Chapter

The Economic, Climate Change and Public Health Edges of the Geopolitics of COVID-19: An Exploratory Bibliometric Analysis

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Abstract

We are in the middle of the storm and this does not allow us to see clearly what is coming. This often generates partial analyses of the issues of the situation. Therefore, this manuscript attempts to generate an integral perspective on the issues of the crisis. This chapter proposes a discussion of the Coronavirus crisis following analysis and comparison of the most important outstanding conversations of general public health, economics and environmental issues. The objective of this chapter is to travel on the far side of the discussion of the articles presently planned within the academic world and that were analyzed within the bibliometric review, that consist of these three issues. This analysis that integrates these dimensions allows to give an additional prospective answer to the queries exposed by the COVID crisis, conjointly taking into consideration geopolitics as a forgotten dimension within the public discussion. Our paper helps to indicate the positions of every one of those ideas and enrich the literature on the environmental sciences and public health by providing analysis of the consequences of international policies.

Keywords: COVID-19, health, growth, environment, geopolitics and bibliometric analysis

1. Introduction

Governments across the globe are putting into place unprecedented measures of lockdowns and social distancing measures and trillions of dollars in monetary and fiscal policies in the fight against COVID-19. These can only help slow down the spread while medical science works on a vaccine as a way to stop the disease. This is the ultimate solution. Everything else is temporary because of the prevalence of the contagious element and the seasonal peaks [1].

The objective of this chapter is to go beyond the discussion of the articles currently proposed in the academic world and which were analyzed in the bibliometric review, which deal with the issues of health, economics and the environment separately. This analysis that integrates these dimensions allows us to give a more prospective answer to the questions posed by the COVID crisis, also taking into account geopolitics as a forgotten dimension in the analysis.

Government has the vaccine but the question is who gets it first and why. It can be a sad reality in life that sometimes the people that desperately need the vaccine

will not necessarily be the first to receive it. The other issue that arises is who can afford this vaccine because if it is only developed and rich countries that are able to reach this stage [2].

People genuinely believe that the only way to truly contain this, ultimately is the vaccine. That is why we have dozens of companies. Sampling is very important in the race to find an effective vaccine that involves researchers around the world at this point in time. There are over 50 companies looking into developing COVID-19 vaccine. It is quite unprecedented. This is a reflection, not only of the seriousness of the pandemic itself but, the state of science and biomedical science in particular. All around the world, China, Singapore, Europe and the US, there are a whole range of companies from the very traditional big multinational biopharmaceuticals to small biotech companies [3].

Governments and other groups have committed to hundreds of millions for vaccine research but aside from cost there are also questions over affordability and accessibility. It cannot be expensive because this is going to be something the governments will have to pay. This is something that is going to be very challenging which is why there are only a few companies that are pursuing this route [4].

Researchers think that in the case of COVID- 19 that governments are looking at a combined effort from both public and private sectors. The Singapore government has research for a vaccine to cover the country. The companies are working on a product which if successful, could vaccinate many people quickly and at a low cost. Right now the choice is half for manufacturing or vaccine for human trials. The industry is presently working with the Health Sciences Authority (HSA) in Singapore to identify a time for those for the first clinical trials. That is going to be relatively soon in the US and in China the first clinical trials on humans have already begun, this is just the initial stage in what is usually a long process [5–7].

2. Methodology

The methodology of this chapter considers two parts. We carry out a bibliometric analysis of the literature taking into account three dimensions: sustainability, health care, economic growth in order to provide an analysis related to COVID-19.

Figure 1 presents the examination of how these three measurements may be reconsidered utilizing the methodology used by Doussoulin [8, 9]. As demonstrated

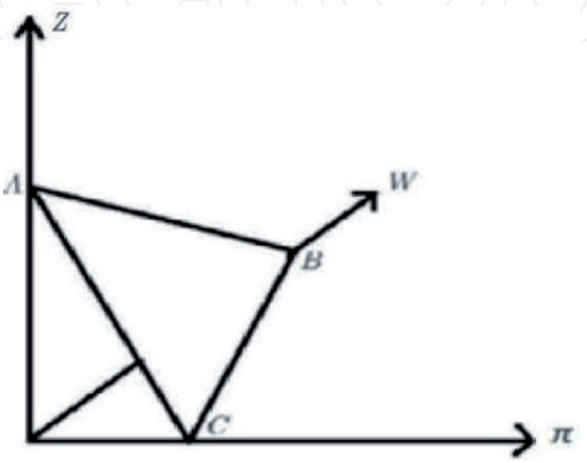

Figure 1.
Three dimensions: economic growth, health care and sustainability. Source: [8].

in **Figure 1**, when π = 100%, z = 0 and w = 0, all consideration devoted by the public authority are allocated to economic development. On the other hand, in the event that π = 0, z = 0 and w = 100%, at that point all consideration is given to medical services. It is additionally conceivable consideration regarding the earth as a characteristic asset which can be addressed where π =0, z = 100% and w = 0, which relates to a green future [1, 10].

In a second part and considering this bibliometric analysis, we will carry out an analysis of the three dimensions in search of characterizing the race for vaccines.

3. Conceptual evolution of COVID-19: a bibliometric analysis

3.1 Data sources and collection

This chapter selects the Scopus collection as the main data source (https://www.scopus.com/). The search terms are the followings: COVID-19 and economy or COVID-19 and environment or climate change or COVID-19 and public health. The period analyzed was from 2019 to 2021. All languages have been considered. Initially, the Scopus database considered various type of documents, but only original articles were included in the present analysis. 7806 documents were selected for the analysis but finally limited to the first 2000 due to the limitation of the Scopus importation in BibTex file and imported into Bibliometrix and Biblioshiny.

3.2 Research software

Bibliometrix and Biblioshiny open-source packages are used from the R language environment. Bibliometrix allows completing the full process of scientific literature analysis and data process. Biblioshiny captures the core Bibliometrix code and creates an online data analysis framework [3]. Biblioshiny enables users to perform pertinent bibliometric and visual analysis based on an interactive web interface.

