

The Impact of COVID-19 on Innovation: Old Projections or New Expectations After the Pandemic?

—REYNA VIRGINIA BARRAGÁN-QUINTERO

Universidad Autónoma de Baja California,
Tijuana 22424, Mexico

Member, IEEE

—FERNANDO BARRAGÁN-QUINTERO

El Colegio de México, Ciudad de Mexico
14110, Mexico

—EDUARDO AHUMADA-TELLO 

Universidad Autónoma de Baja California,
Tijuana 22424, Mexico

Member, IEEE

(Corresponding author: Eduardo Ahumada-Tello.)

IEEE DOI 10.1109/EMR.2020.3016043

Abstract—Today's generation has undoubtedly witnessed spectacular changes all over the world including the emergence of diseases, such as severe acute respiratory syndrome. Now, we are faced with an unprecedented crisis, brought on by coronavirus disease 2019, a worldwide pandemic that has shaken our economic and social equilibrium, bringing about a new set of parameters in personal as well as in social behavioral patterns, and ceding way to new strategies of political conduct and economic planning. In this article, we hope to stress the idea of innovation as a necessary instrument for economic viability and quite possibly an important factor for reconstruction in the aftermath of the pandemic. We propose that society will have to adopt certain tools and conducts to recover from the consequences of the crisis, making use of innovation as a strategy for the recovery and development of the economy that has been weakened from lockdown and social distancing. With this goal in mind, we hope to prove that a crisis, such as a pandemic, is cause for change and innovation at all levels.

Key words: Coronavirus disease 2019 (COVID-19), economic viability, innovation, technology, pandemic aftermath

I. INTRODUCTION

A new coronavirus designated as severe acute respiratory syndrome Coronavirus -2 (SARS-CoV-2), previously known as 2019-novel Coronavirus (2019-nCoV) [1], [2], is the virus responsible for the coronavirus disease 2019 (COVID-19). The global pandemic was set off by this emerging virus of which we know very little, including important aspects such as its precise origins and evolution, not to mention its treatment.

COVID-19 first made its appearance in Wuhan, China, in December 2019, and is now a source of a tremendous effort by the international community to find appropriate methods of treatment. On January 23, 2020, the Chinese government ordered a city-wide lockdown in Wuhan because of the seriousness of the disease, a fact that alarmed much of

the world community at the time and brought to the limelight a disease that has shown itself to constitute a threat to public health and to the balance of the global economy and governance [1]. And so, it did not take long for it to spread beyond the borders of China—by February 27, it had spread to 47 countries and infected 82 000 people [1]; by June, there were more than seven million people infected in more than 290 countries.

In order to decelerate the spread of the disease, and since no vaccine is currently available, the World Health Organization (WHO) has published a series of guidelines and recommendations [3], such as social distancing and lockdowns meaning the closing of schools and nonessential businesses, the suspension of production in large areas of the economy, and the prohibition of large gatherings and mass events [4], all of which have

weighed heavily on the world economy. In the aftermath of the pandemic, we hope to stress the idea of innovation as a necessary instrument for economic viability and quite possibly an important factor for recovery.

II. KEY CONCEPTS

According to the Oslo Manual [5], innovation should be considered central in the improvement of living standards of individuals, communities, as well as nations and can equally affect institutions, entire economic sectors, and of course countries. That is why it is important to consider innovation in the hopes that it may help policymakers better understand the social and economic changes brought about by events of an ordinary or extraordinary nature, meaning evolution and development or crisis [5].

Of the theories, we mention the diffusion theory that examines the processes by which innovation is communicated and adopted by all members of a social system; and the innovation systems theory that requires a multidisciplinary and interdisciplinary approach in examining the interdependencies of actors, the uncertainty of outcomes as well as evolutionary processes [5]. Innovation theories stress four crucial concepts: Knowledge, novelty, implementation, and value creation. Of these, knowledge is particularly important to us as it can be understood in conjunction with innovation: "Innovations," according to the Oslo Manual, "derives from knowledge-based activities that involve the practical application of existing or newly developed information and knowledge" [5].

