

# Exploring the Phases and Measuring the Effectiveness of Social Innovations Waved During Coronavirus (COVID-19) Pandemic: Implications from India

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## Abstract

Drawing on the social innovation process adapted by Van de Ven et al. (2008), we studied the different phases of social innovations in terms of ideation, development and scaling that waved during the pandemic of COVID-19. We also measured the effectiveness of the innovations on different parameters in fighting the Coronavirus when it was at its peak in the first wave. In this article, we also postulated how the various innovations impacted social life. A total of 24 innovations were explored and studied using the qualitative content analysis method. Data were analyzed using the Maxqda software (version Pro 2020). Results revealed that most of the innovations were implemented with new and latest technologies and they had developed using optimum resources. Further, it was noticed that most of the innovations had achieved the scaling and implementation phase in managing the COVID crisis.

## Keywords

COVID-19, global pandemic, social innovations, societal benefits, innovation phases

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## Introduction

COVID-19 entered India in December 2019. According to an official data, about 215 countries were affected by this deadly disease. In the first wave of the pandemic, a million people got infected and the cases were still growing until the second and third waves. Due to this effect, social life was thoroughly disturbed and distorted. However, at the same time, various social innovations took place to fight this disease. The pandemic started in March 2020, and in response, research institutions, organizations, social entrepreneurs and government in the early efforts made various strategies to reduce the transmission rate of the virus. They introduced many innovative products to control the disease and resolve health issues in society. The intervention of the Indian government in terms of social innovation in preventing the disease was immense. Under the dynamic leadership of Hon'ble Prime Minister Shri. Modi Ji, dealing with the social and economic crisis issues was controlled. Though the pandemic coined a situation constraining in India, it also created a space for social innovation during COVID-19.

Many new ideas and thoughts were developed to reduce the transmission rates and control the impact of the virus. This paved the way for social innovations' development and contribution, leading to societal benefits. Social innovations are proved to be an effective and efficient tool in managing crises. They are gaining momentum and acknowledgement due to their increased role in sustainability, social issues and addressing global pandemics. In this study, we brought out the part of social innovations in managing the pandemic. The research objective of this study is to investigate the effectiveness of the innovations on different parameters in fighting the Coronavirus.

Following the above introduction, the article is organized as follows: first, the theoretical background of the social innovations is discussed, which provides a crystal picture for understanding the innovations that happened in India. Further, the literature on social innovation is studied to focus on how it has increased its importance in dealing with global pandemics like COVID-19. Next, the research context of the selected social innovations is stated. The analysis part focuses on the measurement of the effectiveness of social innovations. The article highlights the research findings and discusses practical implications for social practitioners, entrepreneurs, innovators and researchers.

## Literature Review

### *Social Innovation—A Theoretical Background*

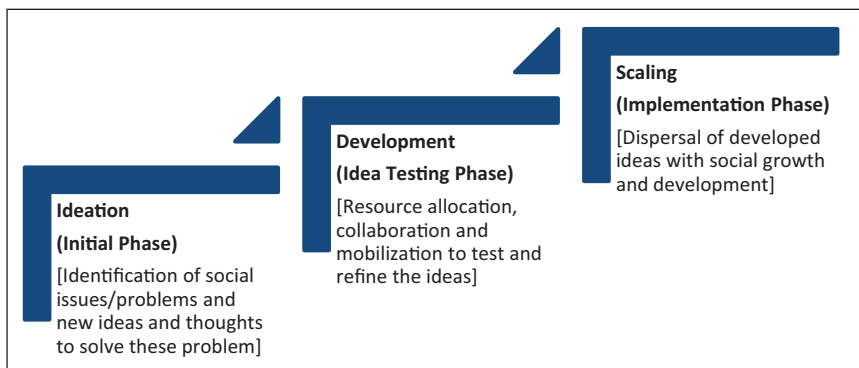
Social innovation refers to new ideas and thoughts that meet social problems. In other words, social innovation may be defined as innovative activities motivated by accomplishing societal goals and objectives. In this sense, it is understood that social innovation paves the way for development and growth, leading to societal benefits. On an allied note, innovation is not only about the discovery of

leading-edge technologies but also about solving social issues and challenges (Priestley, 2020). To Roome (2013), social innovation is that supremacy which can change the economy and society of any country. Social innovations are essential to bringing social changes and developing mechanisms to address social problems (Butkeviciene, 2009). Meanwhile, the Social Innovation Review editors believe social innovation is a unique solution to social issues that are effective, efficient, sustainable and value-based primarily to society rather than private individuals (Phills et al., 2009, p. 36).

As outlined by the World Economic Forum (2016), social innovation is:

*The application of innovative, practical, sustainable, market-based approaches to benefit society in general and low income or underserved populations in particular.*

Social innovation follows a process model. Past studies have indeed shown that there are many process models to illustrate innovation development. There are many views regarding the process. In a related vein, Van de Ven et al. (2008) propose three essential phases in social innovation: idea generation, development and implementation (scaling). The first phase discusses about developing new ideas or thoughts for solving social issues. The second phase focuses on idea testing and the feasibility of exploring the thoughts. In the third phase, the developed ideas are scaled and implemented for the benefit of society. Figure 1 portrays the social innovation phases. This article builds on the literature on the social innovation process to show the effect of various innovations in managing the crisis of COVID-19 in India. The disease affected every aspect of life around the globe, from individual to institutional operations. Governments worldwide were struggling to fight the disease. In this setting, the role of social innovation was essential to help overcome this crisis. Many innovative ideas and thoughts were translated into innovations to fight the current situation.



