Research paper

To recover faster from Covid-19, open up: Managerial implications from an open innovation perspective

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ABSTRACT

Covid-19 has severely tested our public health systems. Recovering from Covid-19 will soon test our economic systems. Innovation will have an important role to play in recovering from the aftermath of the coronavirus. This article discusses both how to manage innovation as part of that recovery, and also derives some lessons from how we have responded to the virus so far, and what those lessons imply for managing innovation during the recovery.

1. Introduction

Covid-19 has severely tested our public health systems. Recovering from Covid-19 will soon test our economic systems. Innovation will have an important role to play in recovering from the aftermath of the coronavirus. This article discusses both how to manage innovation as part of that recovery, and also derives some lessons from how we have responded to the virus so far, and what those lessons imply for managing innovation during the recovery.

Covid-19's assault has prompted a number of encouraging developments. One development has been the rapid mobilization of scientists, pharmaceutical companies and government officials to launch a variety of scientific initiatives to find an effective response to the virus. As of the time of this writing, there are tests underway of more than 50 different compounds as possible vaccines against the virus.[1] Most of these will ultimately fail, but the severity of the crisis demands that we investigate every plausible candidate. We need rapid, parallel experimentation, and it must be the test data that select our vaccine, not internal political or bureaucratic processes.

A second development has been the release of copious amounts of information about the virus, its spread, and human responses to various public health measures. The Gates Foundation, working with the Chan-Zuckerberg Foundation and the White House Office of Science and Technology Policy have joined forces to publish all of the known medical literature on the coronavirus, in machine-readable form [2]. This was done with the intent to accelerate the analysis of the existing research to identify possible new avenues of attack against Covid-19. The coronavirus itself was synthesized early on in the outbreak by scientists

in China, providing the genetic sequence of the virus, and showing where it differed from earlier viruses such as SARS and MERS. This data was immediately shared widely with scientists and researchers around the world. At the same time, GITHUB and the Humanitarian Data Exchange each have an accumulating series of datasets on the geography of the spread of the disease (including positive test cases, hospitalizations, and deaths).[3]

What these developments have in common is openness. In fighting a pandemic, speed is crucial, and the sooner we know more and are able to take action, the better for all of us. Opening up mobilizes knowledge from many different places, causing our learning to advance and our progress against the disease to accelerate. Openness unleashes a volunteer army of researchers, working in their own facilities, across different time zones, and different countries. Openness leverages the human capital available in the world to tackle the disease, and also accesses the physical capital (such as plant and equipment) already in place to launch rapid testing of possible solutions. This openness corresponds well to an academic body of work called open innovation (Chesbrough, 2003; Chesbrough, 2019).

Innovation is often analyzed in terms of costs, and the question of whether to "make or buy" often rests on which approach costs less. But in a pandemic, time is so valuable and essential, that the question of costs is far less important than the ability to get to a solution sooner. The Covid-19 disease appears to be doubling every 3–5 days, so a delay of just a few weeks in the search for a new vaccine (they normally take 1–2 years to develop, or more) might witness multiple doublings of size of the population infected with the disease. It is for this reason that Bill Gates is providing funds to construct facilities in advance for producing

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the leading vaccine candidates[4]. Though the facilities for the losing candidates will not be used, it will save precious time to make the winning vaccine in high volume, once it is found.

2. Open innovation in medical science

Open innovation can help speed things up. The availability of the gene sequencing of the coronavirus establishes a clear target to all of us. The 50 + vaccine candidates being considered are all already-approved drugs for other medical uses. This means that each candidate's basic safety dosage levels in humans have already been established. This allows the testing to start in the middle of the usual drug development process, with the Phase 1 safety protocols already completed. Releasing all the relevant medical research at once, in a machine-readable form that allows rapid absorption of the science, to anyone who wants to look at it, allows researchers from all over the world to contribute. And not just professional researchers and scientists, but also amateur researchers who have a passion and a hunch to test.

