MANAGING INNOVATION DURING THE PANDEMIC

Dr. Nomita Sharma

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Managing Innovation During the Pandemic

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PREFACE

The P-Insights, short for "Productivity Insights," is an extension of the Productivity Talk (P-Talk) series, which is a flagship program under the APO Secretariat's digital information initiative. Born out of both necessity and creativity under the prolonged COVID-19 pandemic, the interactive, livestreamed P-Talks bring practitioners, experts, policymakers, and ordinary citizens from all walks of life with a passion for productivity to share their experience, views, and practical tips on productivity improvement.

With speakers from every corner of the world, the P-Talks effectively convey productivity information to APO member countries and beyond. However, it was recognized that many of the P-Talk speakers had much more to offer beyond the 60-minute presentations and Q&A sessions that are the hallmarks of the series. To take full advantage of their broad knowledge and expertise, some were invited to elaborate on their P-Talks, resulting in this publication. It is hoped that the P-Insights will give readers a deeper understanding of the practices and applications of productivity as they are evolving during the pandemic and being adapted to meet different needs in the anticipated new normal.

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INTRODUCTION

"The only way to discover the limits of the possible is to go beyond them to the impossible," wrote Arthur C. Clarke in *Profiles of the Future* (1962). This well-known quote gained new life during the COVID-19 pandemic, when individuals and organizations were forced to test their potential and expand their strengths in order to survive and sustain activities. The pandemic has been the most difficult and challenging event in many people's lifetimes, leaving them struggling for food, jobs, and even safe air to breathe. But at the same time, it has also offered many opportunities in the form of innovations required to fight the pandemic, ranging from radical changes in products/processes/ services to technological innovations. This was made possible by organizations that believe in a continuous culture of innovation and have been following the pandemic were therefore not necessarily developed then. Many organizations committed to continuous improvement found that the pandemic provided the right match between products/services and the market.

Regular scanning of both internal and external environments became a necessity during the pandemic, allowing innovative responses to be developed and commercialized. Some previously available products found greater utility, market demand, and adaptability during the pandemic. These innovations overcame barriers as people struggled to stay alive. Some of those barriers were threats to basic survival, risks of airborne infection, doubtful/uncertain behavior of COVID-19, discontinuity of internet connections, disruptions to business activities, mental stress, restrictions on movements of people and goods, supply shortages, lack of entertainment options, difficulties in maintaining regular health regimens, labor shortages, etc. Many well-timed innovations helped fight the virus and ensured the continuity of business activities. The timing of innovation and duration of response played important roles during the pandemic.

Bay Care Director of Innovation Craig Anderson, who is also a co-founder of the health tech company Head Rehab LLC, said, "Everything in innovation is about moving at speed. A good idea now will, in a year from now, probably still be a good idea, but won't be considered innovative because by then it will be standard practice" [1]. In the words of architect and engineer Arthur Huang of



the ROC, "The pandemic forces us to become very innovative to come up with the solutions to adapt to the current situation" [2].

This report explores the topic of the management of innovation during the pandemic and presents different models in the context of the ongoing situation. It examines barriers created and innovative solutions to overcome them efficiently. Innovative solutions to help in speedy recovery from the pandemic are presented, with special focus on the risk emergency model.

What Is Innovation?

The word "innovation" derives from the Latin verb "*innovare*" meaning "to renew." It can mean either to improve or to replace a process, a product, or a service. Innovation can be defined as a process by which we try to create a new product or service or update it by applying new processes or by introducing new techniques. It may also involve implementation of successful ideas to create new value for end users. Most of all, it focuses on providing efficient solutions to problems [3].

Why Is Innovation Important?

Innovation provides several benefits such as operational efficiency, affordability, cost advantages, competitive edge, and overall greater value to consumers. Organizations can charge higher prices for innovative products that provide more benefits to more people, making them more competitive.

There are different alternatives to increase competitiveness. Price leadership and developing a strategy of differentiation are common ones. In both cases, innovation is the essential prerequisite for success in the long run for both large and small firms. Large firms may create new products, while small firms may have to adopt products, processes, or procedures that provide better value to the target market. In the case of SMEs, innovation is defined as a process of adopting new products, processes, or procedures that result in more value [4]. The impact of the pandemic has been more or less the same on all organizations regardless of size, causing most to question their basic survival.

