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Article

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Research in Globalization

Provided in Cooperation with:

Elsevier

Suggested Citation: Sobrosa Neto, Ruy de Castro; Maia, Janayna Sobrosa; Neiva, Samara de Silva; Dillon Scalia, Michael; Guerra, José Baltazar Salgueirinho Osório de Andrade (2020) : The fourth industrial revolution and the coronavirus: A new era catalyzed by a virus, Research in Globalization, ISSN 2590-051X, Elsevier, Amsterdam, Vol. 2, pp. 1-7, <https://doi.org/10.1016/j.resglo.2020.100024>

This Version is available at:

<https://hdl.handle.net/10419/330959>

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The fourth industrial revolution and the coronavirus: a new era catalyzed by a virus[☆]



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ARTICLE INFO

Article history:

Received 7 June 2020

Received in revised form 8 September 2020

Accepted 8 September 2020

Available online 16 October 2020

Keywords:

Fourth industrial revolution

Covid-19

Global economic change

Future scenarios

Sustainable development

ABSTRACT

The global pandemic caused by the new coronavirus, COVID 19, has disrupted the lives of most people on the planet. The magnitude of such disruption can only be compared to those caused by World War II. Experts suggest that in order to better evaluate this situation, it should be divided into two waves. The first wave being associated with health issues and the second one with economic issues. This article suggests that this global pandemic is fostering yet a third wave, which in the long run can be much more impactful in our lives than the first two. This third wave consists on accelerating the implantation process of the fourth industrial revolution. This article is divided into sections with the physical, digital and biological spheres of the fourth industrial revolution, as well as the dimensions of sustainability and other important considerations, in order to better demonstrate the emergence of a new era catalyzed by a virus.

1. Introduction

In the second half of 2019, the world received the news that a virus of the corona family was causing thousands of deaths, that its origin was unknown and that new patterns of behavior should arise due to the global pandemic. Its official name was “severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2),” but popularly known as “coronavirus” or “COVID-19.” After this news, a race started in the scientific world, notably in the field of health sciences, in order to develop effective treatments and vaccines to fight it (Elavarasan & Pugazhendhi, 2020; Minhas, 2020). The new patterns of behavior, imposed by governments, consisted of social isolation, and in some cases, lockdown.

These measures have led to an economic global crisis, once in order to fight pandemics, governments need extra financial resources. However, the social isolation imposed upon the population is leading several companies to bankruptcy. Consequently, several million jobs are being extinct, thus reducing government tax collections. As a result, differences of

opinions arose among government officials, researchers and the general population as to what would be the best way to battle this tragic and regrettable situation (Allam and Jones (2020)). On the one side, defenders of a more rigid course of action, like horizontal isolation, arguing that life is priceless and economic indicators are secondary at a time like this (Crokidakis, 2020; Zhang & Ma, 2020). On the other side, defenders of a vertical social isolation, arguing that such a rigid isolation cannot be practiced, once it fosters unemployment and poverty, and that hunger also kills. They complement by saying that the defense of a horizontal social isolation is being preached by those who have their salaries insured, and the government should be wise enough not to impose restrictions on freedom (Dubey et al., 2020; Shaw et al., 2020). Finally, they also mention that restrictive transportation actions, which prevent people from going to work, may in fact occult less noble political interests. In the middle of it all, the population is confused and scared.

The daily and academic debates, regarding coronavirus, have revolved around two aspects. The first, concerns advances in treatments and the

[☆] For your appreciation we are submitting the manuscript entitled “the fourth industrial revolution and the coronavirus: social isolation as the final act in its implementation”, authored by Ruy de Castro Sobrosa Neto, Samara de Silva Neiva, Janayna Sobrosa Maia, Michael Dillon Scalia and José Baltazar Salgueirinho Osório de Andrade Guerra, to Research in Globalization. The authors publicly state that they acknowledge their responsibility for its content. The manuscript is an original work and has not been submitted for publication nor has it been published in whole or in part elsewhere, either in print or electronic format. This article has been approved by everyone involved in this research work, and written informed consent was provided by all participants.

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discovery of a vaccine. The second, refers to the economic aspect, the second wave, which is the countries' concerns regard the virus impact on economies (Lacus et al., 2020; Nicola et al., 2020). Both debates are compelling and crucial. The purpose of this article, however, is to present the evidence and some effects of a third wave, perhaps a tsunami, given its overwhelming potential. That is, even though it seems unseen by most people, the coronavirus has been functioning as a catalyst for the implementation of the fourth industrial revolution (4IR) in our world [marking the integration between the physical, digital and biological spheres.] The fourth industrial revolution (4IR) stands out for the fact that machines have become active, unlike other industrial revolutions where machines were passive (Schwab, 2017).

This increasing feature of machines and algorithms is that it allows forecasts by specialists up to a few years, such as, for example, the presence of fully autonomous robot surgeons operating in hospitals within a few years (Wall & Krummel, 2019). Those technologies include AI and autonomous cars that are being implemented in our daily lives. On the other hand, we come across the coronavirus, which is more threatening and lethal for older people in a proportion that allows associations of this virus with its preferred target (Ruan et al., 2020), older people, and possible demands for the implementation of the 4IR. Young people, who grew up in an already digital world, are dying to a lesser extent from the coronavirus. On the other hand, for several years it has increased the presence of machines and algorithms in our day to day, and the resistance of older people to social isolation promoted in this type of interpersonal relationship with machines has always been striking and since most of the time older people, to adapt to cutting-edge technologies, need it in their social environment of relevant technology socialization agents or networks coordinated by younger people (Correa & Pavez, 2016).

This article still will address what is believed to be the most harmful of the effects of coronavirus on today's society. With the initial regrets to the lives lost by this plague and the economic damage suffered by most people, it focuses on a later effect even more harmful than the loss of millions of jobs due to the crisis generated, and that most people do not seem to be aware, which is the final act that social isolation can produce in the disruptive implantation of the 4IR, for which most people and countries are not yet prepared. In view of the world scenario at the end of 2019, regarding the two waves that concern governments and specialists, this article seeks to answer the following question: how each of the three constituent spheres of 4IR (physical, digital and biological) are currently having their implantation accelerated due to coronavirus? In order to better address this, the article will be divided into sections that present evidence for each of these spheres. In addition to that, two other sections will present the economic, environmental and social dimensions of sustainability, as well as other important considerations, both referring to the coronavirus as a catalyst for 4IR.