This openness in the scientific domain will likely help us find a vaccine sooner. And it is a good practice in the commercial world in ordinary times as well. Many powerful new technologies lack a clear and obvious way to create business value (think of artificial intelligence, or IoT, or blockchain). The best way to find the most attractive business uses is to enable widespread experimentation in a wide variety of possible applications. Don't try to pick the winner in advance. Instead, set up the tests, and let the resulting data guide your decision. And notice that many of these experiments can be done by others, with their own money, people, and equipment. So practicing more openness in the science and technology that undergirds your business is well worth your consideration.

But finding a vaccine is not enough. There are now more than a million confirmed cases of Covid-19, with tens of thousands people in serious or critical condition in hospitals to be treated (a number that is doubling every 3–5 days). First responders and hospital staff in many cities are now overwhelmed by the demand for their services, or soon will be. Openness could help here as well. There has been a shortage of personal protective equipment (PPE) for medical staff to protect themselves against the virus, including masks, gowns, and gloves. Mask manufacturers like 3 M have doubled production of their N95 masks in the past two months, yet this is not enough to meet the surging demand. What if mask manufacturers like 3 M opened up their mask designs and IP temporarily, so that anyone in the world with a 3D printer could print a mask?

There also is a severe shortage of ventilators in this crisis. To obtain many more as soon as possible, we need to enlist multiple stakeholders, including companies, NGOs, universities and individual inventors. For example, given the shortage of ventilators that are needed for the intensive care for some COVID-19 patients, ventilator manufacturers are forming partnerships with carmakers, aerospace firms and others to boost output as fast as possible.[5] Universities like MIT are trying to contribute to alleviating hospital shortages by launching a competition for the best open-source ventilator design.[6] Companies that make ventilators could also do more. What if ventilator companies also provided open access to their designs, and waived their IP rights? Medtronic in Israel has just announced that it is doing just that.[7] Moreover, the company will post the mechanical designs of its ventilators, so that

others can not only see the patents, but can use the actual designs to shorten the time needed to build more ventilators.

3. How open innovation works: outside in and inside out

To understand better how open innovation works, it helps to compare and contrast some of its principal mechanisms in normal times to our present crisis. Open innovation is defined as "a distributed innovation process involving purposive knowledge flows across organizational boundaries for monetary or non-monetary reasons" (Chesbrough & Bogers, 2014). It has two principal directions on knowledge flow: outside in, and inside out. These work somewhat differently in business-to-business (b2b) contexts than in business-to-consumer(B2c) contexts. Some quick examples help to clarify these mechanisms.

For outside-in knowledge flows, Procter & Gamble launched its Connect and Develop program to solicit collaborations with partners all over the world (Huston & Sakkab, 2006). In the Covid-19 crisis, the White House Office of Science and Technology policy published all of the relevant research on Covid-19 and the underlying SARS-Cov2 virus, to encourage collaborators to work on solutions. This mechanism can be extended to b2c contexts. NASA issued an Open Innovation challenge to the public, and received thousands of suggestions from individuals for ways to address hazards in space (Lifshitz-Assaf, 2018). In Covid-19, we are seeing similar crowdsourcing for therapies for managing the disease, plus ways to design and make masks, hand sanitizers, and even modifying a ventilator to support 2 patients at a time.

For inside-out knowledge flows in the b2b context, Amazon famously offered its internal IT infrastructure to host external customers' websites and IT needs (Huckman, Pisano, & Kind, 2008). In the Covid-19 pandemic, Medtronic has opened up its ventilator design for anyone to make, posted its internal design drawings for the ventilator, and waived its IP rights to the design. In the b2c context for inside-out knowledge flows, Lego allowed users and teachers to modify its Lego Mindstorms product to create a whole program of robotics instruction in middle schools (Afari & Khine, 2017). In the Covid-19 pandemic, many companies are converting part of their manufacturing processes to produce scarce supplies like hand sanitizer.