Companies that choose price leadership must ensure their long-term competitiveness by developing innovative, highly efficient processes. Process optimization and continuous improvement in terms of costs are important for them. Companies that strive for a differentiation strategy need innovation to develop unique features distinguishing them from their competitors. Many startups begin by developing an innovative product or service that offers differentiating factors.

While continuous innovation is crucial for all companies, the main difference is the focus of the innovation strategy, which varies considerably. In striving to provide more value to customers and to build up a competitive market position, companies may follow radical innovation, product innovation, process innovation, technological innovation, or social innovation strategies. Take the simple example of "chairs," as shown in Figure 1.

FIGURE 1

EXAMPLES OF THREE CHAIRS WITH DIFFERENT FUNCTIONS FOR DIFFERENT CUSTOMER NEEDS. LEFT, SIMPLE WOODEN CHAIR; CENTER, ROCKING CHAIR; RIGHT, MASSAGE CHAIR.



Sources: IndiaMart [5], Amazon India [6], and Robotouch India [7].

All three examples are chairs, but they offer different functional benefits to users. The one on the left is a simple wooden chair; it is the least expensive and encourages a healthy seated posture. The chair in the middle provides more comfort and allows greater relaxation while seated. The chair on the right is a massage chair, and users can select different modes of pressure, massage strokes, etc. when sitting in it.

A second simple example is masks, as shown in Figure 2, which includes photos of vintage versions dating from the 1919 Spanish influenza epidemic (Figure 2a). Different varieties of masks were introduced during the COVID-19 pandemic

(Figure 2b), and each is somewhat different with unique functional performance features. The mask on the left is the simplest in design and nontransparent. The one in the center has a somewhat humorous design and adjustable elastic ear loops for comfort while wearing, while the one on the right is more fitted to the face and transparent, allowing easier communication while wearing it.



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MANAGEMENT OF INNOVATION

The management of innovation is a continuous process that has three main steps: 1) scanning both the internal and external environments; 2) developing innovative responses; and 3) commercializing the innovative responses. Organizations need to take a continuous or regular approach in performing these steps to ride out the pandemic and assist speedy recovery. Companies that have taken this regular approach were able to come up with innovative solutions and appear to be on the fast track to recovery.

Environmental scanning gives inputs to organizations which they can use to develop innovative products according to the needs identified. Innovation did not happen suddenly during the pandemic but was a continuous approach to develop improved products with more utility, marketability, adaptability, and value. Organizations that conducted regular environmental scanning were able to start on the recovery path sooner than others through innovative responses that could be commercialized.

The three steps in the management of innovation are guided by the following eight principles:1) realization of value; 2) future-focused leadership; 3) clear strategic directions; 4) strong organizational culture; 5) exploiting insights; 6) managing uncertainty; 7) adaptable structures; and 8) a systems approach [12]. The application of these principles ensures that innovators are on the right management track, as explained in the next section.

Principles of the Management of Innovation

The management of innovation, being a diverse topic, has many dimensions. Innovation is a multidisciplinary field of study relying on a number of different models, principles, and theories. Its management principles were developed to capture the essence of effective management of innovation activities. They can be used as an introduction to understand innovation management systems or as tools for assessing the innovation management capabilities of organizations. Eight principles are used to develop the foundations of the management of innovation in organizations [12], as explained below.

1. Realization of Value

Value, financial or nonfinancial, is realized from the deployment, adoption, and impact of new or changed solutions for interested parties.

2. Future-focused Leadership

Leaders at all levels, driven by curiosity and courage, challenge the status quo by creating an inspiring vision and purpose and by continuously encouraging people to achieve new aims.

3. Strategic Direction

The direction for innovation activities is based on aligned and shared objectives and a relevant ambition level, supported by the necessary people and other resources.

4. Strong Organizational Culture

Shared values, beliefs, and behaviors as well as supporting openness to change, risk-taking, and collaboration enable the coexistence of creativity and effective execution.

5. Exploiting Insights

A diverse range of internal and external sources is used to systematically build up a pool of insightful knowledge to exploit stated and unstated needs.