III. IMPACT OF INNOVATION

A. In Society Disease throughout history has represented at times, in

more ways than one, a change in the direction of events. Diseases in the past have had serious effects on society, at times even transforming the social and economic spectrum of a nation, molding politics, the economy (for instance, the disappearance of feudalism), and adapting society's response and needs to a particular crisis. By contrast, as we have stressed, it may also lead to innovation: the development of a vaccine to cure a disease; and from the need to adopt to new circumstances, people have tended to change social customs in improved hygiene [6], [7], and expand public health politics, through the founding of health organizations, departments, and investments in research [8].

According to Smil [9], "Fundamental changes in human affairs come both as unpredictable discontinuities and as gradually unfolding trends." These discontinuities can potentially "affect the course of global civilization," which may include any number of events and phenomena, from natural disasters to emerging infectious diseases, pandemics, political discontinuities, terrorist attacks, violent conflicts, and wars [9]. However, these discontinuities may also represent an opportunity to produce and promote cutting edge science and technology, technical developments, progress in engineering and production, and diffusion of new techniques [9].

B. In Globalization In the context of globalization, the disease is spreading faster, but people are also becoming increasingly aware of the consequences of the pandemic through the media and the information industry. With globalization also comes the need to innovate new information and communication technologies.

So it is only natural that what is termed information technology (IT) is

increasingly present in our daily lives. Gupta *et al.* speak about smart cities, that is, cities whose government depends increasingly on information from digital technologies for communication, health care, energy, etc., and also receives suggestions and complaints from citizens via online data collection systems in order to provide more efficient, inclusive, and sustainable services [11]. This concept of city is included alongside other frameworks; the first being the idea of a just city that focuses on values, law, and rights, and a sustainable city that integrates the social, economic, and ecological spheres [11], [12].

The question arises as to how IT should be applied to reduce the economic and social costs of catastrophes and pandemics? The answer is usually the need to employ a mix of techniques and social endeavors to resolve a crisis, depending on the nature of the event, and for this very reason, there can be no one solution [13]. However, what can be ascertained is the technology behind the strategy, such as the use of cellular technologies, the Internet, Internet Protocol (IP)-based networking, wireless networking, online resource directories, collaboration with commercial firm's sharing files and software, multimodal public reporting and notification, etc., [13].

Innovation is not just limited to the private sector. There are many ways of innovating in the public sector, including employing a system of rewards, providing training and education to civil servants, or by partnering up with the private sector, especially firms that invest in innovation. The latter is especially true when it comes to the participation of government in the economy, but the normal type of innovation expected from the government is usually confined to the fields of politics, public administration reform,

drafting regulations and law, advancing diplomatic instruments, promoting domestic and international trade [10], and international treaties, such as the International Health Regulations (IHR) in the international forum and the North American plan for animal and pandemic influenza at the regional level [10].

C. In Economic Concerns

Globalization seems to direct modern economic activity, and is frequently understood as the process of international market integration as well as of consumer preferences [14], meaning that what happens in one region affects the others. For instance, the 2003 SARS outbreak in China may serve as a case study, an antecedent regarding the effects of the current pandemic to society and specifically to the economy. Indeed, the outbreak in China not only brought with it distress and strain on governance, it also caused economic upheaval, and in general, it disrupted the ordinary life of Chinese citizens. Similar effects were echoed in other countries and were serious enough to cost several nations billions of dollars, especially in the sectors of tourism, hospitality, and the industry of transportation [15].

As to the effects and cost of the COVID-19 pandemic, it is difficult to assess insofar as it is still in process. The forecasts though are particularly bleak for this year and possibly the next. The form the recovery process takes will depend on the state of the economy left at the end of the pandemic.

In the current situation, many small businesses are struggling simply to remain afloat. Others are forced to shut down or sell. Unemployment is raging, which means little or no income. From this, we can gather that the socioeconomic impact has to be studied not only at the household and community levels but also at the

regional and national levels, the business branch level, the impact on the national and international markets, etc., [16]; therefore, innovation can be studied at the very same levels. In other words, a strategy that extends to all these levels is undoubtedly innovation.

Of course, there have been many workaround solutions put to practice all over the world including working at home, doing home-office when possible, online meetings, online schooling, online courses, etc. Some of these activities will probably remain with us in a postpandemic economy. What is significant is that the gap between the rich and the poor seems destined to widen considering the levels of unemployment the pandemic has brought on. Briefly put, while the ordinary household is struggling to make ends meet, companies like Amazon have seen their profits increased considerably [17].