Network analysis and mapping using the Bibliometrix and the Biblioshiny packages, the research allows showing bibliometric indicators on COVID-19 such as publication volume in number of articles, citation count, and keywords. Then, the article presents figures and maps such as a citation network diagram, thematic evolution map, and an international collaboration network map to identify research hotspots, research status and the dynamics of COVID.

3.3 Results of most relevant sources

The journal that published most articles about COVID-19 during the period were presented in **Figure 2**. International Journal of Environmental Research and Public Health was the journal that published the highest number of articles on COVID-19 during the period (72 articles). Frontiers in Public Health was the second leading journal with 63. The journal Frontiers in Public Health published 34 articles and the Journal of Medical Internet Research 23 articles. International Journal of Environmental Research and Public Health is the source with the higher impact, with an h index of 12.

3.4 Mapping the scientific collaboration

A map shown in **Figure 3** identifies the country collaboration of the main producing countries. Two countries hold a connection line indicating the status

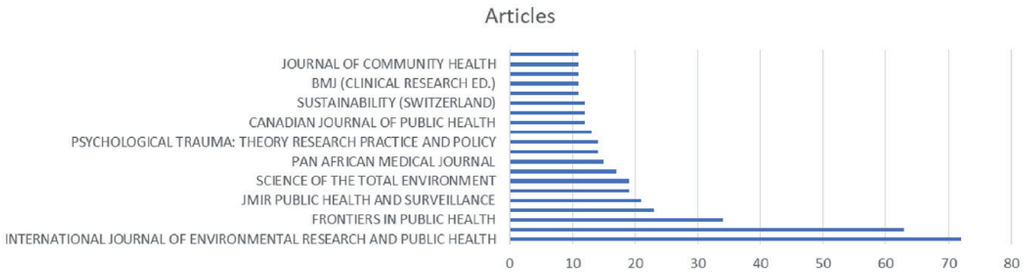

Figure 2.
Most relevant sources in the field of COVID-19.

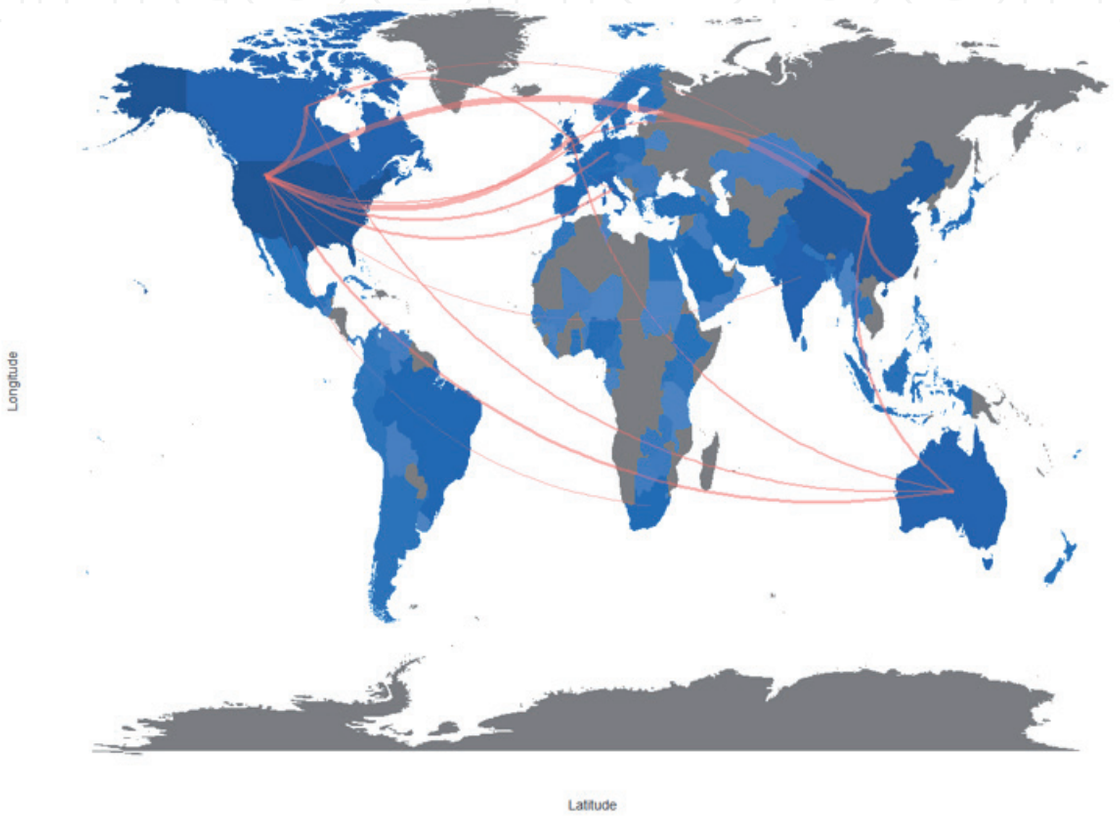

Figure 3.
Country collaboration map.

of collaboration among them. The scale of cooperation is represented through the thickness of the line. The United States, China, Australia, Western European countries showed deepened cooperation and exchange among scholars.

Figure 4 shows a co-citation analysis, with each box representing an article in the COVID literature. The size of the box indicates the volume of the citation (the larger the box, the more author's documents are cited) and the proximity of the boxes indicates a close relationship between the co-cited documents.