6. Managing Uncertainty

Uncertainties and risks are evaluated, leveraged, and then managed by learning from systematic experimentation and iterative processes within a portfolio of opportunities.

7. Adaptability

Changes in the context of the organization are addressed by timely adaptation of structures, processes, competence levels, and value realization models to maximize innovation capabilities.

8. Systems Approach

Innovation management is based on a systems approach with interrelated and interacting elements and regular performance evaluation and improvements of the system. These principles help enterprises in developing innovative products and processes that can give better returns on investment as innovations are matched and updated according to user needs. The guiding principles are also reflected in the models of innovation management discussed below.

Models of the Management of Innovation

There are three main components of models for managing innovation: scanning; development of innovative responses; and commercialization of responses. Different models of managing innovation guide organizations at different times.

1. Stage Gate Model by Robert Cooper

The stage gate process is a patented trademark of Dr. Robert Cooper [13]. The model focuses on the innovation process and is also referred to as the "waterfall process." It is a project management technique in which an initiative or project is divided over several stages. These stages are separated by so-called gates, i.e., the decision points for whether or not to proceed to the next stage. Each gate acts as a checkpoint to analyze what is being done. Is it the right way or the right idea? Is an idea meeting the defined objectives? The stages are discovery, scoping, business plan concept, development, testing and validation, and launch and implementation.

The initial preparatory stage determines which project a company wants and will be able to carry out. Ideas can be generated in brainstorming sessions. In the scoping stage, we evaluate the product and the related market. What are the product's strengths and weaknesses and what advantage does it provide consumers in terms of added value in the market? This stage takes all the probable threats from the business environment into account.

In the business plan concept stage, we develop a business plan focusing on developing a product, usually based on a feasibility study. A feasibility study assesses the chances of success of a plan. If, after this stage, the business concept does not have sufficient potential to generate turnover, the gate will close. During the development stage, the plans from the previous steps are carried out and simple tests are conducted. For example, at this stage customers can be asked what they think of the product. The development team also creates a timeline with specific milestones to be achieved. This timeline can be revised and updated regularly. The gate will remain closed if the product has not been sufficiently developed or requires more improvements.

The testing and validation stage scrutinizes product performance and validates it. The product is usually nearly in its final form after testing. It must be supported by a good marketing plan for its launch. If not, the gate to the next stage will remain closed.

The last stage, launch and implementation, focuses on the marketing strategy. The product is ready to be launched, which includes an advertising campaign, free publicity (press releases), and interviews. An estimate is made of the quantity that will be sold.

2. Chain-link Model by Stephen J. Kline

The chain-link model developed by Stephen J. Kline [14] is based on the premise that new knowledge is not necessarily the driver of innovation. Instead, the process begins with the identification of an unfilled market need. This drives research and design, then redesign and production, and finally marketing, with complex feedback loops between all the stages. There are also important feedback loops with the organization's and the world's stored base of knowledge, with new basic research conducted or commissioned as necessary to fill in gaps. There is continuous innovation where innovators continuously apply knowledge from different sources to improve the products or processes. The process of innovative product development is equally supported by feedback from different stakeholders such as customers, suppliers, vendors, retailers, etc. The feedback is constructively applied to provide better value to the end users.

The model assumes that research, development, production, and marketing are interlinked so that research leads to development, while development results in production, and finally production leads to marketing [15]. An innovation system includes associations among a "potential market" as seen by entrepreneurs, a set of specialized technical activities within firms (for example, design, test, production, distribution, etc.) or research in public institutions, and an available stock of knowledge [15]. Innovation is considered to be both a push-pull process and a top-down/bottom-up process. Innovators can also use available knowledge and improve existing innovations [16]. This can help in removing barriers faced by firms, as explained in the next section.

3. Barrier Approach for Management of Innovation by Hadjimanolis The barrier model approach of Hadjimanolis [17] stresses that innovations are encouraged by inhibitors, and organizations try to remove barriers by developing innovative products. Organizations are surrounded by barriers such as increasing competition, increasing cost of raw materials, or improvements in technology. Firms innovate around these barriers in order to continue their operations. They may innovate in terms of lower costs of the raw materials, new methods of marketing, or the use digital platforms to reach out to more customers. According to this approach, firms are motivated by barriers to innovate products or processes due to changes in environmental factors.