2. Section 1 – physical component of 4ir catalyzed by coronavirus

The greatest severity of coronavirus is the presentation of respiratory and cardiac complications (Chavez et al., 2020). Respiratory diseases are strongly related to patients' emotional state. In cases of chaos (such as a pandemic), phenomena such as bronchial constrictions can be perceived, which aggravates difficulty in breathing and takes more patients to crowded hospitals. The challenge imposed by coronavirus continues, since not even the countries with the best hospital structures can support a high percentage of their population. Another complicating factor of this virus is the fact that the countries with the best hospital structures have a higher HDI. This index, in general, grows with the life expectancy of its populations. Such fact presents itself as a weapon of precise destruction in its target, older people (Giacomelli et al., 2020; Lombardi et al., 2020; Niu et al., 2020), who are also the most resistant to disruptive technological changes.

Doctors have historically belonged to a professional class which has enjoyed social prestige regarding the value of their workforce. Until the coronavirus pandemic, they saw 4IR as an ally for providing them with

technology that allowed them to improve their diagnoses and further increase their prestige. However, the IBM cognitive intelligence system employed at Dr. Watson Healthcare and the lobby for the deployment of telemedicine in some countries were already signs of what was to come (Barney et al., 2020; Cremades et al., 2020; Haynes et al., 2020). Fear of coronavirus contamination has caused many doctors to practice social isolation. This further aggravates the situation of sick people being neglected by doctors. In this sense, the social isolation brought by coronavirus has taken one of its most important steps in supporting industry 4.0. It made the world think carefully about the advantages of a robot doctor during periods of isolation brought by pandemic.

Technological improvement based on automation in the healthcare field are featured at reliable sources, such as: The *Scientific Reports of Nature Magazine* (2020), in its machine learning in healthcare section; as well as in the reports of the *World Economic Forum* (2020), such as the January 2020 report, referring to the Jobs of Tomorrow, in which it maps the future employment opportunities. Robotic medical tools used by doctors and surgeons, which are among the functions with the highest growth rate in high-volume tasks are: Artificial Intelligence Specialists; Medical Transcriptionists; and Data Scientists. Software, clinical and medical billing stand out in the sector-specific technology applications, demonstrating technological transformation in the healthcare field. The seemingly initial coldness in the care provided by a robot doctor becomes warm when you think that it will be by our side in the moments we need it the most (whether in humanoid form or from an application in our computers, tablets and cell phones.) In this sense, technology has already started to be used in hospitals and nursing homes. Consequently, several debates on the ethics involving such theme, as well as the resistance of professionals and patients are already being addressed (Bourbonnais et al., 2019). Biological viruses are different from digital viruses, in which case the difference strengthens the bonds between humans and machines.

3. Section 2 – digital component of 4ir catalyzed by coronavirus

Carl Sagan mentioned that in the search for intelligent extraterrestrial life we could consider beings with a molecular structure based on Silicon (Si) compounds, in addition to Carbon (C) (Sagan, 2000). The coronavirus spreads in a carbon structure and strengthens the implantation of "intelligent life" structured in silicon (computers' "brains".)

With the global pandemic caused by coronavirus, we are watching the world cheer for the supercomputers' performance, as they are helping humanity to find a quick solution of possible drug combinations that are more effective in fighting coronavirus (Ahuja et al., 2020; Robson, 2020). The greatness of this feature is undeniable, but have you ever stopped to think about how many highly educated scientists are being replaced by these supercomputers and their algorithms? Are we realizing that we have come to trust our lives and our destinies more and more on machines? What will happen when all, or almost all of us, have been replaced by machines?

Research addressing autonomous transport systems has been presented to society for several years. Technologies involving this are increasingly consolidated, allowing its implementation. Debates, in most countries, have focused on the concern regarding the need for new legislations on the topic, as the algorithms of these computers on wheels will need to be programmed in order to make difficult decisions in some situations (Martínez-Díaz & Soriguera, 2018). Since millions of drivers will lose their jobs around the world, people began to reflect on the importance of transport applications made by autonomous vehicles. At the peak of this crisis there was a lot of difficulty getting around cities. In addition, in a transport service model composed of autonomous vehicles, passengers would not be at risk of being contaminated by drivers.

Social isolation promoted by coronavirus enhances the approval of laws that regulate the autonomous vehicles circulation. These, in turn, will tend to increase social isolation. Once autonomous vehicles are deployed, millions of parents will not take their children to and from school. In addition, friends and couples who had their relationships strengthened by

carpooling, as well as women in various countries around the world who had advanced their quality of life by working in driver professions, will no longer be necessary (Sattari, 2020). Some celebrate, in addition to the royalty holders of these technologies, advantages such as being able to drink without the fear of being stopped by police officers. However, in the imbalance of this new order, another problem lies, important social and moral barriers will be lost to the control of alcohol consumption in a society where loneliness, unemployment and the concentration of income tend to increase (Makridakis, 2017).

Another change is regarding Distance Learning (DL), which has grown in recent years, as well as its credibility. This form of teaching and knowledge exchange reduces costs and optimizes the transport logistics of its students, but on the other hand, is associated with social distance and the use of computational resources (Gregori et al., 2018; Lee et al., 2019). Privacy concerns are another issue as 4IR turns every company into a tech company. Industries from food, retail, and banking, are going digital and they are collecting tremendous amounts of personal data on their customers. The fact that companies are storing large amounts of data is worrisome amongst consumers when it comes to personal privacy (Crocco et al., 2020; Goad et al., 2020). The concern increases when we are faced with all this movement associated with an extensive lobby of large companies in favor of 5G technology. Such technology should expand data transmission capacity, which, when associated with logic operation, the internet of things (IoT) interface, big data and cloud, raise even more concern upon the theme. The singularity, however, can be achieved right away with the advances of quantum internet and quantum computing. This, when combined with a new pattern of social normality, can then coexist with the internet of thoughts. Such is given, once initiatives such as that from Neuralink can be put into practice on a global scale (Chen et al., 2020; Forge & Vu, 2020; Singh et al., 2020).