3.5 Analysis of keywords and co-keywords

Figure 5 illustrates the keyword co-occurrence network. The number of occurrences of the keywords is represented through the dimension of the box. When authors' keywords were more co-selected in the COVID-19 literature,

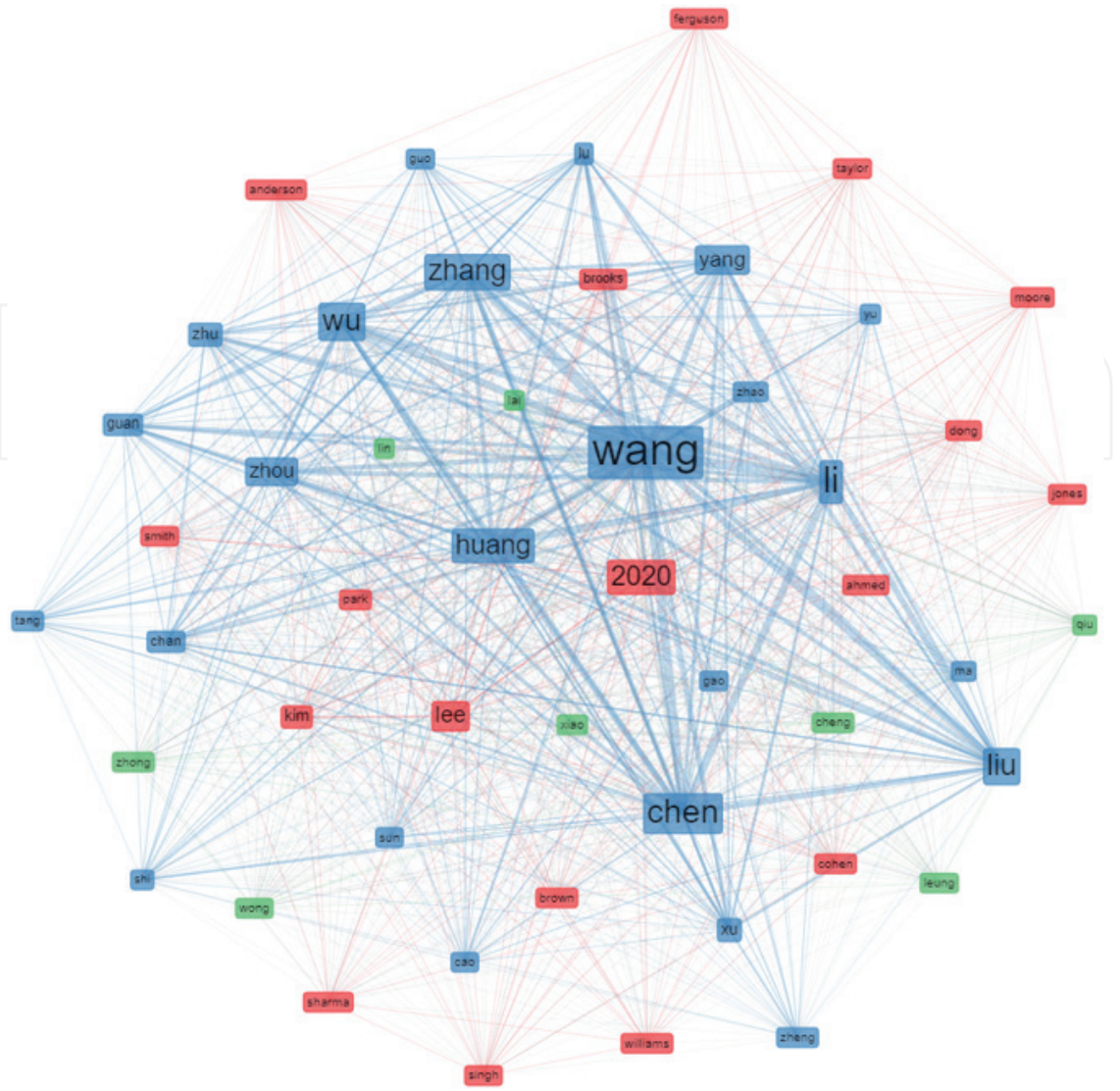

Figure 4.
Co-citation network.

the box is larger. The topic similarity and its relative strength is represented through the distance between the elements of individual pairs. Different box colors were assigned to individual clusters. A network of three distinct clusters are highlighted in **Figure 4**, representing individual subfields in COVID-19 research.

3.6 Keywords top authors and sources relations

In **Figure 6** a three fields graph represented the relationships between the keywords, the main authors' keywords and the sources. Therefore, the diagram of rectangles with distinct colors illustrated the main elements. The value of the sum of the relations appearing between the element represented by the rectangles and the diagram of the other elements designed the height of the rectangles. The size of the rectangles depends on more relations the element had.

The analysis showed in which research topics of the bioeconomy concept the authors of bioeconomy publications had explored and which sources they had most often published. The research topics were considered here as the keywords of the authors.