**Figure 1.** Phases of Social Innovation.

**Source:** Adopted from Van de Ven et al. (2008).

### *Social Innovation and COVID-19: Global Context*

In an interview, an entrepreneur and author of 'Today's Innovator' Proietti (2020) alleged that they do not have to wait for someone to help them move on. They should take their cross and move towards the goal of how complex their future is. They also advocate that this COVID-19 pandemic creates an 'Isolation Economy' where they can embrace the disruption and innovation that provide a solution for a better life in the world. However, it involves high risk. It is also advocated that they must focus on how to proceed safely within their regular production model. HIV/AIDS had been a pandemic in Africa. The need for promoting scientific innovation and how the social and cultural aspects influence the pandemic situation of HIV/AIDS in Kenya and Zimbabwe (Susan & Mugwagwa, 2009).

Similarly, Gene Quinn (2020) emphasizes that 'the U.S. innovation policy should be proactive to tackle the next pandemic.' It was also discussed in the article 'Lesson from COVID-19' those medical diagnostics are not patentable in the US, which leads to de-emphasizing medical diagnostics and owing to this, investors are uninterested in investing in their research and development activities. Moreover, fundraising, the lifeblood of research and development, is also closing. And all those activities cause to lack testing and innovation. Stressing the innovation aspects, Park (2020), in the article 'Preventing the next pandemic,' focuses on how public health can be a pivotal point in using new technology to be one step ahead of a future outbreak. The article also enlightened some of the technological advancements used for catching cases in the early hours to minimize the effect of the pandemic so that the health system would be less exaggerated. Advanced innovations like Artificial Intelligence, Telehealth App like MaNaDr (Singapore), Google Project, Remote monitoring, Chatbots and Call centres are helping to trace contact details, monitor patients across distances and counsel patients from home. Due to the COVID-19 pandemic, internet use became more crucial as we all live in the virtual world. According to Cerf (2020), this pandemic has taught us how virtually we can come into existence. The internet, web, videoconferencing, collaboration tools, email and social media are now primary avenues for business, social interaction and entertainment. We are all devoting our time and money to it. Our work life has also changed with the use of technology and innovations. The article also highlighted that it becomes our responsibility to play a prominent role in shaping our post-COVID-19 society. When there is a necessity, there is an invention. But this invention must give benefits to the community. West Michigan has proved this thing. Anel (2020) enlightens that in this COVID crisis, West Michigan showed its vivid side to the world with its generosity and adaptability to scientific innovation. Moreover, its manufacturing sectors stepped up to produce protective masks and gloves for health care workers, as well as critical parts for ventilators.

Similarly, Handforth (2020) has discussed some of its organization's initiatives taken during this COVID-19 pandemic. Likewise, UNDP (United Nations Development Programme) and Hacker, the most significant online open-source

hardware community, partnered with the world's biggest names in technology and launched the COVID-19 Detect and Protect challenge. The terms are Amazon Web Services, Arduino, Arm, Avnet, Edge Impulse, Google, Microsoft, NVIDIA, NXP, Nordic Semiconductor, Soracom and The Things Industries. Its main aim is to create a global platform of open-source solutions that can detect COVID-19 cases, prevent disease spread and protect individuals and society.

Moreover, the UNDP was also calling on all hardware and software developers, product designers, scientists, hackers, makers, innovators and inventors to come together and help those who could be most affected by these pandemics. The UNDP not only focuses on providing a platform for open-source solutions but also aims to identify and mobilize promising ideas wherever they may be found. Most importantly, they universally spread a message of 'Together We Can.'

Express Computer (2020) surveyed different countries with combat policies and tried to defeat them with innovative technologies. Some countries have done a better job than Italy and Spain, South Korea and Singapore. In the same way, India, Australia, China and other countries are doing their best to sustain this pandemic. They have invented various digital apps that help trace contacts, detect positive patients and provide precious information about prevention. Other than this, these countries also engaged in the production of PPE-Kit, Sanitizer and Sanitizer Tunnels, etc., for the COVID-Warriors as well as for the public. World Health Organization (WHO) Africa (2020) showcased those African innovators are leading the COVID-19 crisis through home-grown creative solutions to address critical gaps in response to COVID-19 in collaboration with WHO. Various innovations have been developed. These are ballparked from interactive public transport, contact tracing apps and dynamics data analysis systems to rapid diagnostic testing kits, mobile testing booths and soft coat critical care beds. Moreover, eight innovators from Ghana, South Africa, Guinea and Kenya presented their solutions already being implemented in their respective countries. WHO believes that providing ongoing support and a regular platform to African innovators may bring more prosperous to this pandemic.

After the outbreak of COVID-19 in China, it captured more than six countries within a month and in a few months, the pandemic reached over 100 countries with no sign of a vaccine. This pandemic affected both the health care sector and the economy. Farrugia et al. (2020) claimed that the COVID-19 crisis taught the world a lesson about innovation and coordination. They advocated that this pandemic taught them 'how to be together' as the public, private and government collaborated to fight against this pandemic. The private industries, academic institutions and start-ups such as Mayo Clinic, the University of California Health Care system, Amazon Web Series and Microsoft come together, which is called cross-sector partnership, to fight against it. This cross-sector partnership brings many benefits such as a telehealth program, fast-tracking applications process, and so on. In the US, collaboration among health care institutions and industries facilitate speedy access to experimental treatments. It shows we are not only experiencing

cross-sector partnerships but innovation and the use of new technology as well. Collaboration with investors across the county initiates a national effort to produce convalescent plasma from eligible donors who have recuperated from COVID-19. Also, the US-based clinician Mayo Clinic has developed a serology test that would be the following critical tool for health care providers.

Moreover, the Mayo Clinic has expanded virtual services to patients. Besides, collaboration brings opportunities to apply artificial intelligence and machine learning to new medical problems. Therefore, while the COVID-19 pandemic created a negative wave, it also opened up the possibilities for innovations in the world.

### *Social Innovation and COVID-19: Implications from India*

Today, it is hard to imagine that the year 2020 would always be remembered as a disaster due to the deadly virus that spread to almost all parts of the world. The WHO named this virus a novel and declared as a big pandemic in history. Looking back at the account, we could find various pandemics and epidemics badly influenced millions of populations and severely impacted social life. A crisis such as HIV/AIDS, MERS, Ebola, SARS, and so on, to name a few. The gravity of the crisis caused by COVID-19 is compared to other global diseases. As per the WHO report, this virus has impacted several countries such as America, Brazil, India, Korea, Malaysia, Singapore, Japan, China, and so on. This disease has posed significant challenges to the worldwide economy and people's daily lives. In India, the disease has been worsened to 17 lakhs.

