Effective Governance in Times of Pandemic

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The current institutional and spatial forms of Institutional Governance are not being effective when dealing with the great and complex challenges that society faces today. Governance systems need to adapt to changing circumstances as well as incorporate social innovations., taking into account various territorial, temporal and technological dimensions.

The emergence of SARS-CoV-2 has baffled us and has highlighted how vulnerable we are, and as if that were not enough, it has broken the operating schemes of development strategies. COVID-19 has made us think even more about the deficient innovation systems on which current models of economic and social development are based.

In the situation in which we currently find ourselves, it is urgent and a priority, first to stop and defeat the SARS-CoV-2 pandemic, and then to face the real causes that contributed to its appearance. Tackling with determination the fight against climate change, deforestation, pollution and the loss of biodiversity are key to this end.

This necessarily involves the implementation of a new economy that is more respectful of people, the environment and natural resources, such as the circular economy. In the same way, it is necessary to adequately support ourselves in emerging technologies, as well as provide ourselves with greater ethics, social innovation and better communication in this development process.

This article analyzes, interprets and evaluates the important and complex challenge that the SARS-CoV-2 virus represents, to try to find some of the keys that might help us discover the causes that favored the appearance and spread of this virus, in order to anticipate other health, social and economic catastrophes such as the one we are witnessing.

CCS CONCEPTS • General and reference~General conference proceedings • Social and professional topics~Governmental regulations • Hardware~Impact on the environment

Additional Keywords and Phrases: Governance, SARS-CoV-2, efficiency, strategy, new technologies, social innovation, circular economy, environmental efficiency, ethics, communication

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1. INTRODUCTION

The great challenges [1] that we face, whether economic, social, technological, environmental, and especially those related to health protection as a consequence of SARS-CoV-2, do not have a direct and simple solution, and the difficulties that they present are a source of constant concern.

One example can be found in the effect that climate change has in multiple ecosystems, favoring the appearance of many pathogens that never were so close to the general population. With our model of progress we have displaced

animals from their habitats, and this has its consequences, such as their predators disappearing from the food chain, which facilitates the appearance of pests.

These pressing matters highlight the importance of achieving an adequate Institutional Governance for a sustainable, intelligent and inclusive development. This entails more than being efficient in policy development, but being effective in reaching the goals and objectives essential to solve important and complex issues, including the fight against SARS-CoV- 2, which highlights both the need to act urgently to stop the pandemic and the importance of facing the real causes that favored the appearance of this virus, in order to anticipate other health, social and economic catastrophes.

2. BACKGROUND

2.1 Climate change

Climate change is one of the greatest challenges of our time and represents one more threat that cities, societies and the environment have to endure. From extreme weather events, which threaten food production, to sea level rising, which increases the risk of catastrophic floods, the effects of climate change are global in scope and have an unprecedented scale. If drastic measures are not taken without further delay, it will be much more difficult and costly for cities to adapt in the near future.

The latest special report of the Intergovernmental Panel on Climate Change (IPCC) [2] highlights the need for urgent action to prioritize timely, ambitious and coordinated initiatives to address significant changes in the oceans and cryosphere.

According to the Special Report on Global Warming of 1.5ºC of 2019 [3], published by a panel of experts on climate change (the IPCC), to reduce the impact of climate change it is not enough to stop and control current emissions, it would also be necessary to remove a trillion tons of CO2 from the atmosphere corresponding to almost 200 years of emissions.

2.2 Droughts

Several studies, such as publications of Nature Scientific Report [4] or articles from Environment Research Letters [5], ensure that, if greenhouse gas emissions are not reduced over the next few years, prolonged periods of droughts are more likely to happen, and their occurrence might be multiplied by as much as seven in the second half of this century.

2.3 Tides and floods

The Fifth IPCC Report AR5 [6] already indicated that the rising of the sea level is happening due in part to the melting of the polar ice-caps, but, above all, due to the increase in water temperature, since water expands when heated.

According to a study led by researchers at the University of Melbourne (Australia) [7] if we do not reduce greenhouse gas emissions, many countries will suffer the consequences of high tides and floods, putting more than 250 million people at risk and causing extensive damage to buildings and infrastructures.

The conclusions of some studies, as seen in [8], puts in evidence the unsuitable nature of current strategies, stating that following the chronicle of the evolution of polar ice in recent centuries, it is apparent that the increasing phenomenon of thawing on the planet is due to an "anthropogenic" process.

2.4 Pollution

WHO estimates suggest that environmental pollution has reached alarming proportions. In their analysis they state that 9 out of 10 people breathe toxic air and 7 million die each year from environmental and domestic pollution. Climate change increases its effects and corrective measures are insufficient. Indeed, air pollution represents a significant environmental risk to the health of the population.