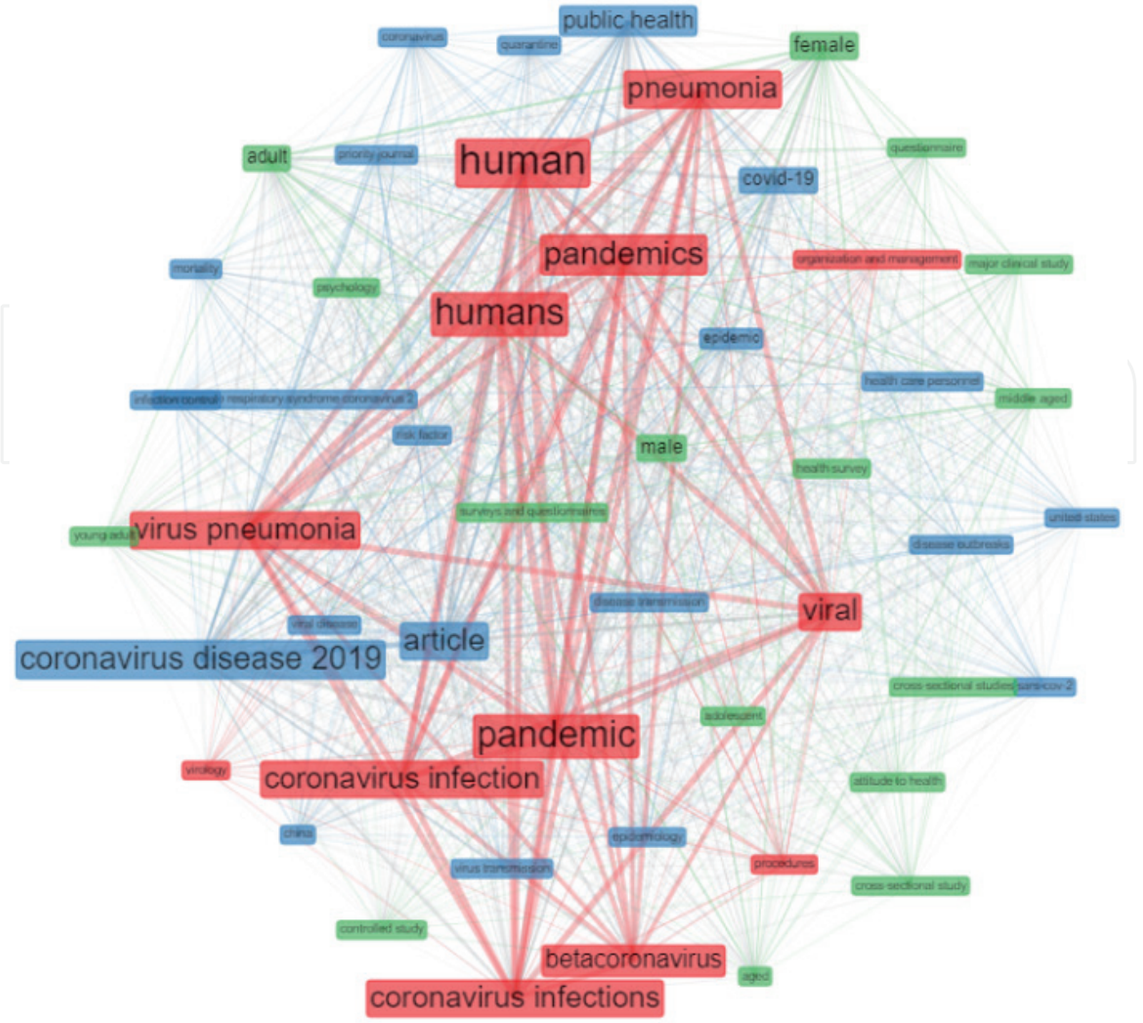

Figure 5.
Author keywords co-occurrence network in the COVID literature.

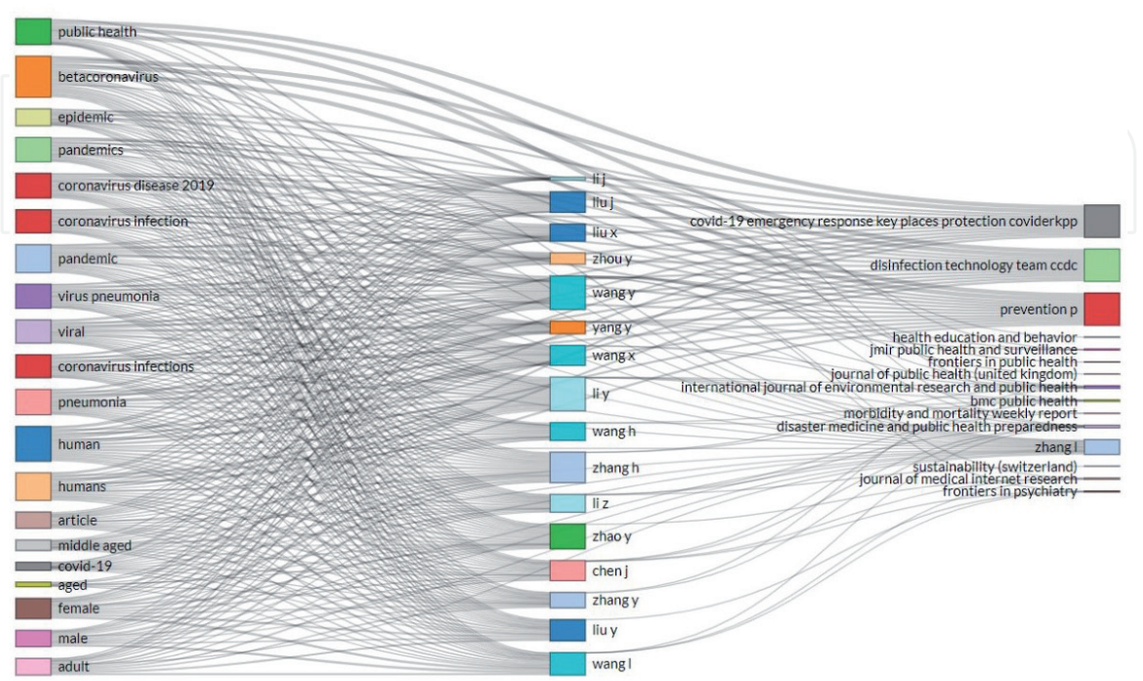

Figure 6.
Relationships between author keywords (left), authors (middle) and source (right).

4. Three dimensions of the Corona race

Ten COVID-19 vaccine candidates are now in late-stage trials. The world is celebrating what could be the breakthrough in fighting COVID-19. Pharmaceutical companies are also cheering the fact that the public sector has invested billions more in development. It is the private sector that will rake in the cash under existing agreements, they control the price and get profits. Pharmaceutical firms say that is fair as development is expensive and time-consuming and results are not announce. It is a gamble for governments too which are reserving millions of doses of a vaccine [11, 12].

Companies are taking billions of dollars in revenue, part of the funding for the vaccine researcher's public money but the profits stay in private hands. The companies can secure exclusive licenses to a vaccine and ultimately decide on a price because they have a monopoly [13–15]. For patents, the race to find the vaccine is in full swing and two German companies are among the leaders in the field, Cure Vac in Tübingen and BioNTech in Mainz which this weekend added promising early results from its phase 3 clinical trial. Both are working which added vaccines using messenger mRNA vaccines [16].

The vaccine takes a snippet of the coronavirus's genome to begin a defensive response without exposing it to the actual virus mRNA, essentially teaching the body to fight a dummy of the virus to help make it immune. Research into this technology has been going on for 20 years and has involved billions in public money and private investment but developing vaccines is highly risky and mixes of candidates active ingredient or vaccine candidate can fail at any stage in clinical trials because of a lack of efficacy or safety issues. Which is why pharmaceutical companies turn to public funding. This is then distributed by groups like the coalition for epidemic preparedness innovations (CEPI) which is co-funding development of some COVID-19 vaccine candidates. The main focus of this cooperation with CEPI is to produce a vaccine as quickly as possible and get it to the population. The commercial side is secondary for now although vaccine development is co-funded. The companies own licenses and distribution based on this the rules are relaxed [17–19]. That would have ensured that CEPI retains intellectual property rights to ensure a vaccine that is affordable for everyone and widely accessible. Pharmaceutical companies stand to make huge profits. If they succeed in coming up with a vaccine successfully which comes onto the market, that opens the door to a flood of similar vaccines and active ingredients that offers great opportunities so public funding could earn billions for private firms. The fear is biotech companies can name their price for access to this powerful pandemic fighting weapon according to professor of public economics Massimo Florio [20].

