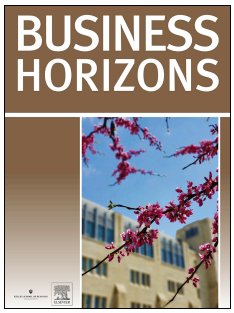

National response strategies and marketing innovations during the COVID-19 pandemic

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National response strategies and marketing innovations during the COVID-19 pandemic

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Abstract
During the COVID-19 pandemic, different nations have adopted a variety of response strategies to fight and contain the new coronavirus. Such national response strategies can be classified into three categories based on their underlying philosophy: strict control with unlimited resources, relentless contribution with limited resources, and rough rationality with limited resources. We discuss the philosophies, characteristics, and performances of the three response strategies and when they should be adopted. We also examine what marketing innovation strategies enterprises should adopt to survive and grow their businesses in both the short and long term. This study provides important strategic implications for national policymakers and enterprises on the use of response strategies as well as marketing innovation tactics and strategies to be used both during and after the pandemic.

KEYWORDS: COVID-19; Pandemic response; Marketing innovation; Business resilience

1. The wide spread of COVID-19

With the worldwide spread of COVID-19 and the number of illness and death cases climbing, the World Health Organization (WHO) declared on March 11, 2020, that the coronavirus outbreak was a pandemic and called for countries to take urgent and aggressive actions in response (Branswell & Joseph, 2020). Less than 1 week after the declaration, the number of confirmed cases around the world was growing rapidly every day. As of May 30, 2020, the total number of confirmed cases in the world was 5,958,857, with 365,593 deaths, and the number is still rising (Johns Hopkins University, 2020a).

The International Monetary Fund (IMF) and Wikipedia have separately compiled national responses to COVID-19 from many countries or regions (IMF, 2020; Wikipedia, 2020). Based on the data on confirmed cases, deaths, and mortality rates, the nations or regions that have dealt well with the pandemic include China, Vietnam, Singapore, South Korea, Taiwan, and New Zealand (Johns Hopkins University, 2020b). For example, compared to many other countries, the outbreak in China appears to be declining, indicating that the virus can be suppressed and controlled. As of May 30, 2020, China had achieved a staged victory in the prevention and control of the epidemic, with 4 new confirmed cases, 0 new deaths, and 1 new suspected case nationwide (China National Health Commission, 2020). In contrast, in countries such as the U.S., United Kingdom, Italy, France, and Brazil, the response to the pandemic has been disappointing (Johns Hopkins University, 2020b). Meanwhile, there are also significant differences in response and effectiveness within countries. For example, some states (e.g., Washington, Louisiana, Idaho, Michigan) in the U.S. have been more effective than others (e.g., Illinois, South Dakota, Virginia, Alabama; Drum, 2020). In Canada, while the provinces of Quebec and Ontario have witnessed a catastrophe, the province of British Columbia has seen one of the most successful outcomes in the world (Cecco, 2020).

The health and safety of people is the foremost concern as nations make vital decisions in the fight against the global spread of COVID-19. The new coronavirus infects people regardless of race or nationality. When humans become infected, they also become carriers of the virus. Carriers of the virus may not show apparent symptoms and are contagious during the incubation period. Therefore, nations and businesses are fighting an invisible enemy. Currently, there is no reliable medicine or cure to eliminate the virus, and we are still developing a vaccine. Moreover, there are not enough accurate, simple, and fast detection tools and methods available to immediately distinguish between virus carriers and noncarriers or between new coronavirus carriers and ordinary influenza patients. Therefore, the response strategies adopted by countries and businesses around the world not only determine the survival of many people and businesses but also determine whether the pandemic can be controlled globally.

2. Three national response strategies

Due to the dynamics and variability of COVID-19, there is both a global battle for survival and a race against time, and it is important to think globally and act locally (Haffajee & Mello, 2020). This is not only a battle for medical treatment but also a war for materials security; it is not only a virus confinement fight but also a psychological war to appease the hearts of the people. According to the epistemology of each country for cutting or delaying virus transmission

(Wright, 2020; Xiang, 2020), we place national response strategies to the pandemic into three categories with four approaches used in different periods in different countries.