In the immediate response to the COVID-19, India tried to make the fight against COVID-19 a people's movement. According to an official Ministry of Health and Family Welfare (MoHFW) report, the Government of India provided medical assistance to more than 150 countries worldwide. The government announced an economic package of over ₹20 lakh crore to help the country fight this pandemic. The vision of *Atma Nirbhar Bharat* was established among the countrymen. Upon the announcement of the lockdown in the entire country, the government announced a food security package for 813 million citizens in India which benefitted about 700 million people. Prime Minister Modi Ji urged *Do Gaj Doori* to follow to maintain social distance and stressed using the Aarogya Setu App. Furthermore, the government focused more on the health care sector and provided the license to 165 distilleries and 963 independent manufacturers to produce hand sanitizers for mass.

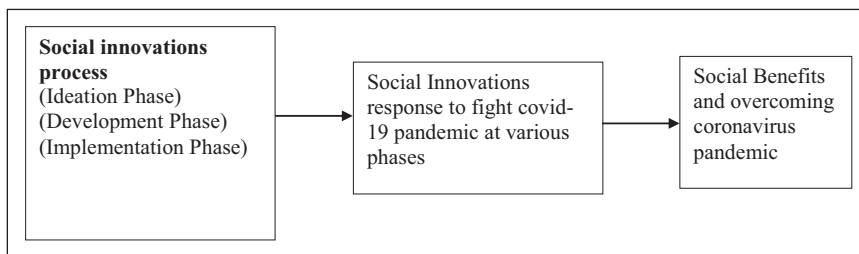
India started producing PPEs and N-95 masks in large numbers to address the challenges. During this time, a public charitable trust, 'PM Cares Fund,' emerged to collect funds from the public to deal with a kind of emergency or distress situation. After a period of panic, India was allowed to export HCQ medicines to USA and Brazil. This medicine was provided to other countries, such as Afghanistan, Israel and Africa. Due to the COVID-19 pandemic, the government stressed more virtual work, wearing masks and gloves, working from home, etc.

This situation also created many issues such as problems of migrant labors, distribution of food to the needy, dealing with essential commodities, management of infections, resource mobilizations and human resources mobilizations. Looking into the long-term issues, COVID-19 cropped up challenges such as reinstating the Indian economy, digital empowerment in India, improving the health care sector, medical infrastructure, and so on. India, being a densely populated country, faced severe effects of COVID-19. Many organizations, individuals and society have come forward to deal with the post-pandemic challenges. The crisis became a strong driver of innovation, research and creativity.

Further, abundant creativity and innovation emerged at the national, institutional, organizational and individual levels to fight this pandemic. Many of the inventions and social innovations stressed the need for time and effort to solve the societal issues and problems posed by the pandemic. In India, several social innovations emerged in the fight against COVID-19 (MoHFW Report, 2020).

Various organizations in India, such as Central Government, State Government, DRDO, IITs, IIMs, NITs, Central Universities, Indian Navy, Indian Army, Police Administrations, Municipal Corporations, and so on, came forward to fight this crisis through innovations and creativities. The virus affected the environment, food system, urban politics, social norms, body and soul, etc. This virus forced socially innovative initiatives, expanding resources and thinking of new ways and instruments to survive this situation. In its efforts to limit the virus, India emerged with various social innovations such as Asimov robotics, Aarogya Setu, Nocca robotics, Qkoy, Marut drone tech, digital stethoscope, Automatic mask machine, Jeevan setu ventilator, covisafe, and so on, to name some few (MoHFW Report, 2020). Appendix I describes the social innovations in India during the COVID-19 period. These innovations are helping to overcome this pandemic even now also. Thus, this article focuses on social innovations in the crisis as a way of measures to solve the societal issues in India. Therefore, this article explores the phases of social innovation in India and their effectiveness in achieving control over the crisis. The research questions for this study are as under:

*RQ<sub>1</sub>*: What are the various phases of the social innovations that waded during the COVID-19 period in India?



**Figure 2.** Conceptual Framework of the Study.

**Source:** Researcher's framework.

*RQ<sub>2</sub>*: How social innovations in India are helping in managing the crisis of COVID-19?

Based on the above RQ1 and RQ2, we proposed the conceptual model for our study, as depicted in Figure 2.

## **Methodological Context**

### *Research Design and Approach for the Study*

This study considered the exploratory nature of the research work and the importance of ensuring an in-depth analysis of the phenomenon from different perspectives. Thus, we adopted the case study analysis approach to seek more meaningful interpretations of the qualitative results. The research was conducted using qualitative content analysis. The Indian social innovations cases were analyzed during the COVID-19 period to achieve these goals.

### *Sample Choice and Data Collection*

The twenty-four case studies of innovations were analyzed to study the phases and effectiveness of social innovations. We considered those social innovation cases that directly impacted the management of the COVID-19 crisis. To meet the requirement of the research study, we used criteria and convenient sampling. We deduced the study's contents from various newspapers, websites, public reports, etc. We traced the relevant content from public sources based on our requirements. We identified five important domains for gathering the case information. They were the foundation of the innovation, objectives, development, technology used and effectiveness in managing crises.

To collect the data, we searched the case information published by various national newspapers, websites of government organizations about COVID-19, documents on COVID which were publicly available, etc. The data were collected during the first wave of COVID from March 2020–December 2020, as most of the innovations and improvements in dealing with the crisis evolved during this time.