Open innovation mechanism	Example from "Normal Times"	Example from Covid-19 response
Outside in, b2b	Procter & Gamble, Connect and Develop (Huston & Sakkab, 2006)	US OSTP sharing all relevant research in machine readable format
Outside in, b2c	NASA Open Innovation Challenge (Lifshitz-Assaf, 2018)	Users sharing designs for masks, hand sanitizer and how to support 2 patients on one ventilator
Inside out, b2b	Amazon Web Services (Huckman et al., 2008)	Medtronic opening up its ventilator design and IP
Inside out, b2c	Lego Mindstorms (Afari & Khine, 2017)	Companies converting from making perfume or alcohol products to hand sanitizer manufacturing

4. Open innovation in crisis management

This openness could go still further. We have a severe shortage of hospital beds. We also have a lockdown on non-essential business travel, causing most business hotel rooms to go empty. Could we devise ways to allow non-contagious patients in hospitals to migrate to these unused hotel rooms? It is likely to be much cheaper than the fully allocated costs of inpatient hospital rooms. And this infrastructure is already built, ready to be used.

User innovation may have a role to play here as well (Von Hippel, 2005; Von Hippel, 2016) —because we know that solutions to complex problems may come for non-conventional sources, particularly when

[4] https://www.wsj.com/articles/bill-gates-to-spend-billions-on-coronavirus-vaccine-development-11586124716

[5] https://www.economist.com/international/2020/03/26/scientists-and-industry-are-dashing-to-make-more-ventilators

[6] http://news.mit.edu/2020/ventilator-covid-deployment-open-source-low-cost-0326

[7] http://www.israelnationalnews.com/News/News.aspx/278120 (Medtronic)

the users themselves stand to benefit from the solution. Users can make their own masks, which will both reduce transmission of the disease to them and more importantly for society, reduce their transmission of the disease to others. And these home-made masks will not deplete the scarce inventory of masks needed for front line medical staff. We are already seeing a version of this with hand sanitizers, as recipes for home-made hand sanitizers (usually featuring grain alcohol, and softeners like *Aloe vera*) abound on the internet. With ventilators, there are reports of individual physicians modifying ventilators to serve multiple patients simultaneously. These developments need to be validated by others, and then, if they withstand this scrutiny, deserve to be widely shared. This could be viewed as c2c, or consumer to consumer marketing. This is another lesson for innovation in the recovery: users can be a powerful source of innovative ideas and opportunities in your business as well.

The pandemic is also stimulating innovation in the management of intellectual property (IP). Some initiatives are now in place to encourage companies and universities to release portions their intellectual property (IP) in the fight against COVID-19. One group of scientists and lawyers in the US and Europe have started the "Open COVID Pledge" [8] that pledges not to assert their IP rights against anyone else who signs the pledge in the quest for solutions to the pandemic. The World Health Organization (WHO) has offered a proposal to create a patent pool for all who are working on Covid-19 initiatives, providing access to all critical scientific information in return for agreeing to compulsory licensing for essential information.[9]

Your own IP is something that you should scrutinize critically in the present moment. Instead of hoarding your IP solely for your internal use, opening up access to your IP might unlock exciting new possibilities with key suppliers, customers, partners, and universities. Most patents in most large companies are neither used nor licensed. This is wasteful in the best of times, and is even harder to justify in times like now.

5. Open innovation in the public sector

In normal times, most companies take their regulatory environment as given. In a pandemic, though, the regulators need to adapt as well. While we search for an effective vaccine, regulators should allow compassionate use of promising (but not yet approved) medicines, particularly those whose safety profiles have already been vetted as noted above. And vaccine candidate drugs that are already approved should not have to again undergo the initial safety tests that the FDA usually requires. Regulators also need to be more open themselves. If regulators in Japan approve a ventilator during the crisis, that should imply provisional acceptance for that device in Spain or the US, so long as certain procedures were followed and, importantly, the Japanese regulator shared the underlying data that justified the approval. Transparency offers society protection against poor or shoddy offerings, so regulatory studies themselves need to be widely shared in these times of crisis.