He argues that the problem with public funds being used to develop a vaccine for this coronavirus in the current emergency [15], that there is absolutely no alternative to disburse such funds. The government will be able to negotiate on prices and other conditions.

There are alternatives about the issue of what citizens are going to do the next time but the governments are in a bad negotiating position for what they are giving these big pharma companies. It is important in the future not to be stuck in this bad negotiating position and that governments or possibly a coalition of governments develop their own research and development capacity in this area [21, 22].

Private firms, of course, are about making a buck but that is that one of the reasons why individuals were not ready for this outbreak. The problem is that governments have entirely delegated to the private pharmaceutical industry the research and development of the weapons against pathogens and other diseases [23, 24].

There is a risk of disconnection or misalignment between the public health agenda and the private agenda if you are a pharmaceutical company. A manager of a pharmaceutical company has financial investors listed on the stock exchange [25, 26].

Some scholars, analyzed in **Figures 4** and **6**, will look into how people could solve the issue of a messenger RNA vaccine cold chain at a reasonable cost. People have heard it was minus 80 degrees Celsius if the interim results on efficacy from the candidate vaccine made by Biontech and Pfizer hold up to scrutiny [27]. By the end of November, if hurdles involving safety could be clear edit is hoped then some countries could approve it quickly maybe even by the end of the year. Companies will have already produced enough doses to vaccinate between 15 and 20 million people and should have production capacity for over a billion more in 2021. Manufacturing infrastructure has been set up in parallel with the trials to speed the whole process up [28, 29].

There is a big hurdle to overcome with this particular vaccine which is that it has to be kept at freezing temperatures minus 70 degrees Celsius to remain stable for any length of time and that the logistics will be expensive and problematic. Every step of the cold chain and the delivery process has to be as foolproof as you can make it, and you have to train people to work with products at such a low temperature [30].

Pfizer has even been building special containers for keeping its doses that could be good news and that they do not spoil instantly after thawing, but they also keep at normal refrigerator temperatures for around five days which makes the task maybe slightly less impossible [31]. There are many other vaccines going through late stage trials that might also prove safe and effective and some of them are based on other platforms with formulations that don not have to be kept at temperatures that low or anywhere close to it. With luck one or more of them will prove safe and effective too and can be used in places that don't have high-tech cold chain infrastructure [32].

This section outlines a set of matters involving the COVID-19 crisis through the exploration of three dimensions: sustainability, health care and economic growth.

4.1 Health care dimensions of COVID-19

It is common for vaccines to take 10 to 12 years to make it to the market but with a pandemic taking an unprecedented toll around the world, there are hopes that the timeline could be accelerated in this kind of situation. Things that generally might take several months to two years to go through are now being done in parallel. For example, the Coalition for epidemic preparedness innovation has set itself a very ambitious target of 16 weeks to try and do these kind of tests in parallel to find the same kind of information. This means that the regulatory authorities also have to change the approach in which they take the data on from the vaccine studies. They use what are called adaptive approaches or rolling submissions where small amounts of data based on the information found will come in sequence. They can sort of give provisional authorization along the way. It is a very different paradigm to assessing vaccines in this kind of pandemic situation compared to under normal circumstances [4–6].

Government agencies like the biomedical Advanced Research and Development Authority called Barda for short, are pushing to modernize the way the U.S. produces emergency vaccines like the flu shot. It is giving grants worth hundreds of millions of dollars to companies like Sanofi which uses recombinant DNA not chicken eggs to produce flu vaccines. One of its main jobs is to help create a market for drug companies to develop emergency vaccines through the use of its grants. In late January 2020, HSS secretary Alex declared an emergency and response to the coronavirus outbreak as part of that Barda announcement [7, 33].

The COVID-19 pandemic in the UK, may have subsided for now, but it is accelerating in many parts of the world. The search for treatments alongside a vaccine remains as urgent as ever. A landmark drug trial has revealed the steroid dexamethasone to

be effective in reducing deaths by up to a third on many patients who come into the intensive care unit, who have a hyperimmune response. Their immune system goes into overdrive so it is the hyperimmune response which actually causes a lot of the damage to the lungs. Dexamethasone helped to just kind of dampen it all down for a 56-year-old. The patient believed that Dexamethasone saved his life because his body wasn't functioning, it was machines that were basically keeping him alive [34, 35].

It is backed by the Bill and Melinda Gates Foundation, as well as the governments of Germany, Japan and Norway. It is a relative newcomer to the global vaccine community. It was created in 2017 to help speed up the process of developing new vaccines. Furthermore, it invested about twenty-three point seven million dollars in the push to develop a COVID-19 vaccine and it plans to invest a total of 100 million dollars in order to get vaccine candidates to early-stage clinical trial [11, 36].

The Oslo based global coalition says it needs about two billion dollars more in additional funding to fully develop viable vaccines against COVID-19. Most of the Biotech companies working on vaccines or treatments already had a head start by previously working on SARS and Middle East respiratory syndrome which are part of the coronavirus family. Biotech firm Moderna has had one of the most promising starts [12].

Moderna is using a new technique had called messenger RNA or mRNA to develop its vaccine candidate. The drugmaker has already started to deliver its vaccine to national health officials. The vaccine was co-designed with the National Institute of Allergy and Infectious Diseases after Chinese scientists decoded the coronaviruses genetic sequence in January 2020 [13, 37]. Moderna set a record within the drug industry for the speed at which it developed its vaccine candidate using its mRNA method. It took Moderna about 42 days after the coronavirus's genome was sequenced, for comparison it took about 20 months to develop a vaccine to the human testing phase during the SARS outbreak in 2002 [14].