### *Measures*

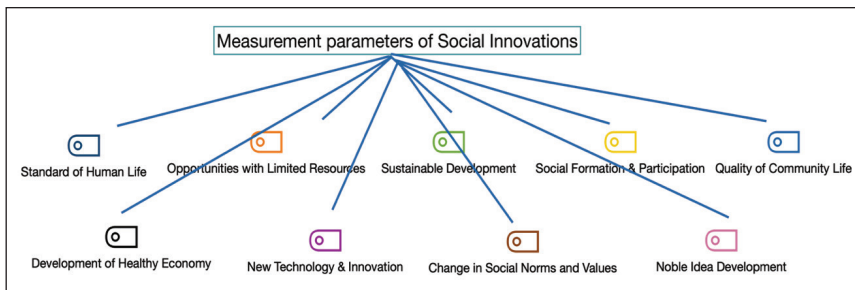
Nine critical factors were selected to assess the relevance and effectiveness of social innovations in various spheres. To do this, an in-depth literature review was done considering the available definitions and propositions. Initially, 24 factors were identified and finally, nine factors were retained by considering the views of a group of competent experts opinions from management and the organization. Table 1 depicts the nine factors and their measurement extents. The phases of the social innovations were analyzed using the Social Innovation Process model borrowed from Van de Ven et al. (2008), as summarized in Figure 1.



**Table 1.** Measurement Parameters of the Social Innovations in India During COVID-19.

Parameters	Measurement Extents of Innovations
Standard of human life	Human life, the standard of living,
Sustainable development	Overall societal growth and development
Social formation and participation	Groups, coordination and participation
Opportunities with limited resources	Best use of resources in time
Noble idea development	Ideas and thoughts leading to innovation
New technology and innovation	Implementation of new technology
Change in social norms and values	Social values, norms and beliefs
Development of a healthy economy	National development
Quality of community life	Improvement of community life

**Source:** Research data.



**Figure 3.** Coding of Measurement Parameters in Maxqda.

**Note:** For reference to color in this figure, please refer to the web version of the article.

### Data Analysis Using the Maxqda Software

Maxqda is a software designed and developed for analyzing qualitative data and quantitative data. This is a very innovative analysis software embedded with graphics and objects. We used this software for data analysis.

We followed the nine measurement parameters and the social innovation process model depicted in Figure 1 to analyze the innovation phases (ideation, development and implementation) and their effectiveness in fighting COVID-19. The content analysis was done with Maxqda Analytics Pro 2020. In all 24 cases, information collected from various published sources was imported into the software for analysis. There were different steps followed to treat the data in the software. They were:

- The data (document) were imported into the software under the document system.

- The coding was done for the code system's nine selected measurement parameters. Please see Figure 3 for details.
- The content analysis was done for each document after an in-depth study.
- The codification was done for all the documents based on the parameters.

### *Coding of Measures for Content Analysis*

Code was assigned to all nine measurement parameters to analyze the social innovations in the software. Further, the cases were investigated and codified for content analysis. Table 2 shows the overview of codes and codification of all the cases. As depicted in the table, a total of nine codes were used for the segmentation of the cases.

### *Categorized Survey Data Analysis to Ascertain the Description of Social Innovations*

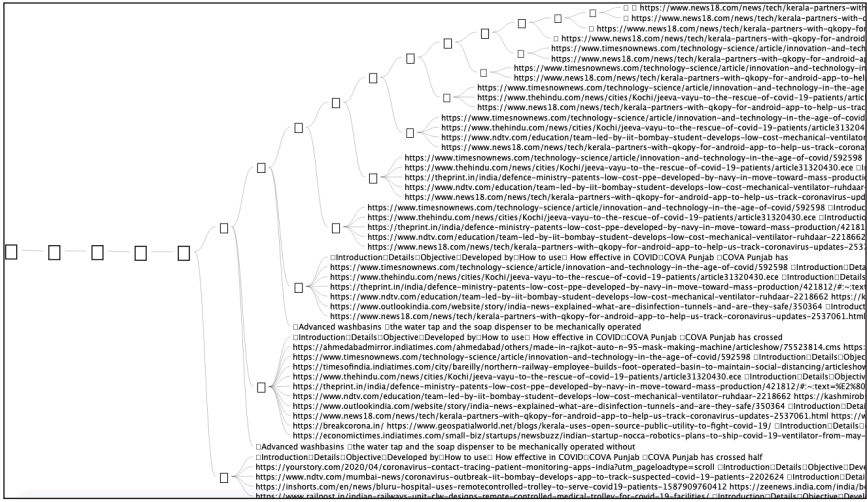
The data about the social innovation cases were collected using an internet search (Please see Figure 4). Further, the surveyed data were explored and imported into the software. To get a comprehensive picture, each case is analyzed individually and then the respective measurement codes were systematized and described for the cases. This analysis categorized each social innovation case into different measurement parameters based on the in-depth study and content analysis. Appendix I shows the detailed categorized analysis of each case for comprehensive understanding.

**Table 2.** Coding Features of the Measurement Parameters.

Code	Parameters for Measuring Social Innovations	Code Segments	% Code Segments	Social Innovation Cases
●	Change in social norms and values	15	1.96	10
●	Development of a healthy economy	25	3.27	17
●	Social formation and participation	29	3.80	16
●	Standard of human life	35	4.58	18
●	Quality of community life	36	4.71	19
●	Sustainable development	54	7.07	24
●	Opportunities with limited resources	60	7.85	26
●	New technology and innovation	75	9.82	27
●	Noble idea development	224	29.32	28

**Source:** Researcher's results.

**Note:** For reference to color in this figure, please refer to the web version of the article.



**Figure 4.** The Various Internet Sources from Where Data About the Social Innovation Cases were Collected During the First Wave of COVID.