2.1. National response strategy I: Strict control with unlimited resources

The first response strategy is strict control with unlimited resources. Specifically, this strategy focuses on rallying the country's human, material, financial and medical resources to implement a joint prevention and control mechanism to completely block the epidemic situation and cut off the virus transmission channels. Treatment methods include the adoption of mandatory quarantine for all confirmed and suspected patients at various types of hospitals and medically centralized isolation points, the self-isolation at home of all people in a country or state, the full suspension of work and school, community lockdown, and required daily reports on health and out-of-home activities for everyone. For each individual, it is important to implement epidemiological tracking and not to go out without wearing a mask. For example, China adopted this response strategy.

2.2. National response strategy II: Relentless contribution with limited resources

The second response strategy is relentless contribution with limited resources. Specifically, this strategy does not enforce mandatory isolation or containment. Instead, based on the epidemiological principle of a low COVID-19 mortality rate in the whole society, this strategy allows humans to generate immunity through infection with the virus. This approach reduces the virus's infectivity to slow the spread of the virus and lowers the peak of the epidemic. Therefore, the patients who die make a life contribution to the production of antibodies throughout society. Two approaches implement this response strategy.

2.2.1. The herd immunity approach

This approach targets a population infection rate of approximately 60%–70% to develop self-immunization and form a collective shield after infection, thereby limiting the continued spread of the virus and ultimately protecting the entire society. This approach is not an individual-level control strategy. Therefore, there is no restriction on travel and community activities. At the same time, the use of limited medical resources for critically ill patients requires that all susceptible people, especially those over 70 years old and people with chronic diseases, stay at home. Countries such as the United Kingdom, Sweden, and Germany have adopted this approach (Campbell et al., 2020).

2.2.2. The herd immunity approach with limited social restrictions

On the one hand, this method is adopted with the expectation that the public will develop self-immunity from COVID-19. On the other hand, the government could be authorized by legislation to implement national emergency regulations and mobilize federal and private resources to urge all hands on deck to protect the health and safety of the public. Therefore, limited restrictions are imposed on the country's transportation to and from key epidemic areas. Countries such as the U.S.A., Italy, France, Spain, and Japan have used this method.

2.3. National response strategy III: Rough rationality with limited resources

The third response strategy is rough rationality with limited resources. Specifically, this strategy requires closing national borders, severing contact with affected countries, and preventing the importation of the virus internationally. Within the country, the approach is limited to the

lockdown of infected cities and towns without implementing individual-level quarantines or controls. Countries or regions that have adopted this strategy include North Korea, Singapore, South Korea, Taiwan, Macao of China, Russia, and Israel.

3. Philosophies of national response strategies

In the battle against the pandemic, humans and businesses must first survive. Sufficient financial, medical, and material resources are the key to defeating the virus and play a vital role in increasing the effectiveness of prevention and control. However, in many Western countries, despite abundant wealth and rich medical resources, many of these resources—hospitals, doctors, and medical equipment—are private. The government cannot expropriate the medical equipment of private medical institutions and medical workers at will. For example, countries such as the U.S. (e.g., the Stafford Act), Japan, the United Kingdom, France, and Spain require governmental authorization to activate corresponding laws and regulations to declare the nation as being in a state of emergency (Wolfe, 2020). This declaration grants the head of the nation several special powers and provides greater flexibility to use extrabudgetary funds for pandemic prevention and control (Kyodo, 2020; Sim, 2020). Therefore, because of the differences in national systems and institutions in many countries around the world, strategies to prevent and control the pandemic are being implemented under the constraints of limited resources. This is also the reason why there are three types of national response strategies, two of which are based on the rationality of limited resources.

In this fight, everyone must strictly guard their boundaries against the virus. For example, wearing a mask is a line of defense between the individual and the virus. In many countries and regions around the world—such as France and Hong Kong of China—there is a mask ban law, which prohibits people from using any materials to cover their faces in public (Southern Metropolis Daily, 2020). However, these laws mention that wearing masks for medical reasons is not prohibited but is conditional on the authorization of a relevant authority proving the necessity of wearing a mask. Such regulations have not been suspended or were suspended only late in the current battle against COVID-19. As a result, in many countries' response measures to cut off the virus transmission channels there is no mandatory requirement that everyone wears a mask. In the meantime, masks have been in short supply in many countries as preventive and controllable medical resources. They have long been out of stock in many markets, and people have been unable to buy them when needed (Sanlian Life Weekly, 2020).