During the pandemic, many organizations innovated out of sheer necessity and for business continuity. For example, low-cost medical ventilators were used to make up for shortages of the standard equipment. Several firms started retrofitting processes for better utilization of resources. Some perfume manufacturers began manufacturing hand sanitizers during the pandemic, when they perceived that a barrier was in the form of declining market demand. Many textile firms started making masks and health-related fabric to manage and capitalize on the change in demand. It was challenging to maintain social distancing in factories, so one firm's innovation was a sanitizer tunnel to keep employees safe during the pandemic. Several innovations were seen in rural areas in the form of new or improved low-cost products due to resource constraints. The pandemic presented different types of barriers to different organizations. Some were able to overcome them, while many others suffered.

BARRIERS CREATED BY THE PANDEMIC

It was a double whammy of sorts as people suffered from COVID-19 as well as barriers created by the virus. Many companies came up with innovative solutions to manage pandemic-related barriers. Certain crucial factors played important roles in managing innovation during the height of the pandemic, including:

- Duration required to innovate
- Timing of the innovation
- Correct matching of external and internal variables resulting in the right innovation
- Advance preparation even if extra cost was involved
- Use of appropriate technology
- Idea generation, which emerged as the most important element in managing innovations.

Some examples of innovative products and services introduced during the pandemic are presented below. Not all used all the principles or were based on all models of innovation management. Some resulted in continuous improvements in products, while others were born out of necessity. Many product innovations resulted due to different barriers such lack of resources and shortages of familiar items. As the products moved through developmental stages, they were scrutinized for their feasibility and validity.

Examples of Innovative Products/Services Introduced during the Pandemic

1. Digi-Key's Ultraviolet Sanitization Tunnel

Digi-Key, a global electronic component distributor based in Minnesota, USA, invented a new technology to disinfect the thousands of totes (plastic containers or boxes) used to move products or components through the company's 1 million-square-foot distribution center every day. To protect employees working with those totes on the assembly line, the company invented a 4.5-m ultraviolet (UV) sanitization tunnel (Figure 3). This tunnel is built into the curve of the conveyor belt to sanitize parts used in production, thus safeguarding employees from potential viral contact. The tunnel uses UV light to kill 99.99% of organisms on the totes, including COVID-19, drastically reducing Digi-Key employee contact.

The company faced two main challenges. First, no previous design existed, and therefore Digi-Key had to develop it from scratch, performing all the math and science calculations in just three days. Second, the UV dose calculation presented a challenge since the totes are moved on conveyer belts and only exposed to the light for a relatively short time. The successful deployment of this innovative solution helped ensure Digi-Key's business continuity and the safety of its employees.

FIGURE 3 PHOTO OF DIGI-KEY'S INNOVATIVE UV SANITIZATION TUNNEL.



Source: EHS Today [18].

2. Virustatic Shield's Antiviral-coated Snood Mask

A snood mask with an antiviral coating was developed by Virustatic Shield of the UK (Figure 4). As mask-wearing became the new normal, Virustatic Shield created this easy-to-wear, light, breathable face mask. Owing to a special combination of coating and base material, the mask becomes an antiviral, multifunctional protective snood. According to lab test results, it prevents contact with airborne viruses. The Virustatic Shield was a breakthrough innovation in face-covering technology. It is a nonmedical, reusable, washable covering with the following innovative features:

- Reduces the escape of virus-laden aerosols from around the sides
- The comfortable, snug fit follows the contours of the face
- Covers critical infection points of the nose and mouth
- Can be conveniently worn around the neck and lifted when protection is required
- Supports clear communication when worn



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3. An Autonomous Robot to Overcome Labor Shortages during the Pandemic Created by Tevel Aerobotics Technologies

Tevel Aerobotics Technologies of Israel invented a flying autonomous robot (FAR) that uses AI to identify and pick fruit (Figure 5). The robot can work 24 hours a day and picks only ripe fruit. The innovation was a direct response to labor shortages. "There are never enough hands available to pick fruit at the right time and the right cost. Fruit is left to rot in the orchard or sold at a fraction of its peak value, while farmers lose billions of dollars each year," the company noted [20].