4. Section 3 – biological component of 4ir catalyzed by coronavirus

In this sense, the coronavirus can again lead to a global approval that chips are introduced in people under the argument of monitoring who is sick and who is not sick, who can and/or should leave the house and who can and/or not it should, and this movement may initially be observed by governments asking cell phone operators to locate their users, in a demonstration of breach of privacy. It can get worse, because after installing the chips in people biohacking can become a reality, with biological data and emotional states monitored and available on the network, hackers and crackers will be able to access them (Battle-Fisher, 2020). And it can get worse, because after installing the chips in people biohacking can become a reality, with biological data and emotional states monitored and available on the network, hackers and crackers will be able to access them. Eerily enough one can make a

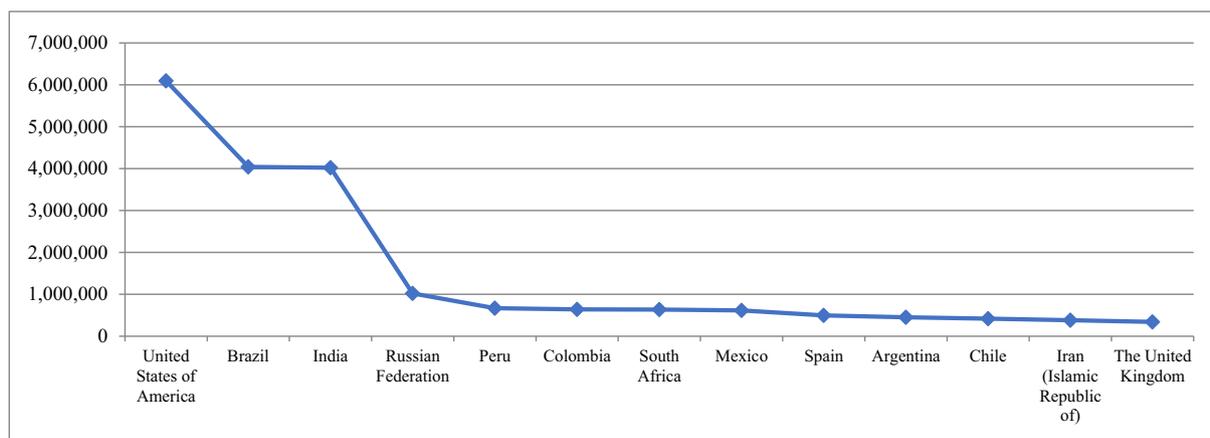
connection with Revelation 13:16-17 “Also it causes all, both small and great, both rich and poor, both free and slave, to be marked on the right hand or the forehead, so that no one can buy or sell unless he has the mark, that is, the name of the beast or the number of its name.” which can be interpreted as a chip implanted in the body to scan for identification and purchases.

In this sense, the social dynamic established during the pandemic offers solid grounds for this to become a reality. It is like the practice of creating the challenge and then selling the resolution. People's routines became dull and paranoid with the arrival of the coronavirus. In order to enter public places, temperature measurement, the use of a mask and hand sanitation are required (Acter et al., 2020; Devrim & Bayram, 2020; Vellingiri et al., 2020). In some countries or regions, inmates are being released on the grounds that they can contract coronavirus in prison, and at the same time, free citizens who do not respect strict social isolation orders are being arrested (Campbell, 2020; Dubey et al., 2020; Montoya-Barthelemy et al., 2020). This situation currently experienced in many countries can restore normality through a new concept of normality, in which biotechnology would be part of our daily lives.

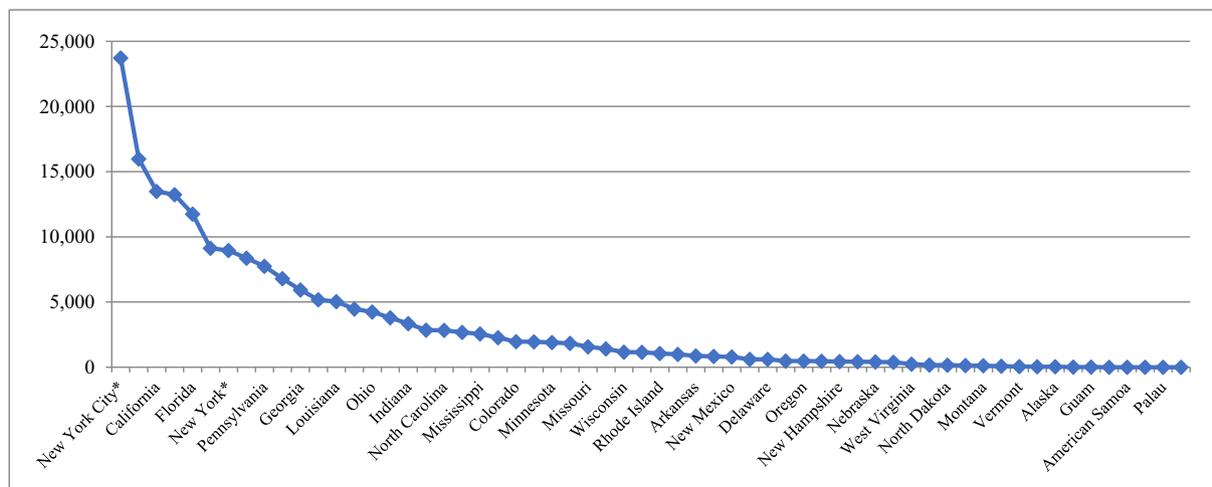
The numbers of deaths recorded from the beginning of the pandemic until September 5th, 2020 are shown in the pictures below. Picture 1 illustrates the 15 (fifteen) countries that recorded the highest absolute number of deaths in Covid-19. It is noteworthy that China did not appear among them, considering that it is the country where Covid-19 appeared. It is also a country with a large population, as well as being one of the main international routes for trade and movement of people, suggesting the need for further investigation of this situation (Al-Raei, 2020; Jin et al., 2020). Pictures 2, 3 and 4 show the stratification by state of the three countries with the highest numbers of deaths due to Covid-19.

According to the WHO, USA is the country that has had the highest number of deaths related to Covid-19 so far. It is also a country known for defending and demanding greater transparency in its nation internal data, relating to the solid compliance and accountability practices identified in this country (Bergquist et al., 2020).

In the case of Brazil, the Supreme Court, has limited the actions of the Brazilian Presidency, delegating to the States and Municipalities the management of the pandemic. The politicization of the pandemic has surpassed issues associated with the use of medicines, such as hydroxychloroquine, a medicine with consolidated use for decades not only by Brazilian civil society but also by its military personnel working in the Amazonian region. The Executive Branch of Brazil was only responsible for coordinating with the Brazilian Congress an adjustment in the budget for the payment of a complementary Social Protection System in the amount of R \$ 600.00 (six hundred reais per month) equivalent to approximately U \$ 113 (one hundred and thirteen US dollars) at a quote of September 3, 2020 (Carbone & Felipe, 2019; Colson et al., 2020).



Picture 1. Situation by country, territory & area cases - cumulative total. Note 1: The collected data was performed until October, 5th, 2020. Source: World Health Organization Coronavirus Disease Dashboard, 2020.