An individual is either infected or uninfected by the virus. After infection, the individual either survives due to self-immunity or dies from the virus attack. These events could be considered high-probability events. Therefore, the National response strategy I is based on the consideration of the maximum protection of each person's life under the high-probability life threat to every individual. Consequently, the public is willing to accept the government's strict control of the pandemic. Saving lives as the top priority has become the consensus of the government and the people. Therefore, it is a rational measure. At the same time, to hold back the virus spread and block the transmission channels more effectively, several important measures are deployed, including lockdowns of heavily infected areas and requiring everyone to digitally report their health status daily, as implemented in China. In this way, each person generates a data file every day, and the aggregation of this data for the whole society leads to a large data system. The

system is updated daily, which can help the government to clearly understand the daily behavior and health status of every citizen in the whole society. This is beneficial to epidemiological tracking. Every 14 days, the system can generate a colored digital QR code for each person based on his/her health conditions in the past 14 days. This information is dynamic, with QR codes colored green, yellow, and red given to healthy people, suspected patients, and confirmed patients, respectively. Only people with a green QR code are allowed to go out to conduct business, shop, take public transportation, or enter or leave certain places. Thus, the prevention and control strategy is tailored to each individual. In addition, the government can adopt fiscal measures to cover the medical expenses of patients diagnosed across the country to prevent and control the pandemic no matter the costs. This is the philosophical basis of the National response strategy I.

Another belief about the pandemic is that the number of deaths is low and occurs in a small percentage of the population, usually several cases per ten thousand people. For example, in the U.S., seasonal flu kills 30,000–50,000 people annually, which accounts for one ten-thousandth to 1.6 ten-thousandth of the 300 million U.S. residents. Therefore, one may consider seasonal flu to be a small-probability event. Consequently, the two approaches used in the National Response Strategy II are based on the consideration of such small-probability events from the scientific perspective of the virus epidemic.

First, an intermediate host that enables COVID-19 to be passed on to humans has not been identified, and the virus's ability to stay in a human body is very strong (i.e., 20 times that of SARS). As a result, the virus may persist for a long time. Second, the current COVID-19 virus does not have a direct cure, nor does it have an approved and readily available vaccine to enable humans to produce antibodies. Furthermore, the virus may mutate during the global pandemic. Therefore, the current prevention and control strategies adopted by different countries can only change the epidemic curve of the virus, and it is best to reduce the peak of the epidemic curve to embrace a flattened low-growth shape. Only in this way can sufficient medical capacities be guaranteed with limited resources for normal treatment. One way to achieve this flattened curve is to follow the principles of virology. Specifically, each virus has an infection value, which is how many healthy people an average virus carrier will infect. The greater the infection value, the stronger the virus is. When the infection value is less than 1, it is theoretically believed that a virus carrier will not infect even one healthy person, and the virus will gradually disappear. The infection value of COVID-19 is approximately 3 (Iftikhar, 2020). Therefore, in theory, to make COVID-19 disappear, it is necessary to reduce its infection value to less than 1. Thus, more than two-thirds of society must be exposed to the virus and produce antibodies to form herd immunity. After being infected by a virus, the higher the number of people who recover is, the higher the number of people who have antibodies. As a result, the people with antibodies will form an invisible protective shield for the entire society, greatly reducing the number of susceptible people and preventing the virus from spreading. Given that two-thirds of the entire population has been exposed to the virus, that not everyone can produce antibodies and that there will be a 5% mortality rate among the patients diagnosed with the virus, the people who die of this virus will make a life sacrifice for the production of antibodies in the whole society. This is the philosophical basis of the National response strategy II.