The FAR uses AI perception algorithms to locate fruit trees and vision algorithms to find the fruit among the foliage and classify its size and ripeness. The robot then works out the best way to approach the fruit and remain stable as its picking arm grasps and picks. The drones are able to harvest orchards without getting in each other's way because of a single autonomous digital brain in a ground-based unit. Tevel Aerobotics Technologies cites the following advantages of its FAR:

- There is a global shortage of seasonal fruit pickers, made worse by COVID-19 travel restrictions.
- Some farmers were forced to leave ripe fruit to rot as a result.
- Now AI flying drones can spot the ripest fruit and pick it autonomously.
- The robots save money and reduce food waste.

Tevel Aerobotics Technologies started in 2017 and has 40 employees. It faced many challenges, from raising funds to technical and physical problems. It overcame financial problems and raised funding of over USD30 million, along with grants from the Israeli innovation authority. The FAR picks over 90% of fruit from trees without bruising. This was challenging as it involves the integration of all complex algorithms, including weather forecasts, to maneuver accurately in an uncertain climate. The design also had to incorporate software that takes into account many fruit varieties and allows frequent upgrades to ensure robot fleet reliability and durability.

Although the project started in late 2017, market factors sped up the FAR development process during the first onslaught of COVID-19. Due to shortages of labor, more fruit was being wasted. This innovation was a direct response to labor shortages.

Even before the pandemic, it was becoming harder to find fruit pickers to harvest the world's orchards. COVID-19 travel restrictions have prevented seasonal workers from crossing borders, so more farmers are turning to AI drones to harvest their crops. In July 2019, the American Farm Bureau Federation warned of continued labor shortages. The UN designated 2021 the International Year of Fruits and Vegetables, with a focus on innovation and improved technologies to increase the efficiency and productivity of fruit and vegetable farming and to reduce losses and waste.

Tevel Aerobotics Technologies points out that its robots are designed to complement human fruit pickers rather than replace them. The company claims there will be a shortage of five million pickers by 2050 and hopes that its drones will ensure that the 10% of fruit currently left unharvested will be picked in future.

FIGURE 5

THE FAR DEVELOPED BY TEVEL AEROBOTICS TECHNOLOGIES.



Source: Tevel Aerobotics Technologies [20].

4. Aarogya Setu

One of the innovative products that helped people in the pandemic was Aarogya Setu, an application developed by the Government of India in April 2020 [21]. "*Aarogya setu*" is a Sanskrit phrase meaning "a bridge to liberation from disease." The app was launched by the government to inform users about potential risks of coronavirus infection in their areas, best practices to stay healthy, and relevant medical advisories issued (Figure 6). Users who come into first- or a second-degree contact with a COVID-19-positive person are alerted by the Aarogya Setu app and put in touch with timely medical help. A self-assessment test helps identify possible signs of infection. By early identification and prevention of potential risk of infection, Aarogya Setu acts as a protective shield for users.

The app also helps the Government of India identify infection hotspots, hence controlling the spread of the COVID-19 virus. The more people who use it, the more effective the app will be in containing the pandemic.



5. Corona-Warn App

The German Federal Government developed the Corona-Warn app (Figure 7) that uses the highest levels of Bluetooth technology to evaluate if phone users have moved in proximity to each other. Consumers receive push messages about infected persons they have come close to in previous days. The technical backbone of this app was created in cooperation with Apple and Google.



PHOTO OF CORONA WARN-APP RISK PROXIMITY MESSAGE.



Source: Apple.com [22].

6. Fitbit Flow

Fitbit Flow (Figure 8) by Fitbit Inc., California, USA, is a low-cost, easy-to-use emergency ventilator developed as a response to the challenges faced by the medical industry in the midst of the COVID-19 crisis. It is designed in an intuitive, user-friendly way, thus reducing the strain on staff who are typically responsible for operating traditional ventilators in medical facilities.