In order to do achieve an effective response from these various open initiatives, we need to agree upon mechanisms of coordination for the open platforms that collect the initiatives and their underlying data. We further need appropriate governance over those platforms to assure that those posting to it will not be abused or harmed by their participation. By investing governance authority over open platforms in agencies such as the WHO, a trusted repository of information can be established for the benefit of public and private organizations around the world. Openness can help build trust, which is an essential ingredient in fighting a pandemic, and a critical part of sustaining your brand image

in more ordinary times.

Other public constraints also require attention in these times. Product liability laws may need to be suspended temporarily, and/or public indemnification for companies from litigation may be needed to speed up the rapid development and manufacture of critical equipment, diagnostics, vaccines, and so on. Society should be willing to accept somewhat higher risk — still insisting on transparency in the process of development — during this crisis period, if it results in faster availability of these items in market.

If and when the crisis begins to abate in the developed countries, it sadly seems quite likely that there will be an extension of the pandemic in less developed countries. The openness provisions sketched here must enable those impacted countries to quickly access all of the data, techniques, vaccines, and other technologies they will need to combat the virus (along with the human, physical and financial resources they will need). This is not only just and humane, it is also enlightened self-interest. Absent such assistance, people from those countries might otherwise ignite a global revival of the virus, or give rise to a viral mutation that evades our treatments, forcing us to start the pandemic cycle all over again.

6. Managerial implications for recovery from the crisis

There are lessons here for us for managing innovation even after the crisis has finally passed. Openness is essential to respond to the pandemic. But it is actually a good practice for you to employ even in normal times. Here are some suggested open best practices for you to use, as you chart your course to recover from the pandemic:

1) Encourage your scientists and engineers to engage deeply with the wider scientific community. Allow them to invest time and contribute work to the community. This will sharpen their own knowledge and provide additional validation for prospective innovations being considered in your company. Encourage them to launch and share their own experiments and learn from the experiments of others.
2) Many of your most challenging problems might benefit from solutions from others in different places around the world. Share some of these problems, along with their relevant scientific and technical data, on open platforms, so that anyone with the interest and knowledge can offer their ideas on how best to address the problem. Be sure to include users in your search for new opportunities.
3) Work with your legal team to manage your internal IP more creatively and openly. Most large companies do not practice or license most of their patents. Instead, separate your IP into three buckets: a) the Crown Jewels, that will be protected as before; b) the Middle group that can be shared selectively with key customers, suppliers, and/or partners for mutual business benefit; and c) the Long Tail of IP that should be opened up to everyone (thus enabling others to innovate more, and saving on patent renewal fees).
4) When you achieve a major technology breakthrough, why not license out the previous generation technologies (which worked pretty well, and are good enough for many markets) to spread these technologies to new markets? And when your next breakthrough product emerges, your now-obsolete earlier version is again put up for license. Only now there is an entire new market waiting for the improved product, built up from the earlier generation of licensing.

7. Conclusion

Good ideas can come from anywhere, making openness is an imperative in these times of crisis. Opening up will speed up your internal innovation process, and allow you to take advantage of the knowledge of others in your business (outside in), even as you allow others to exploit your knowledge in their business (inside out). This will create more experiments, generate more knowledge, and explore more ways to

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[8] https://opencovidpledge.org/
[9] https://www.statnews.com/pharmalot/2020/03/24/covid19-coronavirus-costa-rica-intellectual-property/

apply that knowledge for customers' businesses. And it is a good business practice in other times as well. This is one of the many lessons we are learning as we struggle to meet the challenge of our times.

This openness contrasts sharply with some of the rising nationalist trends we are seeing. Excluding entire countries from access to vaccines, or ventilators, or masks, or tests, or other critical equipment will undermine the ability to enlist the creative minds and imaginations of us all to address the crisis. Moreover, it is short-sighted in the extreme, as shifting the pandemic out of one country in the short term will only cause it to return later, possibly in a mutated form. Global public health simply works better – and faster – when we open up.

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