Moderna plans to start a small-scale human trial of the vaccine soon in Seattle Washington, an epicenter of the COVID-19 outbreak in the United States. It will take about three months or more to show that it is safe and then if persons show that it is safe, it has got to be put it into what is called a phase 2 trial to show that it works. The reason is that there are medical ethical and other considerations in giving this to normal people to prevent infection [15, 16].

Researchers must be sure of the medicial ethic first to do no harm. People need to make sure it is safe, citizens need to make sure it works. This entire process will take at least a year. In a year and a half Johnson & Johnson is also in the race, the company is working with Barda on a potential treatment [17].

It is also developing a vaccine using a deactivated version of the COVID-19 as mentioned earlier. Sanofi is also working with Barda on a COVID-19 vaccine, it plans to have a vaccine candidate to test in a lab within six months and on people within a year to eighteen months but approval could be as long as three years away. Inovio Pharmaceuticals has partnered with a Chinese company called Beijing to speed up the development of its DNA vaccine [18].

It received an initial grant of nine million dollars from the Coalition for epidemic preparedness. Innovations in Opium is using the same method for the COVID-19 vaccine as it did with its DNA vaccine against the Middle East respiratory syndrome. Currently there have not been any DNA vaccines approved for use on humans. Doctors and global health experts have tried to temper vaccine expectations saying that even though this stage has gone quickly, reviewing test results in getting a vaccine deployed to the public could take many more months or even a year to 18 months.

Likewise, it would still be the fastest people have ever seen a vaccine get developed and the way that breaks down right now for the lead program is that it is starting phase 1 clinical trials in people now, which will take about 3 to 4 months to

determine the safety of the vaccine. Then they are going to move into phase 2 which will involve more people and remember these are healthy people.

4.2 Economics dimensions and chaos in global financial markets

The growing coronavirus outbreak is causing chaos in global financial markets. It is freezing supply chains, it is causing companies all over the world to create work from home plans and banned business travel. In late January 2020, Chinese scientists in Shanghai released the fully sequenced genome of the novel COVID-19 that was wreaking havoc in Hebei province which kicked off the race at drug companies and government labs to develop a cure for corona virus or at least its symptoms in terms of vaccines in the US [19].

The US has moved at a pace people have never seen before, still it is going to be at least a year to a year and a half until they have a vaccine broadly available to deploy. Among COVID-19 belongs to a larger family of corona viruses. That family of viruses includes the one that caused the SARS outbreak in 2002 and Middle East respiratory syndrome to spring up in 2012. The official name of the new COVID-19 is severe acute respiratory syndrome coronavirus - or SARS Cove - the one discovered in December 2019 in Wuhan China causes a disease that scientists decided to call COVID-19.

This naming convention works the same way with HIV and AIDS. HIV is the virus that causes AIDS. The disease symptoms of COVID-19 include fever fatigue and coughing. Some people become infected but don't develop any symptoms. Most people, around 80% recover without any special treatment, about 1 in 6 people with the disease end up developing a serious illness, older people and those with underlying medical conditions are most likely to come down with serious issues.

The disease travels through small droplets that spread when people cough or sneeze. Those droplets land on objects. People touch those objects and then touch their eyes, nose or mouth and that is how people catch the new COVID-19. There is no vaccine to prevent them from getting it, there is no vaccine for any of the corona viruses, for that matter. That is why vaccines have become a big market for drug companies' scientists and researchers no longer give them away. The Polio vaccine has become a thirty-five-billion-dollar market with strong and steady demand for vaccines against established diseases like polio measles and hepatitis. Creating vaccines for emergency pandemics becomes tricky.

Researchers are giving the vaccine to see if it can prevent disease, the risk tolerance is lower than if people were already sick. Companies are giving them a treatment, that is why people have to be so careful here, they say it could take perhaps eight months to get through phase two.

That is how it will take about a year before you even know if they have something that is safe and that works to protect people. Other drug companies are hurrying to develop various treatments for the coronavirus, and they could come much sooner.

The drug is already being tested at the epicenter of the outbreak in Wuhan China and Gilead is now expanding to other countries, including the United States. Researchers should know within a period of a few months whether this particular drug works. If it does the implementation of that would be almost immediate. The pressure to develop a corona virus vaccine grows each day as the number of infected people rises and the death toll climbs even higher but there is a real risk to pushing too hard and too fast. some drug companies plan to push testing schedules into human trials rather than spending months testing the vaccines on animals in labs.

That could lead to what is called immune enhancement where a person or animal who receives a vaccine ends up with a more serious disease than unvaccinated subjects according to Reuters. Leading health and drug company officials recently advocated for fast tracking human testing of coronavirus vaccines during a closed-door meeting convened by the World Health Organization.

The question facing health officials if accelerating testing schedules is worth these kinds of risks. That all depends on whether countries like the United States can contain the fast-spreading novel coronavirus.

4.3 Planet conservation and COVID

No war, no recession, no other pandemic, has had such an impact on CO_2 emissions during the last century as the one observed by COVID-19 in just a few months. For example: Germany might even reach its climate goals as the corona lockdown causes the economy to produce much less CO_2, the factories devoid of workers, thousands of flights cancelled, empty streets because people are working from home instead of driving to the office. Global economic activity has been put into an induced coma, bad for the world economy but from a climate perspective the corona virus pandemic is not entirely negative. Environmental activists might actually rejoice measures have been implemented immediately, thick smog has given way to blue skies [21, 22].

The current situation has seen people spending more time at home. They may have decided to have a spring-clean or get started on that bathroom renovation. Keep in mind you are responsible for the disposal of all the waste you produce [23]. Things like food scraps, demolition materials, hard rubbish and e-waste all have different requirements for correct disposal. Councils and the waste and recycling industry continue to provide waste services to the public. Like any business, some disruptions may occur from time-to-time due to physical distancing requirements, but they are not restricted activities and remain operating [24]. The regular curbside bin collections, such as recycling, household and garden waste continue as usual.

Hard rubbish collections are also available from your local council. Private waste collections, such as skip bin hire, are operating for waste such as construction and demolition materials [25]. For people working in the waste industry, the risk of transmission of coronavirus when handling waste is low. Waste handlers should continue using routine hygiene procedures such as wearing gloves and washing hands regularly for at least 20 seconds with soap. Keeping waste services operating helps reduce the potential for illegal dumping that costs millions of dollars to clean up [26].