Some countries with limited resources do not want to adopt the aforementioned herd immunity method. They believe that even with two-thirds of the population being infected with the virus, as based on probabilistic calculations, there is no guarantee that antibodies will be produced 100% of the time. In the meantime, they also do not have sufficient financial resources, and the physical and human resources cannot be refined at the individual level. Therefore, the best option for them is to carry out general and large-scale border control and blockades, which is the philosophical basis of the National response strategy III.

[Insert Table 1 About Here]

4. Characteristics and performances of national response strategies

We next examine the different characteristics and performances of the three national response strategies, as summarized in Table 1. The first strategy of strict control with unlimited resources is implemented at the individual level to protect human lives and comprehensively contain the spread of the virus no matter the costs. To do this, the government needs to rally national resources, undergo a nationwide mobilization, use national medical resources to treat all patients, and block all possible transmission of the virus. China has adopted this approach with encouraging results. Its measures include the following:

- Strong public financial support. As of February 25, 2020, China's fiscal departments in the government at all levels arranged more than CN¥108.75 billion in subsidies for epidemic prevention and control. At the same time, various tax and fee reduction policies were implemented (Xinhuanet, 2020).

- Strong logistics support. The above fiscal policies are closely linked with the implementation of relevant monetary and industrial policies to encourage the enterprises of key materials for epidemic prevention and control to actively increase their production capacities and improve the timeliness of material transportation. The total estimated amount is greater than CN¥510 billion (Guangming, 2020a).

- A steady stream of medical staff and adequate medical resources. In the endangered areas in Hubei Province and Wuhan, China, necessary medical facilities were built with no regard to the costs. These include urgent investments in the construction of two hospitals, the reconstruction of 16 mobile cabin hospitals, and the state procurement of scarce medical supplies and protective equipment. As of March 8, 2020, 42,000 medical staff in 346 medical teams across the country joined together and supported the local fight against COVID-19 in Wuhan and Hubei (Guangming, 2020b). At the same time, 10% of the nation's critical care teams supported Wuhan in person (China News Weekly, 2020).

- Fiscal coverage for the treatment costs of diagnosed patients across the country. For example, it is estimated that the cost of treating an ICU

patient infected by the COVID-19 virus is approximately CN¥710,000, which is covered by financial support from the government (Yi, 2020).

- Blocking all possible channels of the spread of the virus. These measures include the suspension of work and school, lockdowns of villages, cities, and communities, self-isolation at home, and the requirement to wear a mask when going out.

- Strict prevention and control mechanisms for individual and social activities. Each individual's daily health, contact, and movement information can be tracked and reported to one or multiple responsible persons in the residential community. This information is collected digitally and forms a large, dynamic, real-time, and intuitive big data set of each person's activities and characteristics. Such a large data system provides substantial help to make the best decisions about joint prevention and control. It also provides effective tool planning for the resumption of work and production in the later stages of the pandemic to ensure the safe movement of people.

Notably, under this strategy, if the social organization of joint prevention and control is not sufficient, the medical system may be overwhelmed, but a larger humanitarian crisis can be avoided. The use of the abovementioned big-data system for strong blocking is implemented at the expense of personal privacy in exchange for the safety of the entire society. Taking China Mobile, one of the three major mobile carriers in China, as an example, the GPS in the mobile phone and the abovementioned big data health systems are used to generate a QR code query system for each person's travel safety. Anyone can use the system to check his/her own travel history. Because one may want to know whether the community they live in is safe, some online platforms also enable inquiries about the status of each community concerning COVID-19.

Since the lockdown of Wuhan, China, on January 23, 2020, the nationwide implementation of the abovementioned strict joint prevention and control mechanisms has achieved great results. Although the virus has not been eliminated, as of May 30, 2020, China had only 4 new confirmed cases, 0 new deaths, and 1 new suspected case nationwide (China National Health Commission, 2020). As a result, the rate of resumption of industrial enterprises in China—except Hubei Province—has exceeded 90%, and medical teams that moved from other provinces to support Hubei have begun to withdraw in an orderly manner, according to the China Central Television news report on March 17, 2020.

