for enhancing scientific rigour and communication, allowing for a more nuanced understanding of research processes and conclusions Humphreys, et al., 2021). Moreover, science transcends impersonal inquiry, shaping and being shaped by personal experiences and societal dynamics. Crises prompt scientists to focus on pressing issues, fostering adaptability and innovation. The psychology of science during crises warrants further exploration, drawing on interdisciplinary insights from psychology, sociology, and economics to elucidate scientists' incentives and institutional frameworks.

In conclusion, the examination of science in crisis situations offers valuable lessons for understanding scientific practices and fostering resilience in the face of uncertainty. Future studies should delve deeper into the psychological and sociological dimensions of scientific responses to crises, enriching our understanding of science's role in shaping human endeavours and societal progress.

REFERENCES

Alexander, R. B. (2018). *Science under attack: The age of unreason*. Algora Publishing.

Arslan, A., Golgeci, I., Khan, Z., Al-Tabbaa, O., & Hurmelinna-Laukkanen, P. (2021). Adaptive learning in cross-sector collaboration during global emergency: conceptual insights in the context of COVID-19 pandemic. *Multinational Business Review*, *29*(1), 21-42.

Balog-Way, D. H., & McComas, K. A. (2020). COVID-19: Reflections on trust, tradeoffs, and preparedness. *Journal of Risk Research*, 1-11.

Bates, A. E., Primack, R. B., Biggar, B. S., Bird, T. J., Clinton, M. E., Command, R. J., ... & Parmelee, J. R. (2021). Global COVID-19 lockdown highlights humans as both threats and custodians of the environment. *Biological conservation*, *263*, 109175.

Bell, T., Urhahne, D., Schanze, S., & Ploetzner, R. (2010). Collaborative inquiry learning: Models, tools, and challenges. *International journal of science education*, *32*(3), 349-377.

Chi, Y. L., Regan, L., Nemzoff, C., Krubiner, C., Anwar, Y., & Walker, D. (2020). Beyond COVID-19: a whole of health look at impacts during the pandemic response. *CGD Policy Paper*, *177*, 1-30.

Chrystal, P. (2021). The history of the world in 100 pandemics, plagues and epidemics. *The History of the World in 100 Pandemics, Plagues and Epidemics*, 1-320.

Doe-Anderson, J., Baseler, B., Driscoll, P., Johnson, M., Lysander, J., McNay, L., Njoh, W.S., Smolskis, M., Wehrlen, L., Zuckerman, J. & for PREVAIL I Study Group (2016). Beating the odds: successful establishment of a phase II/III clinical research trial in resource-poor Liberia during the largest-ever Ebola outbreak. *Contemporary Clinical Trials Communications*, *4*, 68-

Douglas, K. M., Uscinski, J. E., Sutton, R. M., Cichocka, A., Nefes, T., Ang, C. S., & Deravi, F. (2019). Understanding conspiracy theories. *Political psychology*, *40*, 3-35.

Duarte, J. L., Crawford, J. T., Stern, C., Haidt, J., Jussim, L., & Tetlock, P. E. (2015). Political diversity will improve social psychological science1. *Behavioral and brain sciences*, *38*, e130.

Edwards, K. M., & Kochhar, S. (2020). Ethics of conducting clinical research in an outbreak setting. *Annual Review of Virology*, *7*, 475-494.

Eichenberger, R., Hegselmann, R., Savage, D., Stadelmann, D., & Torgler, B. (2020). Certified CoronaImmunity as a Resource and Strategy to Cope with Pandemic Costs, forthcoming: *Kyklos*.

Eiseley, L. (1961). The man who saw through time. Charles Scribner's Sons.

European Commission. (2013). Eurobarometer. Brussels. doi:10.4232/1.11873.

Evans, T., Evans, A., & Hardy, M. (2010). *Evidence and knowledge for practice* (Vol. 1). Polity.

Feynman, R. P. (1998). The meaning of it all: Thoughts of a citizen scientist. Helix Books.

Feynman, R. P. (1999). The pleasure of finding things out. Basic Books.