IV. CONCLUSION

Past pandemics have taught us very important lessons that we should take into consideration given the tardiness with which organizations and local governments began to deal with the current outbreak. These lessons include the need for greater organizational agility in disaster management [13], and coordination and standardization of public health response at local, state, and federal levels including joint efforts. Also, there is a need to develop an incident management system. After the 2003 SARS outbreak, the Chinese invested in a web-based reporting system for emergencies and developments, but as with most pandemic preparedness and response strategies, they are done at the local level and lack properly trained health workers at that level. There is also an incredible need to improve local-level health response

capabilities, and health coverage and cost programs. Additionally there is a need to maintain a nationwide recruitment of health workers. Informing and educating the public is critical, so additional strategies not just at the government level should be drafted to keep the public constantly informed [18].

This new pandemic forces new approaches, and new solutions for different sectors of society. As to regulations and international law, perhaps the IHR should be revised and made to include SARS (it only contemplates the plague, yellow fever, and cholera) [19] since this is the third coronavirus outbreak the world has known (SARS, Middle East Respiratory Syndrome, and now COVID-19). Also, a new regulatory cooperation plan for zoonotic diseases could be coined at the regional level.

As for the economy, the need to maintain at least a semblance of productivity has led people to work indoors and socially distance whenever possible, a strategy that many may find very appealing even in a postpandemic economy. The pandemic has forced workplace operations to go virtual [20] and many individuals and businesses have made such transition successfully in a short period of time [20]. Innovation has been by far the nodal concept in society to try to ward off the effects of lockdowns, social distancing, and travel restrictions.

The need to innovate in this time of crisis is imperative to solving pressing matters, such as acquiring groceries and paying bills. For many workers, it represents survival, but for companies and businesses, it represents commercial viability. In the coming months and years, society at large will learn to cope with a new reality aided undoubtedly by commercial, political, and educational innovation.

REFERENCES

- [1] Zheng J., "SARS-CoV-2: An emerging Coronavirus that causes a global threat," *Int. J. Biol. Sci.*, 2020;10(10):1678–1685. doi: [10.7150/ijbs.45053](https://doi.org/10.7150/ijbs.45053).
- [2] World Health Organization, *Novel Coronavirus (2019-nCoV) Situation Report 1*, Geneva, Switzerland: WHO; Jan. 21, 2020, p. 5.
- [3] World Health Organization, Coronavirus disease (COVID-19) advice for the public. 2020. [Online]. Available: <https://www.who.int/emergencies/diseases/novel-coronavirus-2019/advice-for-public>
- [4] Ngonghala CN *et al.*, *Mathematical Assessment of the Impact of Non-Pharmaceutical Interventions on Curtailing the 2019 Coronavirus*. *Math. Biosci.* Jul. 2020;325:108364. doi: [1016/j.mbs.2020](https://doi.org/10.1016/j.mbs.2020).
- [5] OECD/Eurostat, *The Oslo Manual 2018. Guidelines for Collecting, Reporting and Using Data on Innovation*. Paris, France: OECD Publishing/Luxembourg City, Luxembourg: Eurostat; 2018.
- [6] Beltz L. A., *Emerging Infectious Diseases. A Guide to Diseases, Causative Agents, and Surveillance*. San Francisco, CA, USA: Jossey Bass; 2011, p. 734.
- [7] Bostrom N, Cirkovic MM. *Global Catastrophic Risks*. Oxford, U.K.: Oxford Univ. Press; 2008, p. 554.
- [8] Crosby A. W, *America's Forgotten Pandemic*. New York, NY, USA: Cambridge Univ. Press; 2003, p. 337.
- [9] Smil V., *Global Catastrophes and Trends. The Next Fifty Years*. Cambridge, MA, USA: MIT Press; 2008, p. 307.
- [10] Khan H. A., *Globalization and the Challenges to Public Administration*. New York, NY, USA: Palgrave MacMillan; 2016, p. 210.
- [11] Gupta J. *et al.*, *Geographies of Urban Governance. Advanced Theories, Methods and Practices*. Cham, Switzerland: Springer; 2015.
- [12] Hewson M., Sinclair T. J., *Approaches to Global Governance Theory*. Albany, NY, USA: State Univ. New York Press; 1999.
- [13] National Research Council. *Improving Disaster Management*. Washington, DC, USA: Nat. Akademies Press; 2001, p. 277.
- [14] Anguelov N., *Policy and Political Theory in Trade Practice. Multinational Corporations and Global Governments*. New York, NY, USA: Palgrave MacMillan; 2014, p. 149.
- [15] SARS. *How a Global Epidemic was Stopped*. Geneva, Switzerland: WHO; 2006, p. 307.
- [16] National Research Council, *Facing Hazards and Disasters*. Washington, DC, USA: Nat. Akademies Press; 2006, p. 394.
- [17] Semuels A., *No Income. Major Medical Bills. What Life is Like for Millions of Americans Facing Financial Ruin Because of the Pandemic*. *Time Magazine*, May 7, 2020. [Online]. Available: <https://time.com/5833008/us-unemployment-coronavirus/>
- [18] Schwartz R, Schwartz J. *Confronting Global Pandemics. Lessons from China and the US*. *Global Health Governance*. 2010;III(2):1–21.
- [19] Wise PH, Barry M. "Civil war & the global threat of pandemics," *Daedalus, J Amer Acad Arts Sci*. 2017;146:71–84.
- [20] Kim R. Y. "The impact of COVID-19 on consumers: Preparing for digital sales," *IEEE Eng. Manage. Rev.*, 2020; 48(3): 212–218.

