



Government Management and Cuban Science in the confrontation with COVID-19

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Keywords

Cuba; science; governance; COVID-19

ABSTRACT

The main purpose of this essay is to systematize and reflect on the experiences accumulated in the confrontation with COVID-19 regarding the link between scientists and government. It shows the working system used, the main actions and research carried out and summarizes the assessments and lessons learned from this experience. It notes the important role played by national science and technology, organically linked to governance, with a view to providing a social, scientific, political and health response capable of meeting the challenge that the pandemic has posed to us. Considering that the COVID-19 crisis is global, the essay begins by exploring some features of neoliberalism that hinder the overcoming of crises such as the one caused by the novel coronavirus (SARS-CoV-2). The convergence of several crises at the global level and the increasing complexity of the challenges to be dealt with emphasize the need to escape the trap of neoliberalism. The text emphasizes that what has been achieved in Cuba also has an ethical and political significance.

Gestión gubernamental y ciencia cubana en el enfrentamiento a la COVID-19

RESUMEN

El objetivo central de esta contribución es reflexionar sobre las experiencias acumuladas en el enfrentamiento a la COVID-19 con relación al vínculo entre los científicos y el Gobierno y sistematizarlas. Se muestran el sistema de trabajo utilizado y las principales acciones e investigaciones realizadas y se resumen las valoraciones y aprendizajes que esta experiencia

Palabras clave

Cuba; ciencia; gobierno; COVID-19



arroja. Se destaca el relevante papel que han desempeñado la ciencia y la tecnología nacionales, orgánicamente vinculadas con la gestión gubernamental, todos en función de ofrecer una respuesta social, científica, política y sanitaria capaz de enfrentar el desafío que la pandemia nos ha planteado. Tomando en cuenta que la crisis de la COVID-19 es mundial, el artículo comienza por explorar algunas características del neoliberalismo que dificultan el enfrentamiento a crisis como la generada por el nuevo coronavirus (SARS-CoV-2). La convergencia de varias crisis a nivel global y la creciente complejidad de los desafíos con los cuales es preciso lidiar acentúan la necesidad de escapar de la trampa del neoliberalismo. En el texto se insiste en que lo logrado en Cuba tiene también un significado ético y político.

INTRODUCTION

The main purpose of this contribution is to systematize and reflect on the experiences accumulated in the confrontation with COVID-19 regarding the link between scientists and government. It shows the working system used, the main actions and research carried out, and summarizes the assessments and lessons learned from this experience.

It notes the important role played by national science and technology, organically linked to governance, with a view to providing a social, scientific, political and health response capable of meeting the challenge that the pandemic has posed to us.

Considering that the COVID-19 crisis is global, it is worth to analyze the international response to it.

The pandemic of the novel coronavirus SARS-CoV-2 (COVID-19) has spread to almost every country, with governments and health systems showing a highly variable response capability. Therefore, a question inevitably arises: What is the reason why countries of wealthy economies and substantial scientific and technological capabilities have shown so many difficulties to deal with the crisis? Seeking for answers, many looks have been directed to the neoliberal models followed in those countries.

The question arises of whether the dogmas of Neoliberalism and their related policies are best suited to deal with the complex environmental, health, economic and global governance processes that the world is facing?

This essay identifies some features of Neoliberalism that call into question its capacity to respond effectively to COVID-19.

In an intricately interconnected world, attention must be paid to those international experiences and draw the appropriate conclusions.

This is essential since COVID-19 should not be regarded as a fortuitous, isolated event that is exclusively health-related and has no future consequences.

There are a number of global trends that will likely be emphasized going forward:

- It is apparent that the world is witnessing increasing pressures on the planetary boundaries for life. The rate and scale of problems and environmental and social disasters are rising.
- Multiple crises converge: i.e., health, environmental, inequity, exclusion, population growth.
- Every country and region, and also at world level, has to learn how to deal with complex problems (non-linearity, irreversibility, strong interconnection, unsuspected emergencies, uncertainties) demanding transdisciplinary approaches and requiring inter-sectoral, inter-institutional and even transnational collaboration too.