**Source:** Researcher’s results.

**Table 3.** Descriptive Statistics of the Content Analysis for the Social Innovations During COVID-19.

Measurement Parameters	Contextual Components		
	Frequency	Percentage	Percentage (valid)
Noble idea development	28	100.00	100.00
New technology and innovation	27	96.43	96.43
Opportunities with limited resources	26	92.86	92.86
Sustainable development	24	85.71	85.71
Quality of community life	19	67.86	67.86
Standard of human life	18	64.29	64.29
Development of a healthy economy	17	60.71	60.71
Social formation and participation	16	57.14	57.14
Change in social norms and values	10	35.71	35.71

**Source:** Researcher’s results.

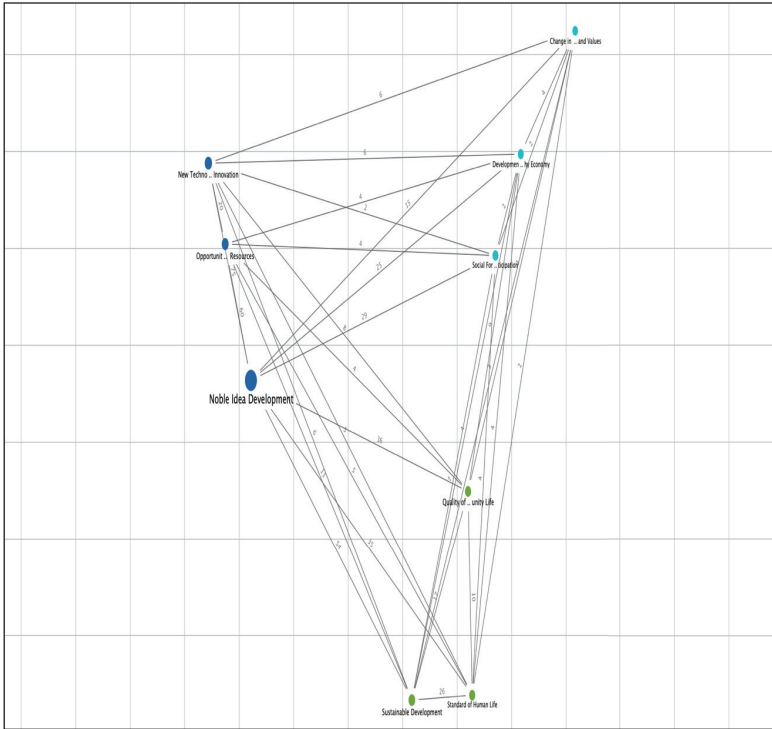
### Code Frequency Analysis to Measure the Impact of Social Innovations

The code frequency analysis was done to ascertain how often the measurement parameters were assigned to each social innovation case. The reflection of the frequency distribution of all the cases is shown in Table 3. This analysis

**Table 4. Grid Relationship Between Social Innovations and Measurement Parameters.**

Measurement Parameters/ Innovations >	Asimov Robotic ySesu	KliniApp and Practo	Noce Robotics, Aerobiasys and Innovations	Digital stethoscope	Infection-proof fabric	BreakCo-rona and Coronasafe-network	Manu-DroneTech	OKo-Sanitiser by Tunnels	Safe swab Phone booth	Ruhidar The low-cost frugal innovator	Low-cost PPEs The Navys innova-tors	Je-veo's ventila-tors	Fee-operated handwash machine and Advance	Automat-ic mask machines	Microbi-Diagnostic one test	Coronavirus Disinfectant Chlorox Tun	WhatsApp Chatbot For Coro	Ultra-violet C Light-based corona sanitisation box	Remote-controlled Sanitizer dispenser trolley	SUM				
Change in Social Norms and Values	0	0	2	0	0	1	2	0	0	2	0	0	1	0	0	0	0	0	0	0	9			
Development of Healthy Economy	1	0	2	1	2	2	1	0	1	2	1	0	0	1	3	0	1	2	0	0	0	23		
New Technology and Innovation	1	0	1	3	2	2	6	3	3	2	1	2	5	2	4	1	7	2	3	4	8	6-7		
Noble Idea Development	9	7	10	8	5	5	10	4	16	9	6	3	8	3	10	6	22	10	9	8	21	207		
Opportunities with Limited Resources	2	0	2	1	1	2	2	2	7	3	2	1	1	0	5	3	5	2	1	1	6	56		
Quality of Community Life	0	1	1	0	3	2	1	4	1	0	2	1	4	0	0	3	2	3	0	0	0	32		
Social Formation and Participation	1	1	1	2	0	0	0	0	4	1	0	2	0	0	1	1	5	3	1	0	3	1	27	
Standard of Human Life	1	1	1	2	1	1	3	1	0	1	0	0	1	1	2	1	4	5	0	0	5	2	35	
Sustainable Development	0	3	2	2	1	1	1	2	1	2	2	1	4	1	3	2	4	6	2	1	6	3	53	
SUM	15	14	19	21	18	14	15	28	15	32	21	17	15	9	24	8	28	14	50	31	21	14	49	509

**Source:** Researcher's results.



**Figure 5.** Analyzed Relations of Codes and Codes Occurrence (measurement parameters) in the Documents (social innovations).

**Note:** For reference to color in this figure, please refer to the web version of the article.

helps indicate the effectiveness of the social innovations in terms of occurrence on the number of times the measurement code is assigned during content analysis.

The above table shows that the maximum frequency is assigned to the factor ‘noble idea development,’ whereas the minimum is to ‘change social norms and values’. Notably, most social innovation cases were of new thoughts and ideas.

### *Code Mapping Analysis to Identify the Collinearity of the Measurement Parameters*

The code mapping was done to define connections and relationships between various measurement parameters and with the social innovations (Please see Figure 5). The map presents the interconnection between different coded measures, representing the additional facts and phenomena in our research work. As we can

see, the measure 'noble idea development' has been coded frequently for the various social innovations (the code circle is larger). Similarly, we can note that 'new technology and innovation' and 'opportunities with limited resources' have also been used more frequently on the map. Further, the map shows that the factors 'sustainable development' and 'standard of human life' have more collinearity in the social innovation effectiveness (the two factors are placed closer on the map). It is interesting to note that all the parameters are highly connected in measuring the performance of social innovations.