Even though we do not know precisely the exact causes that have caused SARS-CoV-2, or if air pollution is a determining factor in the onset of the pandemic, or even if its conjunction with other elements and / or diseases can favor its development, the truth is that we are in an unprecedented situation in the process of economic and social development.

2.5 Deforestation

As seen in [9], one way to reduce the probability of pandemics is to reduce tropical deforestation and limit wildlife trade. In this article, it is stated that about once every two years, a virus jumps from animals to humans, including SARS-CoV-2, Ebola, and probably the new coronavirus as well.

According to the authors of the study, combating deforestation, practicing animal control on farms and reducing the trade in wildlife would reduce the pandemic. Although these interventions can be calculated in the amount of 20 to 30 billion dollars, the cost is much lower than the amount of the cost of five trillion dollars of lost GDP during this year in the United States.

2.6 Biodiversity

The loss of biodiversity is due to multiple causes, the main ones being over-exploitation and depletion of natural systems, the loss of habitats of various species, as well as the constant presence of pollution, especially in recent years.

According to the United Nations Organization for agriculture [10], pests are a real problem that grows continuously, and climate change is favoring some of them to reproduce even more frequently. Furthermore, international trade is spreading insects and pathogens to new areas that previously were inaccessible to them.

The EU has made some economic calculations of the cost derived as a consequence of such loss of biodiversity. In the study called "The economics of ecosystems and biodiversity", it is stated that the amount could be around 14 trillion euros, 7% of world GDP. But, above all, the loss of biodiversity is one of the most significant problems that society faces, due to the great negative impact on health, causing the zoonoses process to spread and favoring the leap of viruses from the animal to the human environment.

2.7 Water

Water must be an ally for climate action [11]. There are many possibilities for good practices related to the use of water, and by using this resource more efficiently, it is possible to reduce greenhouse gases. The water crisis is a global issue.

Water scarcity is a problem that affects more than 40% of the world's population and is expected to increase. It is estimated that 783 million people do not have access to clean water and that more than 1,7 billion currently live in river basins in which the use of water exceeds its recharge. The United Nations considers access to water and sanitation a priority and this is reflected in the Sustainable Development Goal. It is clearly linked to health, food security, climate change and resilience to disasters.

2.8 Institutional Governance Analysis

The current institutional and spatial forms of Institutional Governance are not being effective when confronting the important and complex challenges that society faces. It can be easily verified how the structures of the current economic, social and political model are far below technological development [12].

The SARS-CoV-2 pandemic has turned all the countries of the world into a true social, economic and cultural laboratory, the consequences of which are relatively uncertain, but it will undoubtedly mark a "before" and an "after" of the process of development due to its economic, social, technological, geopolitical, logistical and environmental implications.

Choosing the best strategies will provide and help find solutions to the current and important challenges for society, even though the precise causes of the appearance COVID-19 and its effects in the medium to long term are still an unknown.

Environmental, ecological and energy challenges go hand in hand, but the same can be said about the consequences of their improper management, which can have a clear negative effect on the protection of the health of the population. As microbiologist Ana Fernández Sesma, from the Icahn School of Medicine at Mount Sinai, New York City, points out:

> "Zoonotic viruses are related to environmental challenges. Deforestation, loss of biodiversity, climatic changes… become a vehicle to favor the leap from one species to another (event) of the process (zoonoses)" [13]

3. METHODOLOGY

This research is based on the analysis, interpretation and evaluation of the challenge that SARS-CoV-2 presents, with the purpose of trying to find some of the keys that might reveal the conditions that can favor the appearance of this and other viruses that may arise, in order to anticipate other health, social and economic crises. In addition, this research aims to provide tools and information that contribute to the improvement of the performance in Institutional Governance.

To this end, an analysis of multiple scientific publications related to the main environmental, ecological and energy challenges has been carried out, as well as an analysis of the main currents of thought of the circular economy, including some interviews with its top representatives, and experts in epidemiology.

4. RESULTS

Governance systems need to adapt to changing circumstances. Although it is possible to find different pilot experiences [14] that have been successfully carried out by institutions, states and international organizations such as: Leader approach The European, Grouping for Territorial Cooperation (EGTC), Regulatory Agencies, etc., the situation in which we currently find ourselves with the pandemic is urgent and a priority. First to stop and defeat the SARS-CoV-2 virus, and then to face the real causes that contributed to its appearance. The following sections highlight some of the key aspects and strategies vital to achieving this goal.