Learning how to deal with the so-called “risk society”⁽¹⁾ seems an imperative of our time.

SOME QUESTIONS ON NEOLIBERALISM IN THE LIGHT OF COVID-19

COVID-19 has brought about not only a surge of scientific questions, some unprecedented. It has opened a debate on some of the dogmas advocated by Neoliberalism: the Minimal State, the market as a panacea, deregulation, denationalization, privatization, the shrinking of the Public Sector, the destruction of communal goods, precarious public policies, among others.

The current crisis is both health, socio-economic and humanitarian. In fact, there are various ongoing pandemics associated also with poverty and hunger. Cuba has clearly condemned them: “The pandemic is worsening the pressing problems in a planet riddled with deep inequalities and where 600 million people live in dire poverty and nearly half of the population have no access to basic health services, whose management is defined by the market and not by the noble goal of saving lives”⁽²⁾.

It is correctly said that, under these circumstances, neoliberal ideology and policies have been stripped away, and there are numerous claims that the world should be different after COVID-19.

For the sake of this essay, a number of issues related to Neoliberalism require a special focus:

1. The Minimal State thesis, or the less State the better. It is one of Neoliberalism's core principles. Its apologists talk about a "revolutionary", dynamic, innovative and competitive private sector and a "meddlesome", lazy, bureaucratic and inertial public sector". (3, p.49)

Contrary to the previous statement: "Unless we challenge the various myths on economic development and get rid of conventional views for the role of the State, we would not be able to neither face the structural challenges of the 21st century nor attain the technological and organizational change required to guarantee sustainable and equitable growth in the long term". (3 p.45)

Can we do without States capable of mobilizing actors, resources and capacities to face such major challenges in an organized way?

2. Social policies, particularly health policies, have been increasingly subordinated to corporate profit and competitiveness, further reducing their capacity to respond in extreme situations. Should health be a universal human right or become another marketable good subjected to transactions?
3. Neoliberalism entails the so-called "cognitive capitalism", that is the privatization and marketing of knowledge in order to earn profits for the capital (4). In contrast to this, should socially shared knowledge facilitate the cooperation among scientists and be at the service of the great human needs?
4. Cognitive capitalism generated new means for knowledge production. For instance, in the Triple Helix Model (5, 6), concepts like "knowledge capitalization" or "scientific entrepreneur" are added. This clearly indicates that those models, which emerged from the experience of Silicon Valley or similar, include new objectives for science and scientists are drawn away from the original values of the ethos of science as formulated by Robert Merton in the 1940's (7). One of those very important values was disinterestedness, according to which scientists' only purpose was the pursuit of truth. Another one is the communality, which leads to sharing results because science is a collaborative work. Obviously, in times of a sort of knowledge-based 'gold rush', the original ethos has been extensively eroded. Will scientific values be relevant for solving any crisis as the one posed by the novel coronavirus?
5. The global medical-pharmaceutical industry, largely in the hands of a group of transnational companies, set

their R&D agendas based on profitability and revenues. Considerations inherent to the human welfare of majorities, particularly nations in the South, are outside the focus of their policies. Therefore, they preferentially turn toward the epidemiological profiles of countries of the North and social 10 groups in the nations of the South that can afford the products they supply. Meanwhile, new diseases and traditional tropical diseases are clearly neglected. This also explains why the medical and pharmaceutical industry have neglected the development of new antiviral and antibiotics, while focusing on more profitable drugs. COVID-19 poses an immediate question: Does the knowledge monopoly managed by those big corporations favor the objective of health as an effective universal human right? Should States and the public sector generate capacities enabling them to successfully face current and future challenges?

6. One of the characteristics of modern society is the huge concentration of scientific and technological capabilities in a handful of nations of the North (8).

The scientific and technological capacity is not only less in developing countries but it is usually less aligned with production sectors. Quite a few of these countries have put their strategic sectors in the hands of foreign capital, which is not very interested in local science.