### Grid Analysis to Study Relationships

The grid analysis is done to study a particular phenomenon and the relationship between social innovations and the various measurement parameters. During the investigation, the details of the social innovations were displayed in the column and the parameters were in the rows (please see Table 4). The grid table indicates various relationships and levels of effectiveness of the innovations. As we can note, a total of 509 codifications were done for all

**Table 5.** Analysis of the Innovation Phases During COVID-19.

S. No.	Innovations	Observed Phases of Different Innovations During COVID-19		
		Ideation	Development	Scaling
1	Remote-controlled trolley			
2	Contactless sanitizer dispenser			
3	Ultraviolet C light-based sanitization box			
4	Corona Kavacha			
5	WhatsApp chatbot for coronavirus			
6	Coronavirus disinfectant tunnel			
7	Microbiome test			
8	Automatic mask machines			
9	Covisafe			
10	Feet-operated handwash machine and advance wash basin			
11	Jeeva Setu ventilators			
12	Low-cost PPEs the Navy's innovation			
13	Ruhdaar the low-cost frugal innovator			
14	Safe swab phone booth testing			

(Table 5 continued)

(Table 5 continued)

S. No.	Innovations	Observed Phases of Different Innovations During COVID-19		
		Ideation	Development	Scaling
15	Sanitiser tunnels			
16	QKopy			
17	Marut Dronetech			
18	BreakCorona and Coronasafe-network			
19	Infection-proof fabric			
20	Digital stethoscope			
21	Nocca Robotics, Aerobiosys Innovations, AgVa Healthcare			
22	KlinikApp and Practo			
23	AarogyaSetu			
24	Asimov Robotics			

innovations. The highest segment is ‘noble idea and development.’ Further, new technology, innovation and opportunities with limited resources were noted as the other highest impact on the innovations. In terms of effectiveness, ‘coronavirus disinfectant tunnel,’ ‘contactless sanitizer dispenser,’ and ‘Marut drone tech’ have the highest impact on fighting the crisis.

### Phase Analysis of the Social Innovations

Table 5 shows the phase analysis of the innovations during COVID-19 (the shade in the table indicates the extension of phases). The contents were studied based on the data collected to identify the various stages of the innovations. The social innovation process adapted from Van de Ven et al. (2008) is being used as a framework to study the phases of social innovation.

## Discussion

From Table 2, it is observed that a total of nine factors (parameters) have been coded to measure the effectiveness of social innovations. Around 29.32% of the innovations are coded as ‘noble idea and development.’ Whereas new technology and innovation are recorded at 9.82%, opportunities with limited resources to be as 7.85% and sustainable development at 7.07%. Thus, it is pertinent to note that most innovations during the first wave of COVID-19 were inclined toward new thoughts, ideas and developments.

Table 3 in the data analysis shows the frequencies of the parameters. In the table, it is observed that noble ideas and development, new technology and innovations, opportunities with limited resources and sustainable development have been given more weightage regarding the effectiveness and impact of managing the crisis. Thus, it is imperative to note that the innovations were implemented with new and latest technologies and developed using optimum resources. Further, all the innovations were helping the country in sustainable development and improved the quality of community life in these crisis times.

The code map depicted in Figure 5 indicates more collinearity between sustainable development and the standard of human life. Also, it is noted that new technology, opportunities with limited resources and noble ideas were closer on the map, representing more similarities. It is interpreted that most of the factors had an intimate relationship in terms of measurement of the effectiveness of innovations. Thus, it is said that innovations were highly influential in managing the pandemic and crises. From the Grid Table 4, we can see the effectiveness of the innovations. Innovations include a Contactless sanitizer dispenser, Coronavirus disinfectant tunnel, Sanitizer tunnel, Marut Drontech, Klinikapp and practo, Aarogya Sethu and Asimov Robotics were found to be highly effective in fighting the crisis. These innovations scored the highest in terms of their performance.

Table 5 portrays the various phases of social innovations during the crisis of Coronavirus. As we can observe from the table, it is noted that 14 innovations had achieved the scaling stages. Moreover, it is relevant to point out that around five innovations had attained the development phases. In contrast, five innovations were still in the ideation phase. The study examined the stages of innovation. Thus, our results showed that most of the innovations had achieved the stage of development and scaling while fighting the virus. This seems to signify that the innovations were practical and had a more significant impact on mitigating the pandemic. However, few innovations were still at the early stage of the application. Organizations should be aware that these innovations can make a significant difference in fighting the Coronavirus. Thus, they should try to make these implemented on a larger scale. They should also develop mechanisms to get these innovations used by the beneficiaries.

## **Conclusion and Potential Implications**

Social innovation brings about changes in our day-to-day life, such as in education, health and so on. Social innovations directly improve workforce potential and competence. In this article, to investigate various phases of the innovations process in selected 24 cases of social innovations taking place during COVID-19, nine social innovation tendencies have been identified. It is observed that out of the total of nine (parameters) coded to measure the effectiveness of the social innovations, around 29.32% of the innovations



were coded as 'noble idea and development, new technology and innovation are recorded to be 9.82%, opportunities with limited resources 7.85% and sustainable development 7.87%. Thus, it is imperative to note that most innovations were new and represented new thoughts and ideas. The innovations were implemented with new and latest technologies and developed using optimum resources. Further, all the innovations were helping the country in sustainable development and in improving the quality of community life in these crisis times.

The study attempted to develop a measurement to understand the perception of social innovation using Maxqda software designed and developed for analyzing qualitative and quantitative data. The social innovation tendencies were constructed after an extensive literature review. To do this, an in-depth literature review was done considering the available definitions and propositions. Initially, 24 factors were identified and finally, nine factors were retained by considering the views of a group of competent experts' opinions from the areas of management, managers from organizations, technology management and sociology.

Social innovations mostly find proper solutions to people's daily life problems. Their importance is very much felt at an individual, organizational and societal level. There is no unique solution for complex social issues, so an innovative solution is necessary to solve these problems.