Undoubtedly, behind the good results are not only the contributions of the whole nation made with great effort and struggle but also the various guarantees of sufficient logistics resources. The social cost of this national response strategy is considerable. Although the exact economic figures of the pandemic are not yet known, we can refer to the 2009 H1N1 influenza pandemic as a benchmark, which caused the GDP of the origin country of the H1N1 influenza (Mexico) to shrink by approximately 5.3% and resulted in economic losses of tens of billions of dollars. According to statistics from the Brookings Institution, a U.S. think tank, SARS caused losses of approximately $40 billion to the global economy. As mentioned earlier, many countries'

response strategies rely heavily on private sources, and governments are very careful with taxpayer money. Therefore, invisible consciousness has turned the antipandemic strategy into a strategy of mitigating the pandemic by the careful use and protection of capital, thereby leading to a long-term fight against the virus. However, the desire to protect capital is likely to be wishful thinking because the high probability of an individual's infection by the virus could easily trigger a humanitarian crisis, which will lead to a series of reactions, such as the continued decline of the stock market and social crises. For example, on March 12, 2020, the three major stock indexes in the U.S. all fell more than 7% upon opening, collectively triggering a fuse. During the session, the federal government urgently attempted to rescue the market but was unable to reverse the situation. This is the third time that U.S. stocks have fused in nearly 30 years.

For many countries around the world, early outbreaks are scattered and not as concentrated as those in Wuhan, China. In some countries, the density of various communities is low, the communities are open, residential housing is mostly scattered low-rise buildings, and mutual visits among neighbors are uncommon. Therefore, per local conditions, it is not necessary to adopt a strategy of completely locking down the entire community and closing roads. To protect groups of minors such as students, however, countries around the world have adopted a consistent strategy: the suspension and lockdown of schools and moving all courses online by suspending face-to-face classes and transitioning to virtual learning.

In the anti-COVID-19 fight, many countries adopting the national response strategies II and III are unable to track each individual's epidemiological dynamics continuously. The main reason is that many countries around the world, especially EU member states, have personal privacy data protection laws such as the General Data Protection Regulation, which stipulates that personal health, behavioral, and identity information of citizens are not allowed by the law to be used by unauthorized people and institutions. As a result, many countries have broadened the overall monitoring and control of national borders rather than implementing refined prevention and control strategies at the individual level, such as tracking individuals' health and activities.

Due to the dynamic nature of the pandemic, the three national response strategies may be used alternatively in the fight against the virus. We can take Germany as an example. Before the wide spread of COVID-19 in Italy, Germany's strategy was somewhat similar to China's. At that time, a dozen confirmed cases had appeared in Bayern, Germany, and all these patients were quarantined in a hospital. Bayern's health department also quickly tracked all close contacts of the patients and successfully cut off the chain of infection. Since then, there have been no new cases throughout Bayern. A few weeks later, these patients recovered and were discharged from the hospital without much suffering.

In the middle of February 2020, after Germany discovered confirmed coronavirus cases imported from Italy, the European Union still did not intend to establish border control for European countries. With German labor and capabilities, the close tracking of the virus infection chain would only be effective when the number of cases was small. Once hundreds of people were infected, the number of close contacts that needed to be tracked increased by a geometric order of magnitude. This huge investment in human power and effort could not be achieved in Germany. Therefore, Germany adjusted its antipandemic strategy according to the situation in

Europe. To put it simply, from the beginning, the first response strategy adopted in Bayern, Germany was strict control with unlimited resources, and later, they adopted the second response strategy of relentless contribution with limited resources. Only by understanding these strategies can we understand the subsequent series of policies and behaviors in Germany.

The coronavirus began to spread quickly in Germany's North Rhine-Westphalia region. At this time, Germany sent all mild and asymptomatic patients home for isolation. Even though there were available beds in the hospital at that time, they did not immediately accept mild patients simply to vacate the beds and save a large number of beds for critically ill patients later. Moreover, German society and major media urged citizens not to go directly to hospitals or clinics if they had cold and cough symptoms but to call a family doctor first. Through these telephone interviews, the vast majority of cold patients, including those with mild coronavirus symptoms, were directly kept at home by family doctors for isolation. Why did Germany leave thousands of mild patients at home? It was not due to the virus itself but rather the potential flood of patients overwhelming the limited medical resources. When many people rush to the hospital, cross infections can occur. A more serious problem is that if the medical system collapses, people who are in critical condition might not be treated, thus leading to a sharp increase in the death toll.