7. GG Life App for Mental Resilience

The GG Life app to promote mental resilience (Figure 9) was created by GGTude, based in Tel Aviv, Israel. It helps individuals to cope with the mental and emotional aspects of the COVID-19 pandemic. The personalized app enables users to stay calm and resilient even in times of the greatest turmoil and uncertainty. Created by a clinical therapist and backed by research, the app helps to improve thought processes, confidence, and mood without having to input a single line [24]. The GG Life app evolved from principles of cognitive behavioral therapy, which focuses on inner dialogue and the ability to change people's sense of well-being by changing the way they think.



8. PathSpot Hand Washing Fact Checker

New York-based company PathSpot identified the need for a handy personal device to confirm hand-washing efficiency and developed the hygiene PathSpot scanner (Figure 10). After placing their hands under the PathSpot Hand Washing Fact Checker scanner screen, people receive immediate feedback on their hygiene level. This product enables teams in medical facilities and other workplaces to track the quality of staff hand washing and give advice on improvements. This is especially relevant for enterprises in the restaurant and hotel sectors in addition to the medical field.

FIGURE 10

PHOTO OF THE PATHSPOT HAND WASHING FACT CHECKER IN ACTION.



9. AI-powered Safe, Scalable Parcl Delivery

Refraction AI, Texas, USA, built a robotic platform for providing safe, scalable parcel deliveries in cities. The REV-1 delivery robot (Figure 11) is able to carry packages of various sizes with different contents and deliver them to customers, ensuring minimal contact with delivery staff. Moreover, the robot is allowed to operate in both automobile and bicycle traffic lanes and is ready to hit the road in any weather conditions.



10. Portable Home Gym

OYO Fitness, USA, developed a completely portable gym to sculpt muscles and practice many types of sports in the comfort of one's home [27]. The SpiraFlex technology allows customers to use different weights while exercising (Figure 12). Accompanied by numerous workout programs and challenges, this gym set is a game-changer for home exercise. Paul Francis originally invented SpiraFlex resistance technology for NASA's Mission Critical program to counteract astronaut bone and muscle loss caused by zero gravity. A 16-week NASA study showed that SpiraFlex provided the same benefits as the gold standard of free weights. More than 50 International Space Station crew members have kept in shape over the past decade using the SpiraFlex-powered system invented by Francis.

FIGURE 12

USING PERSONALIZED WEIGHTS FOR AN OYO FITNESS HOME GYM WORKOUT SESSION.



Source: OYO Fitness [27].

11. Examples of Retrofitting (Process Innovation)

Retrofitting is the process of fitting of new or updated parts to old/ outdated assembly lines to manufacture products currently in demand. It is very useful during market fluctuations since it tries to meet the current demand, resulting in greater production efficiency. But matching "what is required" and "what can be made" is a must.

Retrofitting parts is necessary for manufacturing when the design of a large assembly is changed or revised. After the changes have been implemented, if customers with older versions of products wish to purchase replacement parts, then retrofitted parts and assembling techniques must be used so that the new parts will fit into the older versions. There are numerous examples, such as when L'Oreal and Cover Girl owner Coty started producing hand sanitizer at its factories (Figure 13). Inditex, owner of the world's largest fashion apparel retailer Zara, offered to make materials for healthcare workers and patients for the Spanish government [28].

FIGURE 13

RETROFITTED HAND SANITIZER PRODUCTION AT L'OREAL FACTORY.



Source: Economic Times/India Times [29].

Another example is that of Moët Hennessy Louis Vuitton, commonly known as LVMH, a French multinational corporation and conglomerate specializing in luxury goods, headquartered in Paris. LVMH's conversion of perfume factories to manufacture hand sanitizer is a good example of a business that understands

exactly what its consumers need and when they need it. LVMH, the owner of luxury brands Emilio Pucci, Kenzo, Marc Jacobs, and Louis Vuitton, among others, announced that it was converting three factories manufacturing fragrances for Christian Dior, Givenchy, and Guerlain to make hand sanitizer instead. The sanitizer will be distributed free of charge to the French authorities and to Europe's largest hospital system. LVMH is doing this to help those affected by the COVID-19 pandemic. It is a clever move by the brand on a number of levels, showing consumers that it is not concerned with profit alone.

As the examples above show, the pandemic has taught firms that they need to be prepared for any eventuality by following an approach of continuous innovation. This can ensure faster recovery in times of crisis. The next section explains a risk management model that can be adopted during the ongoing pandemic for managing innovation.