Social innovations are for the development and application of novel activities, initiatives, services, processes and the development of goods intended to deal with social and economic problems faced by individuals and society. It's a new social order that changes joint or individual relations. At the micro-level, social innovations satisfy social needs by improving the current living standards, the ability of the individuals/groups and enhancing the production capacity of an organization. On the macro level, it brings a change in society, eradicating inequalities and offering sustainable development. Social innovations are done to satisfy a need and to provide an effective solution, and the solution benefits individuals, organizations and society.

Social systems improve through supportive social innovations and it is not only related to individuals or organizations or society; all society stakeholders such as politicians, governments, markets and even academics are mediators of social innovations. As time demands, we find many social innovations in businesses and every aspect of social life. Like in the present social disruption due to COVID-19, we see many social innovations to restore the day-to-day life of the common people. Here, we can note some of the earlier social innovations in the health sector such as the algorithm that can prevent the spread of HIV among homeless youths, the life-saving device that can seal a wound in under a minute, Wheelmap: Easy access to public places, Home Care: E-home Project, and so on. Social innovations must be given due attention because the obstructions to stable growth can only be overcome through them. It is, therefore, in this article, we have investigated the role of social innovations that have taken place during COVID-19 for the betterment of society.

## Appendix I. Social Innovations and Categorizations on Major Factors Indicated.

Innovations	Excerpts from Social Innovation Practices	Major Factors Indicated
Remote-controlled trolley	<p>'The unique trolley is a new idea.'</p> <p>'The trolley contains two shelves for various items to carry.'</p> <p>'This item helps to reduce the risk of containment and infection of a deadly virus.'</p> <p>'This trolley is user-friendly. The patients can easily use it for pick-up of various needs from the tray as and when needed.'</p> <p>'This trolley is inhouse manufacturing with all sophisticated devices which ease the facility for communication and with a remote camera.'</p> <p>'This trolley is now being used in various hospitals and quarantine centres in India.'</p>	<p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p>
Contactless sanitizer dispenser	<p>'Mist-based contactless hand sanitizer dispenser.'</p> <p>'This machine-generated High-pressure droplet can penetrate both skin pores and under the nail tips.'</p> <p>'The objective is to meet the requirement of the medical fraternity as well as the general public at offices, factories, colleges, public places, and homes this machine has come to use.'</p> <p>'Unlike other devices that are timer-based and dispense a fixed amount of sanitizer, this sanitizer is atomized to spray as long as users keep their hands below the delivery nozzle. On 11 May 2020, it is handed over to two senior doctors at the PGIMER who are handling COVID-19 patients.'</p> <p>'The optimization has been undertaken by the Chandigarh-based Terminal Ballistics Research Laboratory (TBRL) in collaboration with the local industry.'</p> <p>'It is based on water mist aerator technology, which was developed from water conservation.'</p> <p>'The Odisha's government initiates to install this machine across its offices, healthcare facilities, and secretaries.'</p> <p>'This machine uses an ultrasonic sensor for contactless operation.'</p> <p>'This machine was developed by CT University (CTU), Luddhiana, under the flagship of the research and innovation centre for excellence (RICE).'</p> <p>'This device is operated with the Infra-Red hand sensor and accurate amount of sanitizer nozzle down a fine mist of sanitizer over the hands uniformly and consumes five times lesser sanitizer than the manual one. The device can be installed in various schools, universities and shopping malls where the public crowd is more.'</p>	<p>Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Standard of Human Life</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development</p>

(Appendix I continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'This device operates with an Infra-Red Sensor having a capacity of 2.5 liters and IR sensor operates with a miniature pump.'</p> <p>'As prevention is the best cure for COVID-19, Railway Workshop has taken various initiatives for the safety of their workers until the development of the vaccine for COVID.'</p> <p>'To make a cost-effective foot-operated hand sanitizer, they have used available scrap materials like PVC pipes. The foot-operated hand sanitizer dispenser was developed by techies at Technopark. When anyone presses the foot pedal, with the help of spring action the bottle dispenses the liquid. The device is effective in public places and in companies where a large number of workers are employed. The production of one unit costs less than ₹500.'</p> <p>'Contactless hand sanitizer.'</p> <p>'The device has a capacity of 5-litre fluid with an adjustable discharge rate of 1.25 ml-2.5 ml as recommended.'</p> <p>'It automatically dispenses when one places the hand below it.'</p> <p>'About 75 dispensers have been manufactured which are supplied to companies located in Yerna Industrial estates, local hospitals, the health department and 2 units donated to GMC for the OPD section.'</p> <p>'Automatic mist-based sanitiser dispensing unit.'</p> <p>'For sanitization of hands, while entering the buildings/office complexes contactless sanitizer dispensers are used that spray alcohol-based hand sanitizer solution.'</p> <p>'It is based on water mist aerator technology, which was developed for water conservation.'</p> <p>'By the use of an atomizer, in one operation only 5 ml-6 ml sanitizer for 12 sec is discharged over both the palms so that the disinfection process can be completed.'</p> <p>'Defence Research Ultraviolet Sanitizer (Druvs) was developed by DRDO.'</p> <p>'This is a touch-free automatic operation.'</p> <p>'This machine is used to sanitize objects without using chemicals.'</p> <p>'Automated luggage disinfectant using UV-bath also developed by DRDO.'</p> <p>'This machine uses a type of UV that is used for the purpose is Far-UVC, which is effective against Coronavirus.'</p> <p>'The main objective of this machine is to disinfect the baggage or other objects.'</p>	<p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development</p>
Ultraviolet C light-based sanitization box		