Additionally, there are visible constraints in respect of sovereignty in several States. The extreme dependence on the International Monetary Fund, the World Trade Organization, the World Bank and other transnational institutions is of little help to take a sovereign path in terms of science, technology and innovation (STI).

The question is whether the above-mentioned is a problem or not, and whether the solutions to the major economic, social, environmental, health and other challenges can be addressed with turnkey, imported science and technology.

The stand of Cuba against Neoliberalism in the context of the current pandemic is clear: "When looking at the facts that have overwhelmed humankind for the last four months, it is impossible not to mention the huge negative impact of neoliberal policies, which heavily deteriorated the States management and capacities with excessive privatizations, in detriment of majorities" (2).

The abovementioned questions allow us to define the scale and complexity of the issues at stake. Moreover, they can be used as an introduction to the Cuban experience, from positions that are clearly different from Neoliberalism.

SCIENCE, STATE, GOVERNMENT?

The 1945 Vanevar Bush report entitled *Science-The endless frontier*⁽⁹⁾ presented to the President of US, paved the way for the State science policies. Science stopped being regarded as exclusively pertaining to scientists, who mostly worked at university labs, to become a matter of State, whose role in the financing of research and development (R&D) activities kept growing continuously for the following decades. The long Cold War period extensively emphasized this characteristic, which remains to this day, particularly in countries of the North.

In 1968, Argentinian Jorge Sábato formulated the so-called Sábato triangle⁽¹⁰⁾. It might well have been the first science and technology interactive model proposed, even before the current approaches of the Triple Helix and the innovation systems' models, among others. The Sábato triangle included three key players, whose interactions would become a major driver for development: These actors were: the State; the companies (at that time, the most important companies were state-owned) and universities, which were mainly public back then.

The dawn of Neoliberalism in Latin America brought along a significant weakening of the States' science and technology policies. Management was superimposed on policy, and national objectives were displaced by the business rationale.

One of the favorite recipes of Neoliberalism is to recommend the State to have the lowest intervention possible, leaving the regulation of processes in the hands of the market. As regard innovation policies, there have been powerful responses to that precept: "Does the State foster "wild" innovation? Yes, the most disruptive and revolutionary innovation driving the dynamics of Capitalism—from the railroad to the Internet, modern pharmaceuticals and nanotechnology—start out with initial and risky "entrepreneurial" investments, characterized by an intensive use of capital provided by the State"^(3, 30).

The Cuban experience is characterized by a strong State intervention in knowledge production, dissemination and use. This claim can be supported by some milestones. The 1961 nationwide Literacy Campaign and subsequent educational programs were of utmost importance. The founding of the National Center for Scientific Research¹ (CNIC) in 1965 allowed to create a research center according to the models of the most developed countries. A key contribution to that strategy was the incorporation of research into the universities under the University Reform in 1962, notably during the 1967-1972 period. At that time, the regular presence of Fidel at the University of Havana made it possible to establish a genuine university scientific policy that was well articulated with the

¹ In 1966, CNIC was part of the University of Havana. Currently, it belongs to the Group of Biotechnology and Pharmaceutical Industries (BioCubaFarma).

national program being implemented. Afterwards, a thesis on scientific policy was approved during the First Congress of the Cuban Communist Party (PCC) in 1975, which was very advanced for its time. In the 1980's, the biotech scientific cluster began to emerge, creating the basis for today's Cuban medical-pharmaceutical industry, which has been key in combating COVID-19.⁽¹¹⁾

The issues of knowledge, science, technology and innovation have nowadays earned a significant place within the Guidelines for the Economic and Social Policy of the Party and the Revolution for the period 2016-2021, the Conceptual Design of the Cuban Economic and Social Model for Socialist Development, and the Bases of the National Plan for Economic and Social Development until 2030: Vision of the Nation, Axes and Strategic Sectors⁽¹²⁾, and the Constitution of the Republic of Cuba⁽¹³⁾.

It is necessary to continue to advance in strengthening national science, technology and innovation capabilities and in their connection with national development needs. There is a long way to go.