PATH FORWARD AND UPWARD

The COVID-19 pandemic has forced firms to think on a fast track if they want continuity and early recovery. This report proposes a strategy for managing innovation during the pandemic which focuses on advance preparation and early action. Firms can implement this strategy while focusing on principles and models of innovation management. Innovative products or processes developed by firms can be planned around four components of the strategy, as explained below. While working on this strategy, firms might devise new products or services that can help them ensure continuity or fast recovery.

Strategy for Managing Innovation in the Pandemic

Organizations must implement a strategy for managing innovation in the pandemic so that they are prepared in advance to manage crises through innovative approaches and can recover fast. One such strategy proposed is use of the risk emergency management model. This model focuses on managing risk to communities and the overall environment. Firms have a responsibility to identify their roles and play active parts in managing risks like the pandemic by innovating to provide the required products and processes. There are four components of the risk emergency management model:

- Mitigation
- Preparedness
- Response
- Recovery

Firms can recover from any crisis if they mitigate, prepare, and respond effectively in a timely manner. Each component in the model plays an important role in the success of the next component, meaning that they are interrelated. As firms progress to the next component, the level of recovery increases. Mitigation focuses on advance preparation and it is mostly done on a continuous basis, while preparation involves making arrangements or testing plans to manage crises. Response is action in the form of assistance or intervention to manage emergency situations, while recovery is a coordinated effort toward reconstruction or restoration. The four components are shown in Figure 14 and explained in detail below.



Component 1. Mitigation (Reducing Losses)

Component 1, mitigation, is about reducing or eliminating long-term risk. As the costs of disasters/pandemics continue to rise, it is necessary to take sustained action to reduce or eliminate the long-term risk to society. These sustained actions are known as mitigation.

Mitigation is the initial phase of emergency management and should be considered before a disaster or emergency occurs. However, it should also be a continuing activity that is integrated with others. For example, organizations can hold mock drills to test sustained actions. The success of mitigation will decide the success of the remaining phases. The goal of mitigation activities is to protect society and reduce the costs of response and recovery. Mitigation is accomplished through hazard analysis in terms of events that could occur in and around society and the likelihood that those events will occur. In order to be successful, mitigation measures must be developed into an overall strategy that considers ways to reduce hazard losses. The mitigation strategy may focus on the regular identification of potential hazards and acting on them through innovative approaches. Firms may also test their capacity to manage crises by developing innovative products that can be transformed as required by the situation. For example, a simple mask with a single layer may be transformed into a designer mask with seven layers or it may be developed as a branded mask, or to fit facial features, or even be equipped with speakers (need of the future).

In pandemic-specific terms, further analysis of the nature of potential pathogens should be conducted, and countries should prepare stockpiles of medications for diseases that may be contracted after a pandemic, for example, blood clotting, fungal infections, etc. This will mitigate the damage that can occur due to such scenarios in the future.

Component 2. Preparedness (Preparing to Fight the Battle)

Firms need to build up emergency management resources that can respond effectively to and recover from any hazard. For managing innovation, firms can be guided by activities such as preparation in pandemic-like situations. Preparedness includes plans or other methods to develop innovative products and facilitate response and recovery operations. A separate department dedicated to the management of innovation should be established which decides on and plans for the resources to be procured in advance. The R&D Department can focus on innovative experiments and discuss new product/ service/process requirements for managing pandemic-like situations.

Firms can hire specialists for the required jobs to develop innovative products and processes on a regular basis and improve the utility of innovative products on the market. Brainstorming sessions can be conducted to plan activities when an emergency strikes. Advance planning and preparation for future medications can help pharmaceutical companies in their journey of innovation. Firms can make arrangements such as in-house clinics for employees and protocols for ensuring worker safety.

All stakeholders including state and central governments need to develop plans to address identified risks and response measures. Recruiting, assigning, and training staff who can assist in key areas of response operations (medical staff, R&D staff, etc.) are important. Identifying suppliers for procuring sufficient resources for innovating which may be required in an emergency is also necessary. Facilities for emergency use should be designated, e.g., oxygen supply plants, specialty hospitals for COVID-19 or other patients, and specialized R&D labs to study specific pathogens.