Piling up disposable protective equipment and plastic packaging. Initially there had been a hope that the slowdown in the world economy would be good for the planet. Air traffic almost stopped completely, cruise ships were stranded in port and industrial pollution was reduced but the pandemic has had negative consequences for the environment, the world was already drowning under a sea of plastic waste but the pandemic has made the situation worse [38].

Face masks can stay in the environment for up to 450 years, it takes that long before they turn into invisible microplastic. This issue is quite serious as the human toll of the coronavirus mounts and the world economy struggles to adjust to the new normal. The wider impact on the environment is only now starting to become apparent. The global medical emergency has presented an opportunity to check on the health of the planet in the controversial new lockdown measures [39].

4.4 COVID's geopolitics: the dimension forgotten in the debate

Issues related to geopolitics and pandemics intersect through the sovereignty of the countries, to the logistics of vaccine distribution and power games. All of these issues are complex, urgent, and demand a solution through collective action based on their global and cross-border reach [22, 40].

As can be seen in **Figure 4**, the rich nations corner the market for COVID-19 vaccines and treatments. What does that mean for the world's poor? The world's largest trial of possible COVID-19 treatments has produced results that are already being used to save lives. The race to develop vaccines and treatments for the coronavirus pandemic is entering a crucial stage with large-scale trials underway [41].

The debate over opaque pricing has raised concerns that pharmaceutical companies could be charging way too much for COVID-19 treatments. The most recent disquiet was triggered by Gilead's Remdesivir at America's decision to monopolize supplies.

The U.S. government has cornered almost the entire global market of Remdesivir for the next several months. The drug has been found to shorten hospital stays for COVID-19 patients. This America first policy during the pandemic has led to expressions of outrage and dismay among some international leaders. U.S. coronavirus patients may not receive the drug if they do not have enough cash [27, 42].

The drug manufacturer Gilead says governments in the developed world will pay three hundred and ninety dollars for a treatment which will come to two thousand three hundred and forty dollars a patient. However each vial for the U.S. private health insurance system is five hundred and twenty dollars or an average cost of three thousand one hundred and twenty dollars a patient. It is not clear how much each patient will have to pay either out of pocket or in higher premiums as with many drugs that are eventually sold for profit by pharmaceutical companies. That was reported in the U.S. in January and many of those drugs are used to treat COVID-19 or used in intensive care units. Some economists wonder whether amid COVID-19 economic collapse, mass unemployment, the inability of millions to pay their rent and social unrest things may be changing. The perception of price gouging by pharmaceutical companies during a pandemic may become part of a wider reckoning for the U.S. [28–30].

Gilead says that because its drug reduces the time that COVID-19 patients spend in hospital, it priced Remdesivir fairly. Senator Bernie Sanders claimed that Remdesivir cost Gilead ten dollars a vial to manufacture and as you heard taxpayers have paid 70 million dollars towards the cost of development. That is crucial as many Americans do not have or have lost their health insurance and cannot afford to pay for the drug. The problem is Gilead has made the same claim before.

It bought the startup behind a ready to market hepatitis C drug for 11 billion dollars and began to market the drug for 84,000 allowing it to almost recoup the cost of acquisition in the first year according to Bloomberg [31, 32]. How much does big pharma spend on developing drugs? Well, on average 2.6 billion dollars according to Tufts university but advocacy group public citizen believes the cost is closer to 1.4 billion dollars as governments spend billions securing supplies of potential COVID-19 vaccines Pfizer is charging roughly 20 dollars for a dose which the company claims is 30 percent less.

Other drugmakers charge for seasonal flu jabs and because it is not receiving government money for research and development it can expect to make more than 15 billion dollars in revenue [43].

The opinion is, nothing else is working, nothing to lose. He had dexamethasone, his oxygen requirement came down and started to stay down and started to

gradually decrease and for the first time there started to be talk of taking him off the ventilator which people couldn't even believe. The patient was given dexamethasone here at the hospital in Scotland, one of a large number taking part in a UK wide randomized drug trial being run by scientists at Oxford University. The aim to test a number of widely available off-the-shelf drugs with the hope of finding one or a combination that might work to ease some of the worst symptoms of COVID-19 [44].

The patient returning from the brink of death contributed to data that has seen dexamethasone approved as a breakthrough treatment for some of the worst cases of COVID-19. Dexamethasone has been a great result, and it now means that patients who are ventilated or an oxygen can be prescribed in a way they wouldn't been able to be before. The recovery trial has also been successful in ruling out the malaria drug hydroxychloroquine, once hailed as a game changer by president Donald Trump but found instead to be useless in treating COVID-19. As the world waits for a safe and effective vaccine that may yet be a long way off, recovery continues to look for treatments [45, 46]. Police officers in New Delhi are donating blood plasma, they are just some 2 500 police staff in the Indian capital who recovered from coronavirus but health minister Harsh Vardhan says few people have been willing to donate and has launched a campaign as the number of infections has increased [47].

This drive will encourage everyone, especially those who have recovered from coronavirus. to donate their plasma in large numbers. Plasma therapy is treating coronavirus patients around the world. Plasma from a former patient's blood is separated for a transfusion to an infected person. Plasma of recovered patients contains antibodies which can fight the virus. This person is the first person in Delhi to have donated his plasma after recovering from the coronavirus in April.

Trials to determine its effectiveness are continuing but researchers say the results so far are encouraging, it clearly reduces the need for increasing oxygen at the stage when the patient is deteriorating.

It does prevent a lot of patients from actually going onto a ventilator. Various centers across the world have shown mortality rates to be 50 to 80 percent when the patient goes on to a ventilator. By virtue of preventing a patient going onto a ventilator, it may be preventing excess deaths. Delhi state government is one of many around the country to set up plasma donation centers to make it easier for patients needing the therapy. People are struggling to find plasma from those who have recovered. Coronavirus is connected to the deaths of around 30,000 Indians with more than 1.2 million infections. As well as launching a donation campaign, the state government in Delhi is organizing transport for those willing to come to one of its centers. With far more recoveries than active infections health officials are urging Indians who were once sick to help patients who are suffering [48].