New policies, together with their supporting legal provisions, are being developed gradually. They must allow to consolidate the country's national scientific and technological potential, use it in the best way for our economy and increase its contribution to the wellbeing of Cubans. Some of the most relevant policies include:

- Decree No. 363/2019⁽¹⁴⁾ (GOC-2019-998-086): On Science and Technology Parks and on Science and Technology Enterprises functioning as an Interface between Universities and Science, Technology and Innovation Institutions with Production and Services Institutions.
- Decree No. 2/2020⁽¹⁵⁾ (GOC-2020-156-016): On High-tech Enterprises
- Decree Law No. 7⁽¹⁶⁾: On the Science, Technology and Innovation System, signed by the President of the National Assembly of the People's Power, on April 16th, 2020.
- Resolution 286/2019⁽¹⁷⁾ (GOC-2019-999-086): Regulation for the Organization and Functioning of the National Registry of Science, Technology and Innovation Institutions.
- Resolution 287/2019⁽¹⁸⁾ (GOC-2019-1000-86): Regulation for the System of Programs and Projects of Science, Technology and Innovation.

Undoubtedly, knowledge and STI are key elements of development. However, the reciprocal connection between them has to be stressed. Science, technology and innovation are drivers for economic and social development. In turn, the social

focus of STI, the interest they serve and the social groups they benefit, depend on the quality of the development models implemented and the dominant interests in them. For instance, what explains the development of the Cuban Biotech and its contribution to the national health system is not limited to the existence of good institutions with excellent professionals. In fact, the Revolution's historic policies oriented towards strengthening the quality and free public health system, together with the political administration of the biotech industry with the undisputable leadership of Fidel Castro, have been determinant for the outcome. The prevailing values in those professionals are also representative of Cuba's social, socialist and solidarity model. The best of Cuba's science and technology policy has been the values that have guided it, particularly the interest to put the knowledge at the service of development and to meet basic human needs for all the population ⁽¹⁹⁾.

This observation underlines the role of the State and the Government together and the interests they represent. Governance must favor science complying with the social functions required for development.

COVID-19 IN CUBA

The first case of COVID-19 was detected in Cuba on March 11th, 2020. Nonetheless, the country had been readying itself and preparing responses long before. This shows the early efforts aimed at articulating governance with science and technology management and expertise.

On January 7th, 2020, Chinese scientists first identified the causal agent of the disease, a novel coronavirus, subsequently labeled *SARS-CoV-2* and its associated disease *COVID-19*. On January 30th, the World Health Organization declared coronavirus as a new epidemic.

Since that early date, Army General Raúl Castro Ruz, First Secretary of the Central Committee of Party, indicated the need to have a national strategy in place. Consequently, on January 29th, the Council of Ministers approved a Plan for the Prevention and Control of the Novel Coronavirus, which has been subsequently updated. Its first phase started on February 3rd, with the training of health professionals and the staff of central state administration agencies on biosafety issues. On February 12th, the Science Group for the Confrontation of COVID-19 was established. After that, on February 17th and 26th, the COVID-19 Health Observatory and the Innovation Committee were created². As early as February 28th, the first

² It is part of the Science Group for the Confrontation of COVID-19. It evaluates and approves the proposals to use products in research, innovation, development and, therapeutic protocols and clinical trials; it expedites approval in regulatory-related procedures. This Committee is coordinated by the Science and Innovation Directors of MINSAP and BioCubaFarma, and the Directors of the Center for the State Control of Medical Equipment and Devices (CECMED) and the National Clinical Trials Coordinating Center (CENCEC).

five research projects for COVID-19 were approved. By June 1st, 460 research projects were underway, 85 of them led by the Science Group belonging to the National Technical Group³.

This brief chronology shows that upon the very early signs of a potential crisis in the making, the Government response was set in motion, oriented towards the mobilization of all scientific, technological, and professional capacities required to confront the pandemic. Over the course of the months, the government response and the participation of scientists, professionals and experts of several fields has intensified.