Picture 2. Total deaths (USA). Note 2: The collected data was performed until October, 5th, 2020. Source: [Center for Diseases Control and Prevention Data Tracker, 2020.](#)

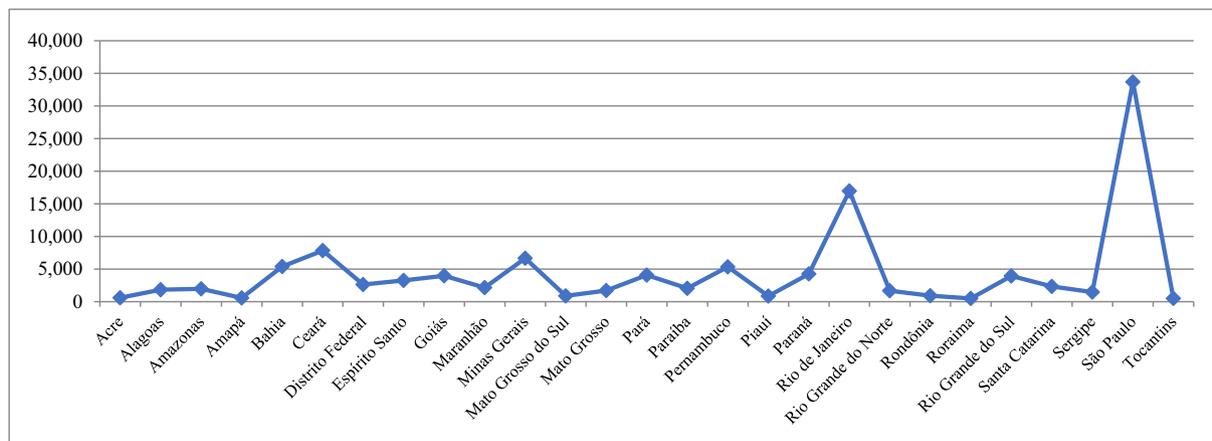
In Brazil, it was also found that municipalities that remained closed on the grounds that the pandemic prevented its reopening, received financial assistance and many complaints were registered in this regard (Brazil, 2020). The payment to hospitals for each registered Covid-19 death was also verified, and in the dictionary of diseases of the Civil Registry of Brazil it was adopted as a criterion to consider as Covid-19 any of the following causes: (1) Coronavirus disease (Covid-19); (2) Covid-19 (Suspected); (3) Corona Virus; (4) Cov; (5) Covid; and (6) Sars-Cov, as written in the death certificate. The procedure to assess all natural (non-external) causes declared in death certificates, and select only one cause per death (among the causes by COVID-19 and other related ones), one of the criteria was that the death certificate mentioned COVID-19, Coronavirus, New Coronavirus, as a cause COVID-19 (suspected or confirmed) (Portal da Transparência do Registro Civil Website, 2020).

India is the third country with the highest number of deaths by Covid-19 according to WHO. Like Brazil and the United States, it is a country made up of dozens of states, and a small percentage of states has more than 5,000 (five thousand) deaths so far.

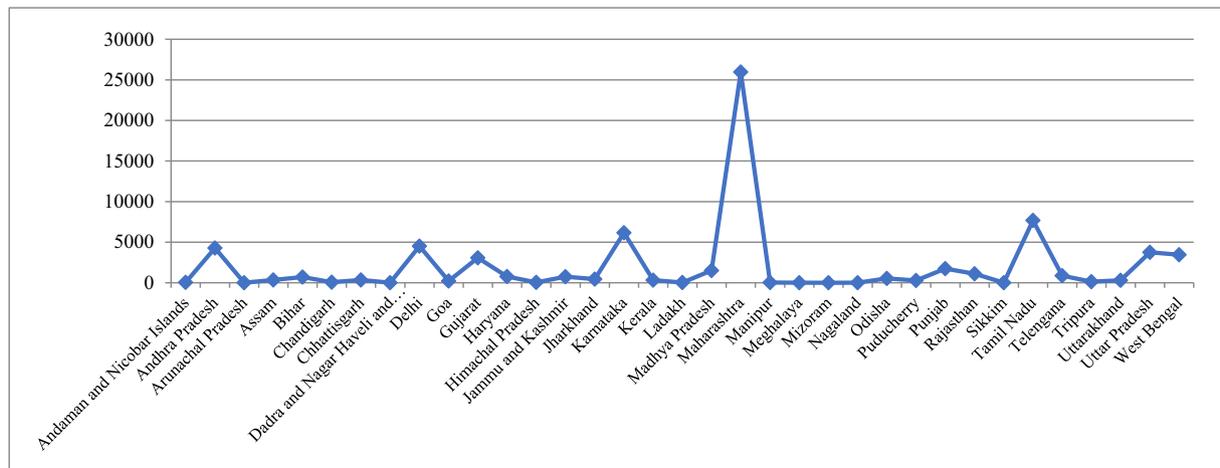
5. Section 4 – dimensions of sustainability in the 4ir catalyzed by the coronavirus

Several countries have social protection systems, the percentage of their GDP destined for this purpose varies (Ştefan, 2015). Some countries use

only financial resources, others distribute food, offer scholarships, help rent payments, among other local variations, however, there is a tendency of most governments to provide this type of assistance, in order to ease the condition of poverty of its population, and therefore living under government aid is characterized by living in poverty (Desai & Rudra, 2019; Ferguson et al., 2017; Kubiszewski et al., 2013). It happens that governments need to collect taxes in order to pay for their social protection systems and for that they depend on a consumer market with a minimum of activity, however, if the 4IR occurs so that most jobs are extinguished, together there will be a breakdown of capitalism as we know it. We will be facing two problems, governments without sufficient collection of taxes to be able to maintain social protection systems at the same time as there will be an increase in aid requests, growing poverty and the concentration of global income (Asquer, 2017). Social credit models, like the one adopted in China, to control people's behavior have been adopted, the main arguments for policies like this are usually associated with maintaining order in large urban centers, and this is done with the support of computers, facial recognition cameras, and software (Ivanova & Borzunov, 2020). The associated algorithms also track users' computers and cell phones and establish a pattern of use and conduct associated with social punctuation, in a practice that brings us back to George Orwell's 1984 work. Important attention must be paid to the evidence that the interests of the 4IR are present in the existing lobby around renewable energies (Lockwood et al., 2020; Sühlsen & Hisschemöller, 2014) that are more easily replicable and deployed by



Picture 3. Total deaths (Brazil). Note 3: The collected data was performed until October, 5th, 2020. Source: [Portal da Transparência do Registro Civil Website, 2020.](#)



Picture 4. Total deaths (India). Note 3: The collected data was performed until October, 5th, 2020.
Source: Ministry of Health and Family Welfare Government of India, 2020.

machines. Assessing the three dimensions of sustainability, environmental, economic and social, we compare the implementation of biodigesters with photovoltaic plates, or wind turbines with photovoltaic plates, for the generation of energy. Photovoltaic plates are more easily produced by machines and even a generating plant can be installed almost entirely by them, with very little human participation, which is not the case with wind turbines or biodigesters and, coincidentally, the same appeals are not seen in their defense (Li et al., 2019). A similar logic occurs with the electric car, which is more easily made autonomous and coincidentally has a strong lobby, with hybrid vehicles being better engineering solutions to meet the three dimensions of sustainability, and yet there is no equivalent appeal for vehicles hybrids. A lobby that fosters human unemployment and the concentration of income.