Fontainha, T. C., Leiras, A., de Mello Bandeira, R. A., & Scavarda, L. F. (2017). Public-private-people relationship stakeholder model for disaster and humanitarian operations. *International journal of disaster risk reduction*, *22*, 371-386.

Foster, G. (2020). The behavioural economics of government responses to COVID-19. *Journal of Behavioral Economics for Policy*, *4*(S3), 11-43.

Gambetta D.G. (1988) Can we trust? In: Gambetta DG (ed.) Trust: Making and Breaking Cooperative Relations. New York: Basil Blackwell, pp. 213–237.

Gewin, V. (2016). Data sharing: An open mind on open data. *Nature*, *529*(7584), 117-119.

Gilman, E. B. (2009). *Plague writing in early modern England*. University of Chicago Press.

Hamilton, L. C., & Safford, T. G. (2020). Ideology Affects Trust in Science Agencies During a Pandemic, University of New Hampshire.

Hamilton, L. C., Hartter, J., & Saito, K. (2015). Trust in scientists on climate change and vaccines. *Sage Open*, *5*(3), 2158244015602752.

Hashem, H., Abufaraj, M., Tbakhi, A., & Sultan, I. (2020). Obstacles and considerations related to clinical trial research during the COVID-19 pandemic. *Frontiers in medicine*, *7*, 598038.

Henderson, M. (2013). The geek manifesto: Why science matters, London: Random House.

Humphreys, L., Lewis Jr, N. A., Sender, K., & Won, A. S. (2021). Integrating qualitative methods and open science: Five principles for more trustworthy research. *Journal of Communication*, *71*(5), 855-874.

Ioannidis, J. P. (2020). Coronavirus disease 2019: the harms of exaggerated information and nonevidence-based measures. *European Journal of Cinical Investigation*, *50*(4), e13222.

Jalobeanu, D. (2015). *The art of experimental natural history: Francis Bacon in context*. ZETA books.

Jefferson, T., Del Mar, C. B., Dooley, L., Ferroni, E., Al-Ansary, L. A., Bawazeer, G. A., van Driel, M.

Keusch, G. T., & McAdam, K. P. (2017). Clinical trials during epidemics. *The Lancet*, *389*(10088), 2455-2457.

Kong, J., & Chan, S. (2020). Advice for the worried. *Science*, 368(6489), 438.

L., Nair, S., Jones M. A., Thorning S., & Conly, J. M. (2011). Physical interventions to interrupt or reduce the spread of respiratory viruses. *Cochrane Database of Systematic Reviews*, (Jul 6;(7):CD006207

Lang, T. (2015). Embed research in outbreak response. *Nature,* 524, 29-31.

Lendvai, P. (2017). *Orbán: Hungary's strongman*. Oxford University Press.

London, A. J., & Kimmelman, J. (2020). Against pandemic research exceptionalism. Science, 368(6490), 476-477.

Manski, C. F. (2007). Identification for prediction and decision. Harvard University Press.

Manski, C. F. (2013). Public policy in an uncertain world: Analysis and decisions. Harvard University Press.

March, J. G. (1978). Bounded rationality, ambiguity, and the engineering of choice. *The Bell Journal of Economics*, 587-608.

Maslow, A. H. (1966). The psychology of science: a reconnaissance. Henry Regnery Company.

McGarity, T. O. (2022). *Demolition Agenda: How Trump Tried to Dismantle American Government, and What Biden Needs to Do to Save It*. The New Press.

McLaughlin, P. A., & Mulligan, C. B. (2022). Three Misconceptions about Federal Regulation. *Journal of Benefit-Cost Analysis*, *13*(3), 287-309.

Merton, R. K. (1973). The Sociology of Science: Theoretical and Empirical Investigations. Chicago.

Mooney, T., Smout, E., Leigh, B., Greenwood, B., Enria, L., Ishola, D., ... & Watson-Jones, D. (2018). EBOVAC-Salone: lessons learned from implementing an Ebola vaccine trial in an Ebola-affected country. *Clinical Trials*, *15*(5), 436-443.