As explained during the Online Summit of the Non-Aligned Movement United Against COVID-19: ⁽²⁾

"For Cuba, the challenge has been a monumental. In the months prior to the outbreak of the COVID-19 pandemic, we were already facing a ruthless tightening of the US economic, commercial and financial blockade policy aimed at bringing our trade and access to oil and foreign currency to a full standstill.

"Through tremendous effort and sacrifice, we have been able under such conditions to keep in place our universal and free public health system that's got dedicated and highly-qualified professionals who enjoy world prestige in spite of the gross and slanderous campaigns by powerful adversaries.

"The early warning signs that COVID-19 would become a pandemic came in the midst of this suffocating context of an economic war, and that made challenges bigger.

"Right away, we came up with a plan with measures based on our main strengths: A well-organized State with the responsibility to look after the health of its citizens and a society with mass involvement as to decision-making and giving solutions to its problems.

"The work resulting from years of resource appropriations to develop and strengthen health services and science has been put to a test and the evolution of the epidemic in Cuba in the last two months is showing the good impact social investment policies may have when facing the biggest and most unexpected challenges." ⁽²⁾

Let us review in detail some of the elements which help to explain Cuba's response to COVID-19.

Even under the abovementioned adverse circumstances, the nation has maintained a public, universal, free, and completely inclusive health policy for decades. Cuba appropriates

³ It coordinates research activities and the follow up of the clinical management protocol. It evaluates and approves research, interventions, clinical trials and applications of impact, as part of confrontation plan's measures. This group is integrated by the Innovation Committee, groups of experts and the COVID-19 Science Observatory.

27.5% of its budget to health and social security, which allows the System to be prepared to confront the pandemic⁴.

A key element of this policy is the primary healthcare system, whose direct proximity with the population favors direct interchange with the people, thus facilitating access to health services, and allows for a prompt and effective response in terms of both health promotion or any adverse event.

According to the *2019 Health Yearbook* ⁽²⁰⁾, in Cuba

“there are 479,623 health workers, accounting for 6.6 % of the workforce, and 71.2 % of them are women. The rate of inhabitants per physician is 116, that is 86.6 doctors for every 10,000 inhabitants. Furthermore, the figures for dentistry indicate there are 566 people per dentist, and 17.7 dentists for every 10,000 inhabitants. There are 150 hospitals, 20.0% of which have at least 400 beds, 62.7 % have 100 to 399 beds, and the other 17.3 % have less than 100 beds. The National Health System has 110 intensive care units, 120 municipal intensive care areas, 449 polyclinics, 111 dental clinics, 132 maternity homes, 12 research institutes, 680 medical libraries, 155 elderly homes, 295 elderly clubs, 52 geriatric services and 30 medical-psycho-pedagogical centers.

“Human resources for the health system are trained in 13 Medical Universities and 9 Schools of Medical Sciences, four Schools of Dentistry, one School of Nursing, one School of Health Technologies, three Schools of Technology and Nursing, 12 affiliate Schools of Medical Sciences, the Latin American School of Medicine (ELAM) and the National School of Public Health (ENSAP).” ⁽²⁰⁾

The healthcare of the population is complemented with the contribution from major scientific institutions within the sector, including institutes and centers that engage in R&D and innovation, whose agendas are defined in line with country's health needs.

The medical-pharmaceutical industry provides a powerful support to Cuba's national health system. The industry is robust and capable of doing research, producing and making available to the population essential resources for human health. This industry, faced with limited resources, resorts to a range of technological options including advanced science, thus creating hundreds of innovations, some of which may be classified as breakthrough. This affords the nation a reasonable level of technological sovereignty in the health sector.

In addition to the sector's own capabilities, the country re-

⁴ <http://www.cubadebate.cu/noticias/2020/05/29/cuba-no-relaja-medidas-ni-se-confia-pese-a-escenario-favorable-en-el-manejo-de-la-Covid-19-video/#.XtHU-szBw0N>

lies on significant human resources working on universities and STI institutions, who are able to respond in face of different contingencies. This includes undergraduate and postgraduate education, including doctoral programs, in biology, microbiology, biochemistry, pharmacy, psychology, biomedical engineering and other specialties relevant for the sector.