6. Section 5 – other important considerations

In an exercise of supposing that there is no pandemic like the coronavirus, but that medical clinics, companies, schools, public transport, in short, that everything stops for one, two or three months, what will happen to millions of lives around the world? How many deaths, not caused by coronavirus, will happen in this case? Patients with different diseases have their treatment interrupted or impaired, as the system has stopped. What is the impact on the health of a patient who waits for another three months to perform a biopsy because the clinics have adopted social isolation? And with the financial complications generated by this pause, how many other diseases and deaths such as heart attack and suicide would we have? People who are malnourished or even without food could die of hunger or other illnesses due to malnutrition (Casagrande et al., 2020; Du et al., 2020; Dubey et al., 2020; Hagerty & Williams, 2020; Mamun & Ullah, 2020). The complexity presented to managers is enormous and a brief exercise to interrupt the social gear already causes numerous deaths and health complications. The pandemic scenario presented by the coronavirus showed that private health plans were of no avail in several locations. Private clinics closed due to social isolation, overburdening public hospitals. As a result, likely, the health plan market will henceforth envision special health plans for VIP care in cases of a pandemic, offering exclusive and personalized ICU services in hospitals that look like bunkers. Again, it is likely that, for this service to be guaranteed, machines will be the protagonists consolidating industry 4.0 (Javaid et al., 2020).

The space race promotes great technological development to nations involved, in addition to stimulate an elevated level expertise in the launching and satellites control systems, which is crucial in the technological era. In the last decade, the European Union, India, Japan, South Korea and Israel, as well as China, have shown interest in space missions to the Moon. Several decades ago, the only countries competing for supremacy in such

matter were the former Soviet Union and the United States. Today several countries are invested in this race, with a highlight to the Chinese crew, who landed on the dark side of the Moon, surpassing the American and Russian crews (Athanasopoulos, 2019; Sherwood, 2019). The current change is such that President Trump inaugurated the United States Space Force, which in the first paragraph of his executive summary (United States Space Force, 2020) quotes:

The use of space has also greatly expanded the capability and capacity of the U.S. military to anticipate threats, to respond rapidly to crises, and to project power globally, at substantially less cost in lives and treasure than in the past. Because these advantages are vital to our modern way of life and modern way of war, unfettered access to and freedom to operate in space is a vital national interest.

It is also in the space race that the 4IR gains strength and humanoid robots (Damjanov, 2018), that are not contaminated by human viruses, can go into dormancy mode, a kind of coma state for humans, and reactivating their consciousness is an easier task and this contributes to space conquests as well.

7. Final considerations

With the replacement of jobs by machines, someone will be behind concentrating this income, and the question is who are these people? (Gregory & Half, 2020). Who accesses and controls the data of users, institutions, and governments that are on the internet? Just as the Central Banks of important nations are often private and non-governmental institutions, whose leaders we do not know who they are, so it follows in the 4IR, whose power of interference and control over our lives is much greater (Nicola et al., 2020; Nijman & Wei, 2020). Who commands and will command the increasingly autonomous machines? What option do we have when installing Google applications, software, products and services and the like? And when we get used to the services and products and new terms of an agreement are present, how to proceed? Do we have a choice? In March 2020, the world saw the triggering of the mechanism called circuit breaker in most of the world stock exchanges, a mechanism that is triggered when there are abrupt falls in the shares traded (NYSE, 2020).

Something similar was seen only in the Second World War and, speaking of World War, in the First World War there was the Treaty of Versailles in which some demands were imposed on Germany, among which the winners were paid compensation for the losses of the war (Baldwin & Förster, 1998). If on the one hand, it may sound very hard to think of a requirement similar to China due to the damage caused to the world by the coronavirus, on the other hand, it is not fair that the country to which the emergence of

the virus that is killing the world is associated, be the country that is obtaining financial gains in its commercial operations and the stock exchanges, at the same time that it has the world industrial park in its territory and has shown itself as the country best prepared for the 4IR, with notable advances in the 5G internet and even on the quantum internet, positioning itself in a condition to practice debt trap diplomacy (Shattuck, 2020).

The United Nations (UN) is always called upon to speak out in times of global crisis and in this sense, an important UN initiative stands out and deserves to be intensified, which is the support for actions and projects that are guided by the water nexus, energy and food (Endo et al., 2019). Despite the UN having a 2030 agenda focused on the Sustainable Development Goals, it is important to note that the coronavirus promotes, on the one hand, the massification of industry 4.0, and on the other a structural crisis in capitalism that, by promoting mass layoffs, weakens its consumer market. Encouraging countries to adopt projects that adopt the water, energy and food nexus will meet several SDGs and most importantly, it tends to promote social ties, weakened by the coronavirus and the 4IR (Märker et al., 2018).

Throughout the evidences presented, it can be understood that coronavirus has instituted a disruption in the paradigms changing process observed in recent decades. In a sense that, even if researchers discover a cure or vaccine for the virus, we can no longer speak of returning to our previous notion of normality. We are now speaking of a whole new understanding of normality. One which must have elements of 4IR highlighted. Habits initiated as a result of the coronavirus are expected to impact people's lives for the next few years. As a result, challenges will arise to governments, entrepreneurs and scholars as to understand and guide society in this new normality, which tends to rewrite our classic understanding of sustainability.

The evolution of societies can be understood as something positive, once it is correlated with HDI development of regions. Revolutions, however, tend to be disruptive and exclusive. In this article's object of study, we are presented with a revolution, the fourth industrial one. Its disruption component has been accelerated by coronavirus. This being a result of the procedures adopted to allegedly protect citizen's lives, and thus providing components for instituting the new concept of normality.

If computers are being able to exponentially accelerate the work of scientists and researchers in the development of science such as the search for coronavirus vaccines, in the development of new drugs and treatment proposals (Baines et al., 2019; Robson, 2020), just as there is a real possibility that humanoid robots will replace surgeon doctors in the near future, so there is no reason to suppose that DL platforms are not structured by machines with their algorithms and artificial intelligence systems soon to replace or decrease the number of vacancies for human teachers.