4.1 The use of technology in the fight against SARS-CoV-2

There are many possibilities that technology offers us to fight against the negative consequences that SARS-CoV-2 is having on society. Indeed, emerging technologies are undoubtedly helping in many phases of the pandemic, from obtaining information, to its transmission through technological devices, which allows to ease the burden of confinement and social distancing, as well as provides the connectivity needed for teleworking, the exchange of information and

facilitating scientific cooperation throughout the pandemic. Listed below are some of these technologies, all of which can help mitigate the consequences brought by the appearance of SARS-CoV-2.

4.1.1 Tracking to monitor patients through applications for mobile devices

An effective way to control the pandemic is through contact tracing. In this way, those people who are infected can be identified in order to stop the spread of the disease.

A successful application against the pandemic, with 96 million downloads, is “Arogya Setu” [15]. This App is designed to keep the user informed in case they have come across someone who has tested positive. The additional feature that “Arogya Setu” has is the self-assessment part, which speeds up the detection of a user and the corrective actions that are taken, including a team of designated healthcare professionals who are dispatched to the user's location to detect the virus.

4.1.2 Big Data

Big Data has fostered a new scenario of multiple development possibilities that affect all sectors or areas of the economy, society and also Institutional Governance. At present, "Big Data" [16] is acquiring a special significance in the fight against the SARS-CoV-2 pandemic, assisting in the collection and processing of data in favor of health systems, scientific research through discovery of medicines and vaccines, genetics and epidemiological monitoring.

4.1.3 Artificial Intelligence / Big Data

Below are some specific applications for using AI and Big Data in the fight against the SARS-CoV-2 pandemic:

- The company 50superReal designed a special protocol algorithm [18] that generates designs for the realization of emergency constructions, by using a set of dimensional relationships with a functional space approach.
- The Allen Institute for Artificial Intelligence (AI2) "USA" has developed the "SciFact" tool, [19] an algorithm that selects the most relevant studies and classifies them according to what they want to investigate about the virus. "SciFact" has been created to help scientists researching COVID-19 quickly verify their hypotheses or new claims with the existing scientific literature.
- Clevy.io [20] is a French startup that launched a “chatbot” to make it easier for people to find official government communications about COVID-19. This “Chatbots” provides official information from the French government and the WHO. Different French cities have used this system.
- The Canadian company “BlueDot” [21] has used AI to detect outbreaks of the SARS-CoV-2 disease. Using its machine learning algorithms, it reviews news reports in several languages. Epidemiologists then review these results from a scientific point of view, so that this knowledge goes into the hands of public health, airlines and hospitals to help them anticipate and prevent risks.
- The UK company “BenevolentAI” [22] has directed its artificial intelligence platform to identify approved drugs that can help fight the virus.

4.1.4 Technologies (IoT)

The Internet of Things (IoT) has been defined in ITU-T Recommendation Y.2060 [23] as a global infrastructure for the information society, enabling advanced services through the interconnection of things (physical and virtual) based on existing and evolving interoperable information and communication technologies.

The Internet of Things (IoT) is being key in the fight against COVID-19, from the geolocation of affected people, the measurement of body temperature, to the development of increasingly specialized robotics tasked with the disinfection of all kinds of spaces, especially hospitals, within this scope of action.

An example of this, is the company "Libelium" [24] which has specialized in the development of intelligent sensors, and promotes the installation of screening systems that detect the body temperature of individuals. It is a system that is capable of performing three measurements in less than five seconds without the need for physical contact, thanks to scanning with infrared technology that allows a distance to be maintained.

The Internet of Things (IoT) also plays an important role in relation to air ventilation in closed spaces, especially with the arrival of SARS-CoV-2, due to the real possibility that some particles may be active while suspended in the air. These sensors provide us with information on air quality, and in combination with Artificial Intelligence systems can regulate different ventilation, heating and air conditioning parameters.

Robotics and automation are playing an increasing role in city-related services. An example of this is the project "Blue Smart Robotics" [25], an autonomous disinfection robot consisting of a platform equipped with an ultraviolet light system that was developed by the Danish start-up “Blue Ocean Robotics” to help in the fight against the coronavirus.

4.1.5 3D Printing

In the SARS-CoV-2 pandemic, the urgent need to provide health care to patients who have suffered the disease has given rise to a collaborative spirit which can be observed in the appearance of initiatives like the “Coronavirus Makers” effect [26], where thousands of people around the world have produced different sanitary elements, from respirators and other medical supplies to the construction of field buildings to care for the people affected by the virus.