There is certainly significant professional, scientific and technological capabilities available. But the most valuable component of these professionals is their values, including solidarity and dedication, values that are integrated to those capabilities which, in conditions like what we have faced in times of COVID-19, are expressed with unique intensity. Science, technology and values all together offer Cuba the possibility of looking for answers to contingencies old and new.

The 28,000 plus healthcare collaborators that Cuba has deployed in 59 countries⁵ illustrate very well the particular ethical fabric of our professionals, scientists and technicians, noting that more than 34 Cuban medical teams comprising more than 2,500 collaborators have brought their health services in solidarity to 26 nations, upon request from their governments, to mitigate the impact of the COVID-19 pandemic.

In 2003, Fidel Castro ⁽²¹⁾ said: “This country will live, mainly, on its intellectual productions, although it will not live on that exclusively; it will increasingly live on intellectual productions, its science, the development of health products and services”.

So far, it is possible to say that the intelligence created is notably helping the nation to overcome the pandemic.

GOVERNANCE IN INTERACTION WITH SCIENTISTS

Prior sections help to understand the relevance of an active governance that is able to mobilize the scientific potential available in order to jointly find the best response to COVID-19⁶.

Key aspects of what has been done include the direct dialogue between experts, scholars and professionals and the government, the development of inter-institutional and intersectoral collaboration, interdisciplinary participation, intense work in order to expedite responses and an active public

⁵ Cuban News Agency. Los 28 mil colaboradores de salud en el exterior: sanos y capacitados ante la COVID-19. By Claudia González Corrales, March 17th, 2020. <http://www.acn.cu/salud/62198-los-28-mil-colaboradores-de-salud-en-el-exterior-sanos-y-capacitados-ante-la-covid-19>

⁶ Not all countries have achieved the closer relationship between scientists and the government that has been achieved in Cuba: “But it will be worth reviewing some of the lessons learned from this hard experience. One of them that seems very important to address will be: Why is there a disconnection between science, researchers and governments? As stated by Ignacio Ramonet, they would not be listened to, despite warning that a highly transmissible and virulent disease outbreak that could become a pandemic was imminent. Nor did they listen to the repeated alerts from the World Health Organization (WHO) urging in September 2019 about a devastating and very deadly pandemic” (Aragonés, A, 2020).

communication to improve information and the behavior of the population.

To this end, a working system was put in place, including the following:

- Creation of the National Task Force, led by the President and the Prime Minister, which meets daily.
- Weekly meeting with experts and scientists to evaluate research results and their application.
- Activation of Provincial Defense Councils throughout the national territory.
- Daily press conferences to inform the population of updates and progress in implementing the Novel Coronavirus (COVID-19) Prevention and Control Plan.
- Daily television programs to provide updates on different topics related to the COVID-19 Prevention and Control Plan.
- Weekly work sessions with the Economic Advisory Group to address issues concerning the economic and social development strategy.
- Visits to research centers.
- Discussion, at the Provincial Defense Council of Havana, of results of mathematical models, geo-location and geo-referencing studies by researchers at the University of Havana (UH) Mathematics and Geography departments.
- Analysis in all Provincial Defense Councils of the epidemic's evolution with mapping provided by geographers at the UH.
- Advisory Group conference to prepare for monthly Council of Ministers meetings to address the impacts of COVID-19, scenarios, and necessary productive transformation.
- Approval and current implementation of strategy designed for the post-COVID-19 recovery phase.
- Current Intense activity on the design of the Economic and Social Strategy during the phase of economic strengthening for a scenario of a protracted crisis. This management and innovation process comprises:
 - Working sessions of the task force on each of the central state administration agencies to draw up the strategy.
 - Briefing session with each task force to submit their proposed strategy to the consideration of the Government.
 - Elaboration and presentation of the strategy at the Party Politburo.
 - Presentation of the strategy at the Executive Committee of the Council of Ministers.
 - Presentation and approval of the strategy at the Council of Ministers.

- Implementing the strategy and its implementation control.