Bauman addressed in his works the liquidity of postmodern relations where the formats established in the past no longer apply in the present. With the consolidation of the 4IR driven by extreme social isolation caused by the coronavirus (Huang et al., 2020), where unemployment and poverty tend to advance to higher levels, it is possible to face a mix of this liquidity of relations and the retrotopia described by Bauman (Kociatkiewicz & Kostera, 2018), but with a mix of new formats of family arrangements observed in the post-war periods. A phenomenon to be studied by social scientists in the post-coronavirus world.

Finally, the technology associated with 4IR offers conditions for humans to have developed in various segments of their lives, however, these advances and possibilities must be correctly used, in the search for a more just and humanitarian global society, with access to water, food, energy, health, and technology for all. The key question is whether there is a genuine interest from entrepreneurs and countries, in general, to use these technologies in favor of humanity, as oppose to employ it solely in benefit of a small group (Abulibdeh & Zaidan, 2020; Mishra & Schmidt, 2018; Mpofu & Nicolaidis, 2019; Wright & Schultz, 2018). The rest is silence.

CRedit authorship contribution statement

Ruy de Castro Sobrosa Neto: Conceptualization, Methodology, Formal analysis, Validation, Investigation, Writing - review & editing,

Supervision, Project administration. **Janayna Sobrosa Maia:** Formal analysis, Validation, Investigation, Writing - review & editing. **Samara de Silva Neiva:** Methodology, Formal analysis, Validation, Investigation, Writing - review & editing. **Michael Dillon Scalia:** Formal analysis, Validation, Investigation, Writing - review & editing. **José Baltazar Salgueirinho Osório de Andrade Guerra:** Conceptualization, Methodology, Formal analysis, Validation, Investigation, Writing - review & editing, Supervision, Project administration, Funding acquisition.

Declaration of competing interest

The authors state that there is no conflict of interests.

Acknowledgements

This study was conducted by the Centre for Sustainable Development (Greens), from the University of Southern Santa Catarina (Unisul), in the context of the project BRIDGE - Building Resilience in a Dynamic Global Economy: Complexity across scales in the Brazilian Food-Water-Energy Nexus; funded by the Newton Fund, Fundação de Amparo à Pesquisa e Inovação do Estado de Santa Catarina (FAPESC), Coordenação de Aperfeiçoamento de Pessoal de Nível superior (CAPES), National Council for Scientific and Technological Development (CNPq) and the Research Councils UK (RCUK).

References

- Abulibdeh, A., & Zaidan, E. (2020). Managing the water-energy-food nexus on an integrated geographical scale. *Environmental Development*, 100498.
- Acter, T., Uddin, N., Das, J., Akhter, A., Choudhury, T. R., & Kim, S. (2020). Evolution of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) as coronavirus disease 2019 (COVID-19) pandemic: A global health emergency. *Science of the Total Environment*, 138996.
- Ahuja, A. S., Reddy, V. P., & Marques, O. (2020). *Artificial Intelligence and COVID-19: A Multi-disciplinary Approach*.
- Allam, Z., & Jones, D. S. (2020). Pandemic stricken cities on lockdown. Where are our planning and design professionals [now, then and into the future]? *Land Use Policy*, 104805.
- Al-Raei, M. (2020). *The basic reproduction number of the new coronavirus pandemic with mortality for India, the Syrian Arab Republic, the United States, Yemen, China, France, Nigeria and Russia with different rate of cases*. *Clinical Epidemiology and Global Health*.
- Asquer, A. (2017). *Public sector revenue: principles, policies and management*. Routledge.
- Athanasopoulos, H. K. (2019). *The Moon Village and Space 4.0: The "open concept" as a new way of doing space?* *Space Policy*.
- Baines, D., Nørgaard, L. S., & Rossing, C. (2019). *The fourth industrial revolution: Will it change pharmacy practice? Research in social and administrative pharmacy*.
- Baldwin, F., & Förster, S. (1998). *The Treaty of Versailles: a reassessment after 75 years*. Cambridge University Press.
- Barney, A., Buckelew, S., Meshierikova, V., & Raymond-Flesch, M. (2020). The COVID-19 pandemic and rapid implementation of adolescent and young adult telemedicine: Challenges and opportunities for innovation. *The Journal of Adolescent Health*, 67(2), 164–171.
- Battle-Fisher, M. (2020). Transhuman, posthuman and complex humanness in the 21st century. *Ethics, Medicine and Public Health*, 13, 100400.
- Bergquist, S., Otten, T., & Sarich, N. (2020). COVID-19 pandemic in the United States. *Health Policy and Technology*. <https://doi.org/10.1016/j.hlpt.2020.08.007>.
- Bourbonnais, A., Rousseau, J., Lalonde, M. H., Meunier, J., Lapierre, N., & Gagnon, M. P. (2019). Conditions and ethical challenges that could influence the implementation of technologies in nursing homes: A qualitative study. *International journal of older people nursing*, 14(4), Article e12266.
- Brazil (2020). Complementary law n° 173/. Available in <https://www.in.gov.br/en/web/dou/-/lei-complementar-n-173-de-27-de-maio-de-2020-258915168> Access in 05 oct 2020.
- Campbell, A. M. (2020). An increasing risk of family violence during the covid-19 pandemic: Strengthening community collaborations to save lives. *Forensic Science International: Reports*, 100089.
- Carbone, T. R. J., & Felipe, P. G. (2019). Arboviroses urbanas e o Exército Brasileiro: a visão do reumatologista. *EsSEX: Revista Científica*, 2(2), 52–70.
- Casagrande, M., Favieri, F., Tambelli, R., & Forte, G. (2020). The enemy who sealed the world: Effects quarantine due to the COVID-19 on sleep quality, anxiety, and psychological distress in the Italian population. *Sleep Medicine*, 75, 12–20.
- Center for Diseases Control and Prevention Data Tracker. Available in: <https://covid.cdc.gov/covid-data-tracker/#cases>. Access in: 05 oct 2020.
- Chavez, S., Long, B., Koyfman, A., & Liang, S. Y. (2020). Coronavirus disease (COVID-19): A primer for emergency physicians. *The American Journal of Emergency Medicine*. <https://doi.org/10.1016/j.ajem.2020.03.036>.
- Chen, Y., Sui, Y., Gong, C., Ma, B., Hao, H., & Li, L. (2020). Chronically monitoring the deep brain rhythms: latest clinical progress. *Science Bulletin*, 65(12), 965–967.