4.1.6 Blockchain technology

"Blockchain" technology [27] is a transaction record that allows creating a digital ledger of data and sharing it among a network of independent participants, at the same time employing encryption as a way to validate that the entries are correct and cannot be changed. The United Nations is paying special attention to the potential that the "Blockchain" has to solve global problems, exploring its technology in order to discover processes and tools that allow solving problems of a global nature (73rd edition of the UN General Assembly) through the “United Nations Developing Program” [28].

4.1.7 Drones

These small unmanned aerial vehicles, have also carried out an interesting and useful work in favor of the fight against the pandemic, which, as indicated by the company “Quaternium” [29], significantly helps to reduce the risks of contagion in communication, disinfection and logistics tasks. The possible applications for this technology range from conducting surveillance tasks by state security forces to comply with confinement measures, to disinfection of public spaces affected by the virus.

4.2 Environmental efficiency in the development process

It is estimated that the technology industry is responsible for 3.5-4% of global greenhouse gas (GHG) emissions and, in turn, constitutes one of the main keys to achieving the objectives set in the Paris Agreement and the SDGs [30]. The ITU (International Telecommunication Union) notes that the ICT-related industry must reduce greenhouse gas emissions by 45 percent by 2030 in order to meet the Paris Agreement between 2020 and 2030 [31].

The ITU standard – ITU-T L.1470 [32] states that GHG emission pathways for the ICT sector consistent with the UNFCCC Paris Agreement have been defined in collaboration with the *Global Enabling Sustainability Initiative* (GeSI), the GSMA and the BTi. This standard is complemented by the Guidelines for the scientific establishment of objectives for ICT companies [33], and reports to the ITU-T Study Group for Standardization in the field of Environment, Climate Change and the Circular Economy, as seen in [34].

This standard will help ICT companies reduce GHG emissions at the rate necessary to meet the goal of the Paris Agreement of the United Nations Framework Convention on Climate Change (UNFCCC) of limiting global warming to 1.5ºC above from the pre-industrial level. The recommended emission reduction target is the first approved by the Science Based Target Initiative (SBTi) specifically related to the ICT industry.

Environmental Efficiency, understood in a broad sense (comprising environmental, ecological and energy challenges) is key in this development process. Thus, in this way, a wide range of fields of action are forming part of it, be it the energy consumed, the fight against climate change, pollution or the improvement of the pressure exerted on natural resources, among others.

In this process of Environmental Efficiency, the principles represented by some of the Schools of Thought of circular economy [35, 36, 37] such as the preservation and improvement of natural capital, the control of finite populations and the balance of the flows of renewable resources will make a decisive contribution to reducing emissions.

The experimentation with emerging technologies, together with the implementation of a circular economy go beyond the traditional theoretical models known until now, and therefore, require adequate assimilation and understanding to pave the way to keep moving forward while preserving environmental efficiency. A shift to a circular economy has the potential to create local jobs at all levels and reindustrialize regions, in addition to drastically reducing CO2 emissions (by as much as 66% on a national level), consumption of energy, materials, water resources, and volumes of pipe waste [38].

Here are some successful experiences in Environmental Efficiency through the use of emerging technologies such as Artificial Intelligence (AI), Blockchain, Big Data, etc. that can effectively contribute to the achievement of the Sustainable Development Goals (SDG) [30].

4.2.1 Artificial Intelligence (AI)

- CodeCarbon. Tool that tracks how much an algorithm pollutes. This tool calculates the amount of carbon dioxide (CO2) produced by computing resources used to execute code to incentivize developers to optimize the efficiency of their code [39].
- Automatic images of projects and satellites to reduce methane emissions. Developed by the Data and Informatics Center (CDAC) [40] at the University of Chicago (USA), it uses machine learning and satellite imagery to reduce methane emissions.
- Rainforest Connection Project. An Artificial Intelligence called “Rainforest Connection” uses acoustic signals in real time to detect illegal activities in protected forests. Protecting trees protects everything, as well as fighting climate change [41].

4.2.2 Blockchain

- Bitcoin energy consumption index [42]. Bitcoin's Energy Consumption Is Underrated – A Market Dynamics Approach. Energy research and social sciences.

4.2.3 Big Data

- GISAID. An example of the synergy between AI and Big Data is the GISAID Open Scientific Platform [17]. The GISAID Initiative promotes the rapid exchange of data on all influenza viruses and the coronavirus that causes "COVID-19". This includes the genetic sequence and related epidemiological and clinical data associated with human viruses, and geographic and species-specific data associated with avian and other animal viruses, to help researchers understand how viruses evolve and spread during epidemics and pandemics.