Notably, regardless of which of the above three national response strategies was adopted, COVID-19 has not been eliminated. It has the potential to make a comeback at any time. Therefore, the best approach to defeat the virus is to launch highly effective vaccines and antiviral drugs and simultaneously find the intermediate hosts of the virus.

5. Missing the window: Role of early warning systems

COVID-19 is the only virus in history that has caused the WHO to issue alerts one after another, from outbreak to epidemic and then to pandemic. Although we are far more prepared since the SARS pandemic in 2003 and the H1N1 pandemic in 2010, COVID-19 likely represents the worst public health crisis in a generation. We know the importance of early warning in prevention and control. However, the early warning system did not play its "early" and "alert" roles in all countries regarding coronavirus. The period in which that window was open was missed.

According to a joint inspection report on COVID-19 between China and WHO on February 24, 2020 (WHO, 2020), the outbreak occurred on December 2, 2019. There was a 53-day window between the outbreak in December 2019 and the lockdown of the epicenter, Wuhan, China, on January 23, 2020. It is unfortunate that during this window, due to hesitation in response, 5 million of the 16 million Wuhan citizens left the epidemic area before locking down the city (China CCTV News, 2020). According to a leading medical expert in China, Dr. Zhong Nanshan (Caixin, 2020), if the government had implemented measures five days earlier, the epidemic would have been effectively controlled, and the final number of confirmed cases would not have exceeded 25,000. However, if implementation had been postponed for five days, the number of cases would have increased exponentially. Therefore, early detection and isolation are of foremost importance.

In addition, on the China Central Television "News 1 + 1" program on the evening of February 17, 2020, Mr. Jiao Yahui, the deputy director of the National Health and Medical Commission's Medical Affairs and Hospital Administration Bureau, said that the Wuhan epidemic lasted a long time because of the lack of timely control measures. Many community cases were not treated promptly. On average, it took 9.84 days for severe cases to develop from onset to hospitalization. If the best treatment time in this 10-day window was missed, it was very likely that waiting would cause mild cases to become severe or critical.

For the rest of the world, the period from the lockdown of Wuhan, China, on January 23, 2020, when the world was convinced that this was a severe infectious disease, to March 11, 2020, when WHO announced that coronavirus escalated to the highest-level pandemic, was 49 days. Many countries, including the U.S., did not immediately take emergency measures to lock down cities and the nation to cut off the channels of virus transmission. As a result, the epidemic repeated the situation that occurred in China within other countries. As of May 30, 2020, the number of confirmed cases outside China exceeded 5.87 million (Johns Hopkins University, 2020a).

This shows that in the criteria for evaluating early warning responses, the weights of relevant elements in the early warning systems did not produce a true "alarm". Therefore, the issue of how to make the most effective response quickly remains a major research topic with great academic and practical value.

6. Marketing innovation during and after the pandemic

While severe crises and catastrophes such as this pandemic are awful, they almost inevitably result in innovations that benefit humanity. For example, the wars of the last 100 years, as horrible as they were, gave us life-changing innovations such as microwave technology, drones, GPS, and penicillin (Boot, 2007; Satell, 2015). The Great Recession in 2008 led to financial innovations such as Kabbage, NerdWallet, Venmo, and Kickstarter (MacConnell, 2020). This pandemic will undoubtedly see innovations that may change the world. In the short term, enterprises may face several serious problems, including cash-flow shortages, the shutdown of facilities, and the disruption of the supply chain. Therefore, it is critical for enterprises to adopt a number of innovation tactics for business survival. In the long term, the crisis could become an opportunity for marketing innovation and transformation, which will lead to business growth and sustainable competitive advantage. As a result, we propose some tactics and strategies for enterprises to grow their business and establish sustainable competitive advantages, as shown in Table 2.