Reyna Virginia Barragán-Quintero (Member, IEEE) received the bachelor's degree in business administration and the master's degree in corporate finance from CETYS Universidad, Tijuana, México, and the Ph.D. degree in management science from Universidad Autónoma de Baja California, Tijuana, in 2017, with a dissertation on the innovation capabilities of the wine industry in Guadalupe Valley, México. She worked in the private industry for more than 20 years, and has held management positions in global companies, such as HSBC Bank and Scotia Bank Mexico. During her practice, she was certified on Ethics for Financial Markets, as an Investment Markets Promoter, and as a Stock Broker by the Mexican Association of Stock Market Intermediaries. She is also certified in Human Resource Development and Foreign Trade for IMMEX Companies. She is currently the MBA coordinator with the School of Engineering, Management and Social Sciences, Universidad Autónoma de Baja California, and a Professor in the fields of business strategy, finance, and management. Her research interests include finance, innovation for regional development, innovation management, strategic management, and people and organizations.

Fernando Barragán-Quintero graduated as a Lawyer from Universidad Iberoamericana, Mexico City, Mexico, and as a Classical Philologist from Universidad Nacional Autónoma de México (UNAM), Mexico City. His graduate studies in social sciences include the master's degree in Asian and African Studies, specializing in India and Southeast Asia, and the master's degree in Middle Eastern Studies, both from El Colegio de México (Colmex), Ciudad de México, Mexico. He has done research work on Roman law, legal history, international law, specifically international trade law, and globalization. He has also done editorial work for the Institute of Philological Research and has been a member of the Seminar of Roman Law with the Institute of Legal Research, UNAM.

Eduardo Ahumada-Tello (Member, IEEE) received the Ph.D. degree in education from Universidad Iberoamericana, Mexico City, Mexico, working on creation and analysis of knowledge societies and the Ph.D. degree in management science from Universidad Autónoma de Baja California (UABC), Tijuana, Mexico, focusing on competitiveness and business strategies in knowledge-based firms. He is currently a Professor in information technologies and management science with UABC. He is also a Guest Lecturer with the Universities in France, Spain, Bolivia, United Kingdom, and México. He participated in two specializations on management science with Harvard University, Cambridge, MA, USA, as well as grassroots startups courses for high-value technology firms with the University of California San Diego, La Jolla, CA, USA, among other courses. Prior to joining UABC, he was an independent consultant in strategy and information management for knowledge-based, energy, transportation, and retail firms. He also coordinates the Ph.D. in Management Science Program at Facultad de Contaduría y Administración (UABC), a member of the National Researchers System in México (SNI), and a certificate Professor by the Mexican Education Ministry (SEP). His research interests include complex systems and innovation strategies, digital transformation, subjective well-being, business and firm's intelligence, and knowledge management. Also, he has recently being appointed as a Member at Large of the IEEE Technology and Engineering Management Society.