4.2.4 Drones

- DroneSeed. DroneSeed uses drones with Artificial Intelligence (AI) and Biological Engineering for the reforestation of fires [43]. This tool from a US based start-up allows the creation of 3D maps of the vegetation of the land, an analysis of the soil and the plant life of the area.

4.3 Circular Economy

The Circular Economy represents a new model of economic and social development, which identifies a series of processes of the economy in relation to the production, consumption and recycling of products, in order to respect and repair natural resources, as well as promote the renewal and reuse of products and their components. Different Schools of Thought [36] have been formed in recent years around the Circular Economy: Generative, Performance (Life-product) [44], Cradle to Cradle [45, 46], Industrial Ecology, Biomimicry, Blue Economy [47] Natural Capital and Systemic Thought.

In the strategic line of the United Nations for the implementation of the principles of the Circular Economy in all the countries of the world, the U4SSC has published the "Guide for Circular Cities" [48].

As seen in [49], some of the tools at the service of the implementation of circular business models become key to reducing emissions, adding to the advantages that Artificial Intelligence and other emerging technologies have for the environment and efficiency.

4.4 Social Innovation

The complexity of the challenges that society faces requires a broad innovation system, where social innovation will contribute decisively in the development process, highlighting the importance of social capital, social interaction laboratories, co-implementation, standardization, social platforms, corporate social responsibility, public-private partnerships and collective intelligence [14].

4.5 Ethics

Giving the development process an ever greater social and ethical dimension, is becoming a real necessity. The COVID-19 pandemic has fostered an impulse towards a new model of action based on principles of free access to information, as opposed to a traditional model of "closed" science, where collaboration, databases, articles and publications are at the service of the innovation of a sustainable and intelligent development. Ultimately, it is a matter of trust between countries, where intellectual property acquires great importance in the development of universal solutions for the implementation of vaccines in the population of the whole world.

4.6 Communication

How to successfully associate the challenge of SARS-CoV-2 with the truth, certainty and opinion is key in this process in order to be able to communicate in the best possible way this complex and ever changing challenge. This is a necessity for everyone involved in the development process, especially those in responsible of political communication through Institutional Governance.

5. DISCUSSION

The emergence of SARS-CoV-2 has baffled the world, and it has highlighted how vulnerable we are. In addition, it has broken the patterns of action in our development strategies, making us realize at the same time the ineffectiveness of some of our economic and social operating structures.

The appearance of COVID-19 has led to even more reflection on the deficient innovation systems on which current models of economic, social, environmental and political development are based. The COVID-19 pandemic further aggravates current problems (like the collapse of economies and employment, a constant danger in many countries around the world) which means that there are more and more people vulnerable as a result of this situation, underlining the need to make systemic changes on an unprecedented scale.

6. CONCLUSIONS

This research project refers to how the current institutional and spatial forms of Institutional Governance are not being effective when confronting some of the important and complex issues that society currently faces, such as environmental, ecological, energetic challenges, as well as the negative effects on the health of the population.

Although this research shows some innovative forms of Governance that have given good results in the experimentation of projects carried out by the EU and other parts of the world, in the situation in which we currently find ourselves it is urgent and a priority, first to stop and overcome the SARS-CoV-2 pandemic, and then to face the real causes that contributed to its appearance. Innovation systems need to adapt to a new reality.

The use of emerging technologies, such as Artificial Intelligence (AI), blockchain technology, big data and other emerging technologies are one of the keys to the fight against the SARS-CoV-2 virus. In the same way, confronting with determination the fight against climate change, the loss of biodiversity, deforestation and pollution are key to this end. There is a need for an implementation of a new economy that is more respectful of people, the environment and natural resources, such as the circular economy.

Environmental efficiency, understood in a broad sense, acquires special importance in this process, whether attending to the consumption of energy in our daily lives, the development of productive activities related to the development of products and materials, construction systems, or the preservation of the environment and biodiversity, among others.

Finally, it is necessary to provide ourselves with a greater and better ethical and social dimension, as well as better communication between science and society. We are faced with challenges of a global nature, which require comprehensive solutions and therefore require forceful and direct action, not only from the governments, which have to lead this process, but also from all stakeholders, economic and social, in which we should all contribute.

Governments must realize that they cannot be anchored in the past of the reality that surrounds us, of the uncertainty that this means, nor can it jeopardize the lives of future generations. It is time to act, put knowledge into practice and promote an international collaboration in accordance with the seriousness of the situation in which we find ourselves,

where Collective Intelligence, open data, and emerging technologies must be put at the service of a sustainable and inclusive development to combat the pandemic.

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