[Insert Table 2 About Here]

First, in the short term, business survival throughout the pandemic will be the top priority. To ensure survival, an enterprise can adopt some quick tactics given the three different national response strategies in its country. In Table 2, we present different innovation tactics to address cash-flow shortages, the shutdown of facilities, and the disruption of the supply chain. To solve the problem of cash-flow shortages, an enterprise can adopt innovative marketing tactics to expand revenue sources and cut costs simultaneously. In terms of revenue expansion, an

enterprise can attempt to apply for external funding such as government subsidies, tax cuts, loans, venture capital investments, and outside grants. Such external funding may have eligibility requirements. Hence, not every firm is qualified for these funds. On the other hand, the enterprise could engage in rapid marketing innovation internally to explore more revenue sources from its current and new customers. For example, because many consumers are working from home, an enterprise can quickly implement online marketing innovations and establish and expand the online business team to transition their offline businesses online. Examples of such online marketing innovations include using Chatbots and A.I., connecting customers directly using private messaging apps, providing personalized offers and interactive contents to customers, and adopting digital and social media to form authentic relationships with customers and other stakeholders. Many restaurants, technology, and services firms—such as airlines, utilities, technology firms, and universities—have quickly adopted such tactics successfully.

Another tactic that an enterprise can use is to undertake marketing innovations, including embracing a customer-centric marketing mindset and engaging in proactive customer relationship management (Sun et al., 2006). During the pandemic, many customers naturally run into financial, personal, and social difficulties. As a result, they may have a high expectation of the customer services and social responsibilities of firms. More than ever before, customers may attribute product or service issues to the firm, resulting in low customer satisfaction and a high customer attrition rate. Therefore, it is critical for enterprises to proactively adopt a customer-centric mindset by tracking and learning about each customer's needs and preferences over time and making optimal marketing decisions accordingly.

During such a crisis, engaging in proactive management—reaching out to customers, listening to them, offering help, and learning about their problems and needs—is more important than ever. Such marketing innovations could effectively bring in new customers and increase revenues from current customers. Managers need to know that their content marketing establishes engagement and goodwill/brand awareness with little impact on revenue in the short term and that it is a good investment toward future revenue based on relationship strengthening. Enterprises in a country adopting National Response Strategies II and III, where their production facilities are not completely shut down, can adopt rapid product innovation tactics, including switching to the production of face masks, medical protective gear, or other medical equipment if their capabilities allow. They can also try to advance the selling of their products and services during the crisis. Finally, the enterprise can implement cost-cutting measures to reduce nonessential production and operation costs. During the crisis, firms should have a people-first mindset and treat their employees, partners, and customers fairly. This means that employee layoffs should be considered with care and used as the last option.

Facility shutdowns are more severe for enterprises in a country adopting national response strategy I because an enterprise's factories and offices are usually required to be shut down completely during the pandemic, and reopening depends on the development of the crisis. In countries using national response strategies II or III, an enterprise's factories and offices may still be open for business. Such different requirements in countries with different response strategies may call for different production and operation approaches. Specifically, in the case of a complete shutdown of facilities, the enterprise should move all their business online during the crisis if possible. A company can implement innovative online operations, customer support,

product offerings, and internal team collaborations with employees working from home or other safe locations. Enterprises with partial or no shutdowns can also adopt flexible and innovative production and operation schedules, including simultaneous online and offline operation of businesses.

In terms of disruption of the supply chain, no matter which country the enterprise is in, it can attempt within-chain collaborations and innovations. Specifically, within the supply chain, all channel members need to work together and help each other survive the pandemic. For example, a restaurant can close its dine-in business but work closely with online food delivery websites to obtain new contracts and expand its delivery and take-out services. A manufacturer may even come up with an innovative contract with its retailer (e.g., Walmart, Amazon) or logistics management company (e.g., UPS) to let its employees work for the latter during the crisis due to its factory shutdowns and the latter firms' temporarily increasing demand for more labor during the crisis.

Second, regarding long-term strategies, this pandemic can serve as an opportunity for a variety of business models, marketing and strategic innovations, and business acquisition. In business model innovation, a good long-term strategy is to enable the digitization of the business. For digital and informational products and services, this goal is easy to achieve with the help of the internet and digital technology. However, for the production of physical material products, digitization is challenging; it requires new AI algorithm design and breakthroughs in industrial software. When using mobile robots instead of workers to operate production equipment, they must be able to organize production, logistics, and distribution according to intelligent software. The algorithm design of industrial software should also enable mobile robots to complete planting, breeding, and industrial production on time under the remote command of humans.