Component 3. Response (Acting)

The response component consists of the different innovative solutions that organizations devise to fight the pandemic or other crises. It focuses on implementing/conducting emergency operations to reduce or eliminate risks. An innovative response starts with the analysis of activities to be undertaken to provide the required solutions, restore critical utilities to develop products/ processes/services, and ensure continuity of critical services (e.g., law enforcement, public works). In other words, response involves putting preparedness plans into action. Companies may also look for operational efficiency by utilizing unused assets, for example, LVMH started making hand sanitizers by opening a nonoperational plant. It perfectly matched the prevailing market conditions and demand.

Organizations must make quick, accurate assessments of the situation, prioritize response activities, allocate scarce resources, and request additional assistance from mutual aid partners as well as the state. This must be followed by initiating response activities in an organized fashion. Information on lifesaving needs, such as evacuation and search and rescue as well as the status of critical infrastructure such as transportation, utilities, communication systems, and fuel and water supplies will help organizations further. Other essential elements include information on the potential for cascading events. Good planning, training, and exercises before an event occurs can help reduce cascading events and their effects. Discipline must also be maintained in following plans during response operations to reduce the effects of cascading events.

Component 4. Recovery (Rebuilding and Restarting)

Recovery is about rebuilding the environment/communities so that individuals, businesses, and governments can function, return to normal life, and protect against future hazards. The goal of recovery is normalization and it should begin immediately after the emergency. Some recovery activities may be concurrent with response efforts. Long-term recovery includes restoring economic activity and rebuilding community facilities and housing. Long-term recovery (stabilizing all systems) can sometimes take years. Some of the steps that may be taken are:

- Implementing mitigation measures;
- Making grants/subsidies available to individuals and families for temporary housing, repairs, replacement of possessions, and medical and funeral expenses;
- Addressing psychological problems through counseling sessions to improve morale;
- Providing legal services; and
- Offering disaster unemployment benefits.

Recovery from disaster is unique to each community depending on the amount and type of damage caused and the resources that the community has ready or can obtain. In the short term, recovery is an extension of the response phase in which basic services and functions are restored. In the long term, recovery is a restoration of an economy. The success of the recovery phase depends on the success of the previous stages of this model. Recovery from the pandemic becomes easier when firms act on a continuous basis to manage risk created by crises. There is no shortcut to recovery. The management of innovation is a continuous exercise that firms must undertake for speedy recovery.

CONCLUSION

Whenever firms have been hit by recession or any crisis, innovation has always been their savior. In the ongoing pandemic, innovation became a savior for the whole world. It gave us continuity and hope. The pandemic also provided many opportunities to innovate. Firms with innovation cultures ruled the world. Regular scanning of the business environment became the new norm. It is accepted that innovation provides a competitive edge and additional benefits such as operational efficiency, affordability, cost advantage, and more overall value to consumers. It may take the form of radical product, process, technological, or social innovations. All have been visible during the pandemic. Many firms invented new products, while many others adapted innovations to survive.

The challenges of the COVID-19 pandemic taught us to be resilient and more ready to adopt innovations. Many organizations showcased innovative products and processes to fight the pandemic, ranging from designer masks, apps that motivate health tracking, devices to monitor personal hygiene, and equipment that allows safe home workouts. All these innovations proved useful during the pandemic and are likely to continue to be used.

The management of innovation is a continuous cycle that adapts to prevailing environmental factors. Several models of the management of innovation such as the stage gate model, chain-link model, and barrier approach provide new insights into managing innovation. The risk emergency management model is useful in overcoming pandemic-like situations. Steps such as mitigation, preparation, response, and recovery must be followed in a continuous manner. Mitigation prepares organizations in advance to face crises in the future; preparation focuses on resources to be procured in a time-phased manner; and response covers the actions taken to manage innovation and continuity during times of crisis. The success of the first three steps will be the deciding factor of success in the final recovery phase of the model. The faster firms are in mitigating, preparing, and responding, the faster they will reach the path of recovery. Although investment is required to follow those steps, it is worthwhile in the long term. This is especially useful in view of the impact of the pandemic so far. It is hoped that the COVID-19 pandemic will leave the world soon and that until then we will continue to innovate productively.

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