- Colson, P., Rolain, J. M., Lagier, J. C., Brouqui, P., & Raoult, D. (2020). Chloroquine and hydroxychloroquine as available weapons to fight COVID-19. *Int J Antimicrob Agents*, 105932(10.1016).
- Correa, T., & Pavez, I. (2016). Digital inclusion in rural areas: A qualitative exploration of challenges faced by people from isolated communities. *Journal of Computer-Mediated Communication*, 21(3), 247–263.
- Cremades, M., Ferret, G., Pares, D., Navinés, J., Espin, F., Pardo, F., ... Julian, J. F. (2020). Telemedicine to follow patients in a general surgery department. A randomized controlled trial. *The American Journal of Surgery*, 219(6), 882–887.
- Crocco, M. S., Segall, A., Halvorsen, A. L., Stamm, A., & Jacobsen, R. (2020). "It's not like they're selling your data to dangerous people": Internet privacy, teens, and (non-) controversial public issues. *The Journal of Social Studies Research*, 44(1), 21–33.
- Crokidakis, N. (2020). COVID-19 spreading in Rio de Janeiro, Brazil: do the policies of social isolation really work? *Chaos, Solitons & Fractals*, 109930.
- Damjanov, K. (2018). Accounting for non-humans in space exploration. *Space Policy*, 43, 18–23.
- Desai, R. M., & Rudra, N. (2019). Trade, poverty, and social protection in developing countries. *European Journal of Political Economy*, 60, 101744.
- Devrim, İ., & Bayram, N. (2020). Infection control practices in children during COVID-19 pandemic: differences from adults. *American Journal of Infection Control*, 48(8), 933–939.
- Du, J., Dong, L., Wang, T., Yuan, C., Fu, R., Zhang, L., ... Bouey, J. (2020). Psychological symptoms among frontline healthcare workers during COVID-19 outbreak in Wuhan. *General Hospital Psychiatry*. <https://doi.org/10.1016/j.genhosppsych.2020.03.011>.
- Dubey, S., Biswas, P., Ghosh, R., Chatterjee, S., Dubey, M. J., Chatterjee, S., ... Lavie, C. J. (2020). Psychosocial impact of COVID-19. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 14(5), 779–788.
- Elavarasan, R. M., & Pugazhendhi, R. (2020). Restructured society and environment: A review on potential technological strategies to control the COVID-19 pandemic. *Science of The Total Environment*, 138858.
- Endo, A., Yamada, M., Miyashita, Y., Sugimoto, R., Ishii, A., Nishijima, J., & Kumazawa, T. (2019). Dynamics of water–energy–food nexus methodology, methods, and tools. *Current Opinion in Environmental Science & Health*, 13, 46–60.
- Ferguson, J., Power, D., Stevenson, L., & Collison, D. (2017, September). Shareholder protection, income inequality and social health: A proposed research agenda. In *Accounting Forum* (Vol. 41, No. 3, pp. 253–265). Taylor & Francis.
- Forge, S., & Vu, K. (2020). Forming a 5G strategy for developing countries: A note for policy makers. *Telecommunications Policy*, 44(7), 101975.
- Giacomelli, A., Ridolfo, A. L., Milazzo, L., Oreni, L., Bernacchia, D., Siano, M., ... Piscaglia, M. (2020). 30-day mortality in patients hospitalized with COVID-19 during the first wave of the Italian epidemic: a prospective cohort study. *Pharmacological Research*, 104931.
- Goad, D., Collins, A., & Gal, U. (2020). Privacy and the Internet of Things—An experiment in discrete choice. *Information & Management*, 103292.
- Gregori, P., Martínez, V., & Moyano-Fernández, J. J. (2018). Basic actions to reduce dropout rates in distance learning. *Evaluation and program planning*, 66, 48–52.
- Gregory, A., & Half, G. (2020). The damage done by big data-driven public relations. *Public Relations Review*, 101902.
- Hagerty, S. L., & Williams, L. M. (2020). The impact of COVID-19 on mental health: The interactive roles of brain biotypes and human connection. *Brain, Behavior, & Immunity-Health*, 100078.
- Haynes, S. C., Dharmar, M., Hill, B. C., Hoffman, K. R., Donohue, L. T., Kuhn-Riordon, K. M., ... Steinhorn, R. (2020). The impact of telemedicine on transfer rates of newborns at rural community hospitals. *Academic Pediatrics*, 20(5), 636–641.
- Huang, Z., Zhao, S., Li, Z., Chen, W., Zhao, L., Deng, L., & Song, B. (2020). The battle against coronavirus disease 2019 (COVID-19): Emergency management and infection control in a radiology department. *Journal of the American College of Radiology*, 17(6), 710–716.
- Ivanova, E., & Borzunov, G. (2020). Optimization of machine learning algorithm of emotion recognition in terms of human facial expressions. *Procedia Computer Science*, 169, 244–248.
- Javaid, M., Haleem, A., Vaishya, R., Bahl, S., Suman, R., & Vaish, A. (2020). Industry 4.0 technologies and their applications in fighting COVID-19 pandemic. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(4), 419–422.
- Jin, L., Zhao, Y., Zhou, J., Tao, M., Yang, Y., Wang, X., ... Yuan, H. (2020). Distributions of time, place, and population of novel coronavirus disease 2019 (COVID-19) from January 20 to February 10, 2020, in China. *Revista Clínica Española (English Edition)*. <https://doi.org/10.1016/j.rceng.2020.04.003>.
- Kociatkiewicz, J., & Kostera, M. (2018). After retrotopia? The future of organizing and the thought of Zygmunt Bauman. *Scandinavian Journal of Management*, 34(4), 335–342.
- Kubiszewski, I., Costanza, R., Franco, C., Lawn, P., Talberth, J., Jackson, T., & Aylmer, C. (2013). Beyond GDP: Measuring and achieving global genuine progress. *Ecological Economics*, 93, 57–68.
- Lacus, S. M., Natale, F., Santamaria, C., Spyrtacos, C., & Vespe, M. (2020). Estimating and projecting air passenger traffic during the COVID-19 coronavirus outbreak and its socio-economic impact. *Safety Science*, 129, 104791.
- Lee, K., Choi, H., & Cho, Y. H. (2019). Becoming a competent self: A developmental process of adult distance learning. *The Internet and Higher Education*, 41, 25–33.
- Li, A., Xu, Y., & Shiroyama, H. (2019). Solar lobby and energy transition in Japan. *Energy Policy*, 134, 110950.
- Lockwood, M., Mitchell, C., & Hoggett, R. (2020). Incumbent lobbying as a barrier to forward-looking regulation: The case of demand-side response in the GB capacity market for electricity. *Energy Policy*, 140, 111426.