Neureiter, A., Stubenvoll, M., Kaskeleviciute, R., & Matthes, J. (2021). Trust in science, perceived media exaggeration about COVID-19, and social distancing behavior. *Frontiers in Public Health*, *9*, 670485.

Nowotny, H., McBee, D., Leahey, E., Downey, G. J., Feinstein, N. W., Kleinman, D. L., ... & Cassidy, A. (2016). *Investigating interdisciplinary collaboration: theory and practice across disciplines*. Rutgers University Press.

Or, Z., Gandré, C., Zaleski, I. D., & Steffen, M. (2022). France's response to the Covid-19 pandemic: between a rock and a hard place. *Health Economics, Policy and Law*, *17*(1), 14-26.

Patel, N. V. (2020). The best, and the worst, of the coronavirus dashboards, MIT Technology Review.

Phillips, D. C. (2000). *The expanded social scientist's bestiary: A guide to fabled threats to, and defenses of, naturalistic social science*. Rowman & Littlefield.

Plohl, N., & Musil, B. (2020). Modeling compliance with COVID-19 prevention guidelines: The critical role of trust in science, mimeo, University of Maribor.

Rabaan, A. A., Al-Ahmed, S. H., Sah, R., Tiwari, R., Yatoo, M. I., Patel, S. K., ... & Leblebicioglu, H. (2020). SARS-CoV-2/COVID-19 and advances in developing potential therapeutics and vaccines to counter this emerging pandemic. *Annals of Clinical Microbiology and Antimicrobials*, *19*, 1-37.

Russell, B. (1985). The Impact of Science on Society. Routledge Classics.

Sen, A. (2016). Adam Smith and economic development. *Adam Smith. His Life, Thought, and Legacy. Princeton University Press, Princeton*, 281-302.

Sideris, L. H. (2017). *Consecrating science: Wonder, knowledge, and the natural world*. Univ of California Press.

Smolin, L. (2006). The trouble with Physics: The Rise of String Theory, the Fall of a Science, and What Comes Next. A Mariner Book.

Snowden, F. M. (2019). *Epidemics and society: From the black death to the present*. Yale University Press.

Stadelmann, D., & Torgler, B. (2013). Bounded rationality and voting decisions over 160 years: Voter behavior and increasing complexity in decision-making. *PloS One*, 8(12): e84078.

Styers, R. (2004). *Making magic: Religion, magic, and science in the modern world*. Oxford University Press, USA.

Sutton, G. V. (1982). *A science for a polite society: Cartesian natural philosophy in Paris during the reigns of Louis XIII and XIV*. Princeton University.

Tenopir, C., Dalton, E. D., Allard, S., Frame, M., Pjesivac, I., Birch, B., ... & Dorsett, K. (2015). Changes in data sharing and data reuse practices and perceptions among scientists worldwide. *PloS One*, *10*(8). e0134826.

Tooze, A. (2021). *Shutdown: How Covid shook the world's economy*. Penguin UK.

Tsamakis, K. (2020). COVID-19: Religion and the Rise of Trust in Science, British Medical Journal, https://www.bmj.com/content/369/bmj.m1336/rr-17

Ukwamedua, N. U. (2021). Between Paul Feyerabend's Epistemological Dadaism and an Existential Anarchism: A Critical Discourse. *Cogito-Multidisciplinary research Journal*, (1), 50-62.

Van Marrewijk, A., & Dessing, N. (2019). Negotiating reciprocal relationships: Practices of engaged scholarship in project studies. *International journal of project management*, *37*(7), 884-895.

Weible, C. M., Nohrstedt, D., Cairney, P., Carter, D. P., Crow, D. A., Durnová, A. P., ... & Stone, D. (2020). COVID-19 and the policy sciences: initial reactions and perspectives. *Policy sciences*, *53*, 225-241.

Wrigley, T. (2018). The power of 'evidence': Reliable science or a set of blunt tools?. *British Educational Research Journal*, *44*(3), 359-376.