The main actions have been:

- Development and update of mathematical models for prediction, coping and the evaluation of the pandemic's evolution.
- Geo-location system applied to epidemiologic management.
- Classification scale for seriously ill patients.
- Study of prognostic biomarkers for disease severity.
- Nationwide mapping of clinical-epidemiological risk areas with the representation of risk groups of population aged 60 and over.
- Use of the ultra-microanalytical system (SUMA) as diagnostic tool for population screening.
- Development and production of personal protective gear for health personnel.
- Design and development of Cuban prototypes of pulmonary emergency respirators.
- Design and development of an ultraviolet light decontamination lamp.
- Use of *big data* techniques to evaluate population mobility during the pandemic.
- Development of five Cuban vaccine candidates.
- Application of the anti-CD6 monoclonal antibody, peptide CIGB-258 and Heberferon® to COVID-19 patients.
- Conduction of clinical trials for the treatment of critical and seriously ill patients.
- Modification of the therapeutic protocol based on early PCR negative results after treatment with the combination of Interferon alpha-2b and interferon alpha + gamma.
- Evaluation of results from computer applications: COVID-19-InfoCU, COVID-19 Repository, Outbreak Surveillance and Response Management & Analysis System, Virtual Screener, COVID19CUBADATA, Andariego, active screening app developed by CINESOFT.
- Holding of the COVID-19 Modeling, Follow-up and Epidemiologic intervention Symposium.
- Elaborating and systematizing the Cuban Model of Clinical-Epidemiological Management for Confrontation and Control of COVID-19.
- Approval and implementation of the Protocol for the Attention to Convalescents.

- Elaborating and systematizing the Cuban Model of Clinical-Epidemiological Management for Confrontation and Control of COVID-19
- 460 research and studies in the Research Plan on COVID-19 (85 at national level and 375 at provincial levels). An average of 8.3 studies and proposals for product, equipment and medical devices development are discussed and approved every week.
- Program for a historical memory of the fight against COVID-19.
- Involvement of social sciences on impact mitigation, co-responsibility on collective care, people and community participation, innovative initiatives in the face of confinement, ethical and responsible use of the media, and the denunciation of anti-Cuban campaigns.
- Conduction of several research, including:
 - Development of systems for statistical information and websites for standardizing and visualizing information ([COVID19cubadata.github.io](https://github.com/COVID19cubadata)).
 - Development of systems for geographic information and automation of epidemiological networks.
 - Development of a mobile app for active epidemiological screening and surveys.
 - Estimating epidemiological parameters: basic reproduction number (at the start of the epidemic) and effective reproduction number (evaluation of interventions), force of infection.
 - Analysis of disease spreading, its distribution and the risk for transmission per province, municipality and health area, and its relationship with risk factors.
 - Predictions of the COVID-19 epidemic according to climate, temperature and relative humidity factors.
 - Network-based modeling for contact tracing and evaluation of the control of the epidemiological transmission chain.
 - Evaluation of the impact of implemented measures aimed at restricting population mobility.
 - Evaluation of the impact of the introduction of biotechnological products on the reduction of severity and mortality due to COVID-19.
 - Development of multilevel and artificial intelligence models for comparing the epidemic in Cuba with other countries in the region and elsewhere.
 - Population study of carriers.
 - Prediction of the end of the epidemic and post-epidemic behavior.
- Establishment of indicators to scale back.
- Use of Biomodulina-T in older adults residing in long-term care facilities.
- Clinical-epidemiological characterization of Cuban children and teenagers suffering from COVID-19.
- Intervention programs for mental health and psychological support during the COVID-19 pandemic.