How can drug companies offset the cost of their research and offer cheaper drugs particularly to developing nations? That is a good and important question. A couple of things to note about research and development costs, first is the way that industry calculates research and development costs that include things that you and me would probably not consider research and development, for example the lost opportunity costs of foregoing investments with an annual return of over 10.

Some wealthier countries are being asked to pledge money to buy vaccines in advance which then will be distributed according to a global equitable allocation framework by the World Health Organization (WHO). Should all countries and

companies adhere to this future framework? It is out there so that vaccine supply is truly allocated based on public health need, as said by the WHO and the Bill Gates foundation and not captured by narrow political or commercial interests. How that is going to work when the world has rich nations snapping up all the available supply? That is a big concern, these bilateral deals really help no one because it has been said before that no one is safe until everyone is safe.

For the world to have herd immunity, people are going to have to beat this thing, it will be crucial that this is successful and that countries commit a certain proportion of even the bilateral deals that they have struck to a facility that will share vaccines with the world. To be fair to the likes of companies like AstraZeneca and Johnson & Johnson, both have said that they are going to produce the vaccine on a not-for-profit basis.

What does that mean for poorer nations though even on a not-for-profit basis ? Can they afford them? That is a very good question, both companies should be applauded for their commitment to not profit from the pandemic. Unfortunately what companies say and what they do is not always the same. For instance, if you take Johnson & Johnson in the past, they have claimed that their lowest global price for an important drug called Bedaquiline was a not-for-profit price but which is disputed by independent academics.

It could be produced at profit for less than a quarter of that price. There have been calls for the price to be halved and just earlier this month they actually further dropped their supposedly not for profit price by over 30 percent following intensive campaigning. It is important to mention that these pledges only apply for the pandemic period and if SARS turns endemic [49].

What about the ethics of a vaccine treatment in a hurry? For strict ethical standards this should be the case too because vaccines and drugs act differently in different patient populations but what it definitely should also mean is that the very populations on which these vaccines and drugs are being tested should have equitable access to them in the future. It cannot be that they are just the guinea pigs for clinical trials but then will not be able to access the vaccines afterwards. In the midst of a global pandemic, should generically drugmakers be given licenses to produce much-needed treatment drugs? Generic drug reproduction will be crucial to meet the demands of this pandemic and national hoarding of physical supplies of drugs or vaccines is regrettable.

Should actively using intellectual property to prevent generic ground companies be avoided? There is a wealth of research into testing kits, there is one produced in Senegal for a dollar. Is there any way of commercializing that kind of expertise as a solution for developing nations?. People having accurate rapid diagnostic tests will be incredibly important to the global COVID-19 response given that they are simple to use, and while there are over 100 tests on the market the majority have limited to no evidence on diagnostic performance. An inaccurate test is worse than no test, quality assured rapid diagnostic tests are needed but once solid evidence for rapid diagnostic tests does emerge.

It will be crucial to scale up the production as quickly as possible. An example to cite is actually an excellent example of a private company in the UK collaborating with the Pasteur Institute to develop a rapid diagnostic test and then in the future locally producing it in Senegal for a price that is affordable for governments in the region. Some state actors have also been accused of attempting to hack laboratories and drug companies for COVID-19 research and vaccine secrets as more of us are lucky enough to work productively from home. Companies are stepping up cybersecurity for employees. One company that helps businesses replace usernames and passwords with biometrics is Silicon Valley based. The cost now is if a Silicon Valley social media platform like twitter can succumb to a hack.

5. Conclusions

We are in the middle of the storm, which does not allow us to see clearly what is coming and as can be seen in **Figure 4**, the keywords *pandemic* and *coronavirus infection* are positioned in the collective unconscious. People are told they may be ready by the end of the year probably more likely to be the middle of the next year.

What is going to be the fairest outcome for both drugmakers and developing nations. The fairest outcome for the public would be that no one dies from COVID-19 because they cannot access a drug or a vaccine and the fairest outcome for drug makers would be that of the experience with COVID-19. A new era of drug development which is collaborative, open and does not have profit as the sole motive for innovation manual.

From an economics viewpoint, they are used hopefully for a short period of time to address a problem that then individuals hope to be able to move past. It is not a big moneymaker for the industry, and it is very hard to predict flu vaccines for example grown in chicken eggs, this process takes a long time and it is not as reliable as newer methods such as incubating vaccines and cells as opposed to eggs. more than 100 national influenza centers in more than 100 countries monitor the flu throughout the year and make recommendations on how to create that seasons' flu vaccines.

Society needs something else. People need a mechanism not based on the priorities of financial investors. People need a mechanism based on the priorities of public health with a long term perspective. Just summing up really briefly SARS obviously didn't change anything. Will this outbreak change something because the alarm bells were there even 20 years ago but for some reasons they were in certain places and not such a global factor. Still more coronaviruses could come along. Vaccines could become big farmers new cash cow. One of the largest pharmaceutical companies only had four special vaccine units last year. Now everyone is getting in on the act, which is great, but they are using our money and can charge what they want. Some developers promise to only charge the cost price. It could even be cheaper than the flu vaccine, it is a race everyone wants to win whoever makes the first successful COVID-19 vaccine also stands to make a fortune.

The use of vaccines has a geopolitical dimension, there is no guarantee that prices will be affordable, especially for developing countries. In the Northern Hemisphere in winter, there is likely to be a second wave in the pandemic. Is a vaccine going to be in place by then to limit the effects of a second wave? What do you think the likely outcome will be? Well, individuals do not know. Citizens know that many groups are working very hard to still develop a vaccine but no vaccine candidate has passed phase three trials yet, people do not really know, how efficacious those vaccines are going to be and therefore also how likely they will be successful.

Finally, this text recognizes that there must be autonomous action priorities for each territory, which must consist of small victories in economic, health and environmental aspects within the territory. It is also relevant to incorporate into the discussion the geopolitical influence that recognizes and encourages unequal access to vaccines, generating a gap between rich, middle-income and poor countries.

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