In addition, the pandemic has revealed that in the future, enterprises' production and business models can adopt a flexible way of combining peacetime/wartime to cope with complex and changing markets. The production technology of an enterprise in ordinary times consists of conventional production. When a crisis occurs, the company's production technology should be able to quickly turn into a defensive force to maintain the company's continuous production instead of blindly looking for new business opportunities. This approach requires enterprises to establish some reserved production technology routes. During the production of one generation of products, they should consider the development of a new generation and plan another new generation of innovative products in a strategically phased manner. Such an approach will increase the firm's probability of surviving a crisis and experiencing long-term growth. It is also a good idea to build a complete innovation chain from raw materials, equipment, production technology, application technology and standards, and downstream product markets to constantly promote the company's overall technology upgrade to enhance the enterprise's resiliency.

Regarding marketing and strategic innovations, enterprises should take a long-term and forward-looking view of business growth. Specifically, companies can embrace the aforementioned customer-centric marketing mindset by proactively learning and tracking each customer's needs and preferences over time. During this process, with the help of various technologies—such as big data, AI, machine learning, cloud computing, internet, and information technologies—the enterprise can develop and maintain a win-win relationship with its customers, partners, and

other stakeholders in the long term. This could also result in new business culture innovation such that a new and financially healthy customer-centric and people-first business culture will be implemented. Last, the pandemic could also be a good opportunity for business acquisitions and mergers if it fits the enterprise's strategic goals and if there is sufficient financial support. In summary, a crisis such as the COVID-19 pandemic could become a good opportunity for an enterprise's business survival in the short term as well as its long-term growth.

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Table 1. Characteristics and performances of the three national response strategies

Factors	National strategy I: Strict control with unlimited resources	National strategy II: Relentless contribution with limited resources	National strategy III: Rough rationality with limited resources
Treatment of virus transmission channels	National containment	Blocked in some areas	Blocked in some areas
Source of financial support	Public resources	Public and private	Public and private
Single-person infection probability	High-probability event	Low-probability event	Low-probability event
Medical power	National	Voluntary, public, and private expropriation	Voluntary
Medical equipment	National all-inclusive	Public and private expropriation	Public and private expropriation
Patient treatment cost	Patient free, Covered by governments	Paid by patients and medical insurance	Paid by patients and medical insurance
Lockdowns	All	Partial	Partial
Population density	Dense	Sparse	Sparse
Individual epidemiological follow-up	Health tracking for everyone	None	None
Personal health information privacy	Sacrificed	Protected	Protected
People with antibodies	Few	Many	Many
Virus eliminated or not	No	No	No
Best solution	Vaccine	Vaccine	Vaccine

Table 2. Innovation strategies conditional on the three national response strategies

Time horizon	Business problems	National strategy I: Strict control with unlimited resources	National strategy II: Relentless contribution with limited resources	National strategy III: Rough rationality with limited resources
Short term	Cash flow shortage	• External funding: government subsidies, tax cuts, loans, VC, etc. • Innovation in online business • Customer-centric marketing • Proactive customer relationship management • Cost-cutting measures	• External funding: government subsidies, tax cuts, loans, VC, etc. • Innovation in online business • Product innovation • Customer-centric marketing • Proactive customer relationship management • Cost-cutting measures	• External funding: government subsidies, tax cuts, loans, VC, etc. • Innovation in online business • Product innovation • Customer-centric marketing • Proactive customer relationship management • Cost-cutting measures
	Shutdown of facilities	• Marketing channel innovation: online	• Production and channel innovation: flexible operation	• Production and channel innovation: flexible operation
	Disruption of supply chain	• Within-chain cooperation and innovation	• Within-chain cooperation and innovation	• Within-chain cooperation and innovation
Long term	Business growth and sustainability	• Business model innovation: digitization • Marketing and strategic innovations • Business acquisition and mergers	• Business model innovation: digitization • Marketing and strategic innovations • Business acquisition and mergers	• Business model innovation: digitization • Marketing and strategic innovations • Business acquisition and mergers