The following appraisal results from all of the above:

- Cuban science has made a significant contribution to successfully and efficiently deal with COVID-19, facilitating through several researches the prediction, design of confrontation procedures, the improvement of therapeutic protocols, the management of pandemics confrontation, and the improvement of intervention models for reducing risks and vulnerabilities in the face of epidemics.
- A knowledge base has been built and it has become a point of reference and support for governmental management of pandemics.
- Expert knowledge mobilization to deal with the pandemic included, as a very important element, the work of the entire health system, particularly doctors, nurses and medical students who engaged daily with the population.
- Significant research and a number of clinical trials have been conducted and implemented.
- New products and developments were created, they are likely to become potential products of the national industry to substitute imports and promote new investment opportunities.
- Crucial scientific activity was achieved, which is expressed in 66 research papers by Cuban authors in academic journals and other media in Cuba (57) and abroad (9). Other 21 articles are in preparation.
- The Cuban biotechnological products that were used considerably avoided death of critical and seriously ill patients, saving up to 80% of them, while 80% of patients die elsewhere.
- Cuban science has improved, providing valuable solutions at an increasingly complex moment. It has strengthened its bonds with society and the diverse economic and social actors. Its participation and results have been decisive.
- It is confirmed that doing science based on pertinence and social responsibility is invaluable; which is closer to the concept of sustainable science. ⁽¹⁹⁾
- It is confirmed that consolidating the good practices and the best values of our society in the implementation

of the scientific policy is important in order to provide solutions to complex situations of the society.

These breakthroughs and outcomes “are irrefutably proof of the contribution that Cuban science is making in this fight”. They also show the potential of multidisciplinary work and inter-institutional collaboration: “They give hope, strength and demonstrate that there is a comprehensive focus on the management of science and innovation, due to the convergence of all scientific specialties” (22).

“In dealing with the pandemic, we have achieved an honorable, very honorable result; even more so under the circumstances in which the country has done it” (...) “the scientific results we have attained have given the country a high visibility and a huge prestige, as principal component during the confrontation”. Particularly outstanding is “the contribution of Cuban biotech to the fight against COVID-19, both with the anti-CD6 monoclonal antibody, from the Center of Molecular Immunology, the CIGB-258 peptide, from the Center for Genetic Engineering and Biotechnology” (23).

Addressing COVID-19 has taught some lessons that are useful for future experiences. The capacity and pertinence of a close collaboration between the scientists and the Government has been confirmed.

CONCLUSIONS AND THE WAY FORWARD

The experience of dealing with the COVID-19 confirms the great opportunities afforded by the close and interactive collaboration between research institutions and the Government. This is an issue of interest for all countries. It is commonly believed that public policy formulation and design should always rely on expertise. However, this is difficult to accomplish. A fluent communication of mutual understanding between the academic world and policy decision-makers is not always achieved.

The first part of this essay identified various problems caused by Neoliberalism. Having an alternative, socialist, social project, provides Cuba with excellent opportunities to let science effectively act as a transforming social driver

The experience gained in the battle against COVID-19 demonstrates that it is possible and highly beneficial to achieve shared goals under Cuba’s current circumstances. Such collaboration is based on the ethical and political foundations forged by the Cuban Revolution.

The relevance of considering innovation, computerization and social communication as pillars for the management of the Cuban government is corroborated. This has facilitated the generation of innovative scientific solutions, the development of computer applications to deal with the pandemic, and

a social communication exercise to give people confidence and guidance. At the same time, it has dignified the contribution of health workers and scientists with remarkable social recognition.

Moreover, it indicates that collaboration between Government and scientists should become a permanent standard practice. It must facilitate “the profound exercise of innovative thinking” (24) as required by the country. The aim must be “becoming the productive transformation that the country needs at this time, ensuring processes with higher efficiency, productivity, profits and revenues, meeting the domestic demand, providing opportunities for exports and enabling the wellbeing, development and prosperity” (idem). Particularly, “if there is anything that we need to put all our thoughts in and take it to a concept different from what we have been doing, that is food production” (24).

It is about applying as soon as possible what was adopted at the sixth and seventh Congresses of the Party, the Guidelines for the Economic and Social Policy of the Party and the Revolution, and the Conceptual Design of the Cuban Economic and Social Model for Socialist Development, all of which have set forth far-reaching innovations, pending to be implemented.

Scientific advice and the leading role of expertise are key to achieve these efforts, and the experience discussed in this essay constitute an important basis.

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