- Lombardi, J. M., Bottiglieri, T., Desai, N., Riew, K. D., Boddapati, V., Weller, M., ... Lehman, R. A. (2020). Addressing a national crisis: The Spine Hospital and Department's response to the COVID-19 pandemic in New York City. *The Spine Journal*, 20(9), 1367–1378.
- Makridakis, S. (2017). The forthcoming artificial intelligence (AI) revolution: Its impact on society and firms. *Futures*, 90, 46–60.
- Mamun, M. A., & Ullah, I. (2020). COVID-19 suicides in Pakistan, dying off not COVID-19 fear but poverty?—The forthcoming economic challenges for a developing country. *Brain, Behavior, and Immunity*, 87, 163–166.
- Märker, C., Venghaus, S., & Hake, J. F. (2018). Integrated governance for the food-energy-water nexus – The scope of action for institutional change. *Renewable and Sustainable Energy Reviews*, 97, 290–300.
- Martínez-Díaz, M., & Soriguera, F. (2018). Autonomous vehicles: Theoretical and practical challenges. *Transportation Research Procedia*, 33, 275–282.
- Minhas, S. (2020). Could India be the origin of next COVID-19 like epidemic? *Science of The Total Environment*, 138918.
- Ministry of Health and Family Welfare Government of India. Available in: <https://www.mohfw.gov.in/>. Access in: 05 oct 2020.
- Mishra, P., & Schmidt, G. B. (2018). How can leaders of multinational organizations be ethical by contributing to corporate social responsibility initiatives? Guidelines and pitfalls for leaders trying to do good. *Business Horizons*, 61(6), 833–843.
- Montoya-Barthelemy, A., Lee, C. D., Cundiff, D., & Smith, E. (2020). COVID-19 and the correctional environment: The American prison as a focal point for public health. *American Journal of Preventive Medicine*, 58(6), 888–891.
- Mpofu, R., & Nicolaidis, A. (2019). *Frankenstein and the fourth industrial revolution (4IR): Ethics and human rights considerations*.
- Nature. Available in: <https://www.nature.com/collections/xkhrxkzwwv>. Access: 02 April 2020.
- Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., ... Agha, R. (2020). The socio-economic implications of the coronavirus and COVID-19 pandemic: A Review. *International Journal of Surgery*, 78, 185–193.
- Nijman, J., & Wei, Y. D. (2020). Urban inequalities in the 21st century economy. *Applied Geography*, 102188.
- Niu, S., Tian, S., Lou, J., Kang, X., Zhang, L., Lian, H., & Zhang, J. (2020). Clinical characteristics of older patients infected with COVID-19: A descriptive study. *Archives of Gerontology and Geriatrics*, 104058.
- NYSE - New York stock exchange. Available in: <https://www.nyse.com/article/circuit-breakers-are-doing-their-job-but-dont-close-the-markets>. Access: 04 April 2020.
- Portal da Transparência do Registro Civil Website (2020). Available in: <http://www.portaltransparencia.gov.br/>.
- Robson, B. (2020). Computers and viral diseases. Preliminary bioinformatics studies on the design of a synthetic vaccine and a preventative peptidomimetic antagonist against the SARS-CoV-2 (2019-nCoV, COVID-19) coronavirus. *Computers in Biology and Medicine*, 103670.
- Ruan, Q., Yang, K., Wang, W., Jiang, L., & Song, J. (2020). Clinical predictors of mortality due to COVID-19 based on an analysis of data of 150 patients from Wuhan, China. *Intensive Care Medicine*, 46(5), 846–848.
- Sagan, C. (2000). *Carl Sagan's cosmic connection: An extraterrestrial perspective*. Cambridge University Press.
- Sattari, N. (2020, January). Women driving women: drivers of women-only taxis in the Islamic Republic of Iran. *Women's studies international forum*. Vol. 78. (pp. 102324). Pergamon.
- Schwab, K. (2017). The fourth industrial revolution. Currency. Ftefan, GM (2015). A brief analysis of the administration costs of national social protection systems in EU member states. *Procedia Economics and Finance*, 30, 780–789.
- Shattuck, T. J. (2020). The race to zero?: China's poaching of Taiwan's diplomatic allies. *Orbis*, 64(2), 334–352.
- Shaw, R., Kim, Y. K., & Hua, J. (2020). Governance, technology and citizen behavior in pandemic: Lessons from COVID-19 in East Asia. *Progress in disaster science*, 100090.
- Sherwood, B. (2019). Principles for a practical Moon base. *Acta Astronautica*, 160, 116–124.
- Singh, R. P., Javaid, M., Haleem, A., & Suman, R. (2020). Internet of things (IoT) applications to fight against COVID-19 pandemic. *Diabetes and Metabolic Syndrome: Clinical Research and Reviews*, 14(4), 521–524.
- Ştefan, G. M. (2015). A brief analysis of the administration costs of national social protection systems in EU member states. *Procedia Economics and Finance*, 30, 780–789.
- Sühlsen, K., & Hisschemöller, M. (2014). Lobbying the 'Energiewende'. Assessing the effectiveness of strategies to promote the renewable energy business in Germany. *Energy Policy*, 69, 316–325.
- United States Space Force. Available in: <https://media.defense.gov/2019/Mar/01/2002095012/-1/-1/1/UNITED-STATES-SPACEFORCE-STRATEGIC-OVERVIEW.PDF>. Access: 05 April 2020.
- Vellingiri, B., Jayaramayya, K., Iyer, M., Narayanasamy, A., Govindasamy, V., Giridharan, B., ... Rajagopalan, K. (2020). COVID-19: A promising cure for the global panic. *Science of The Total Environment*, 138277.
- Wall, J., & Krummel, T. (2019). The digital surgeon: How big data, automation, and artificial intelligence will change surgical practice. *Journal of Pediatric Surgery*, 55, 47–50.
- World Economic Forum. Available in: http://www3.weforum.org/docs/WEF_Jobs_of_Tomorrow_2020.pdf. Access: 02 April 2020.
- World Health Organization Coronavirus Disease Dashboard. Available in: <https://covid19.who.int/table>. Access in: 05 oct 2020.
- Wright, S. A., & Schultz, A. E. (2018). The rising tide of artificial intelligence and business automation: Developing an ethical framework. *Business Horizons*, 61(6), 823–832.
- Zhang, X., Ma, R., & Wang, L. (2020). Predicting turning point, duration and attack rate of COVID-19 outbreaks in major Western countries. *Chaos, Solitons & Fractals*, 109829.