*(Appendix 1 continued)*

<p>Innovations</p>	<p>Excerpt from Social Innovation Practices</p> <p>'The mechanism of this machine consists of a roller-based conveyor carriage moving inside a chamber which is configured with a UV bath of calibrated dosage. For sanitization of luggage, this machine can be used which are entering the campus of industrial establishments/defence units, etc.'</p> <p>'The same system is planned to be used for the disinfection of items being carried onto naval ships and submarines.'</p>	<p>Major Factors Indicated</p> <p>New Technology and Innovation, Noble Idea Development, Sustainable Development</p>
<p>Corona Kavacha</p>	<p>'Corona Kavach'</p> <p>'The Corona Kavach is different from MeitY's COVID-19 feedback app. While the former has been designed to capture the outbreak, the latter collects feedback on any treatment undergone by individuals.'</p> <p>'The app uses a person's location to assess whether they are in the high-risk geographical zone or not.'</p> <p>'It is developed by the National e-Governance Division of the Ministry of Electronics and Information Technology (MeitY) in association with the Ministry of Health and Family Welfare (MHFW).'</p> <p>'Corona Kavach is designed to provide information about COVID-19 and capture information.'</p> <p>'Corona Kavacha lets any person know if and when he/she comes into contact with someone who is already been infected by the virus by offering a one-hour location tracking window to keep a check on the surroundings.'</p> <p>'The data collected by this app will be useful to perform analysis and provide reliable information about the active COVID-19 cases in India. Moreover, Additional features are also added that will track a person's breathing capacity and a survey form to keep a self-check.'</p> <p>'The app also uses colour codes to figure out whether the user has come in contact with a COVID-19 carrier or not. While one colour will identify a user who has never come in contact with an infected person, another will indicate if a user is nearby.'</p> <p>'This app will track the data of the users every hour to alert them of whether they have crossed paths with any person who has tested positive for the infection.'</p>	<p>Noble Idea Development</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation, Sustainable Development</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Quality of Community Life</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>Change in Social Norms and Values, Development of Healthy Economy, Noble Idea Development</p> <p>Change in Social Norms and Values, Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Quality of Community Life</p> <p>Noble Idea Development</p>
<p>Whatsapp chatbot for Coronavirus</p>	<p>'MyGov Corona Help the official WhatsApp chatbot desk.'</p> <p>'Within the first week of its launch, it processed over 1.4 crore conversations from users across the country.'</p>	<p>Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p>

*(Appendix 1 continued)*

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'This app is designed to serve information about the disease that is believed to be caused by the Novel Coronavirus (known as SARS-CoV2).' 'Users can begin with the MyGov Corona Helpdesk by simply saving the number—9013151515 in their contact list and then send a message to the chatbot. For userfriendly conversation, there is a direct link to the chatbot that uses machine learning and artificial intelligence (AI) algorithms to provide a set of information.' 'This app highlights various ways to spread social awareness to fight COVID-19.'</p> <p>'Initially, the MyGov Corona Helpdesk was launched in English, though the government expanded its scope by bringing support for Hindi.' 'The main objective of this app is to eradicate fake news and spread awareness about COVID-19.' 'The chatbot does provide access to state and language-specific chatbots offered by the Gujarat, Maharashtra, Karnataka, and Kerala governments.' 'It crosses 1.7 crore users in 10 days of launch.'</p> <p>'The MyGov chatbot on WhatsApp provides details about the COVID-19 symptoms, professional advice from AIIMS Director, and basic knowledge about the coronavirus outbreak. It also includes the helpline number and email ID assigned by the government about the pandemic.'</p>	<p>Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p>
Coronavirus disinfectant tunnel	<p>'Techno advanced disinfectant tunnel.' 'The tunnel operated with the help of ultrasonic sensors and microcontrollers. It has three different levels of disinfection with two chambers.' 'The main objective is to maintain effective sanitization.' 'IT Kanpur's Technopark and Artificial Limbs Manufacturing Corporation of India (AL-IMCO) have collectively developed.' 'The mechanism is to spray ionized liquid disinfectant over a person in the 1st stage of the process. The liquid evenly distributes on the skin of the person and as compared to other normal disinfectants it can neutralize the virus from the surface more effectively.' 'In the 2nd chamber, the person encounters a hot air blast of 70-degree centigrade and this is to make sure that any bacteria that survived in the 1st stage would be killed. Then the person is exposed to UVC light with a wavelength ranging from 207 nm to 222 nm. This light can kill the virus and is safe for human eyes and skin.'</p>	<p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources Noble Idea Development Noble Idea Development, Standard of Human Life</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p>

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'This tunnel had been constructed to be used in areas where there is a high flow of people such as airports, bus stations, and even schools.'</p> <p>'The innovators are planning to add a feature like the thermal camera to this tunnel which will help in recording the temperature of the person before they entered into the tunnel.'</p> <p>'Disinfectant tunnel'</p> <p>'The disinfectant was prepared to sanitize people within 20 seconds from any possible bacteria.'</p> <p>'The disinfectant consists of a combination of a water-soluble polymer and iodine. The solution is known to be effective against SARS, MERS, and Ebola viruses.'</p> <p>'The tunnel has been designed to provide maximum protection in around 20 seconds.'</p> <p>'The automatic disinfection tunnel.'</p> <p>'This tunnel is completely automatic and contactless. It has a sensor-based automatic hand sanitizer inside it and also records the temperature of every person walking in.'</p> <p>'The sole purpose of this tunnel is to control the spread of the novel coronavirus.'</p> <p>'This system would help the individual to get disinfected up to 95% and the possibility of a virus staying alive on the surface.'</p> <p>'Disinfection tunnel'</p> <p>'The tunnel was built at a cost of around ₹90,000 and with a capacity of 1,000 litres, it will work uninterrupted for 16 hours.'</p> <p>'The objective is to maintain proper hygiene to protect yourself in a crowded place.'</p> <p>'The idea was generated by—D.Venkatesh, who owns a water treatment company in Tirupur, Tamil Nadu.'</p> <p>'The Corona Disinfectant Tunnel is portable, with a 16-feet stainless steel structure fitted in a mild steel frame.'</p> <p>'Later—the tunnel was set up by the District Administration in collaboration with Young Indians.'</p>	<p>New Technology and Innovation, Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Social Formation and Participation</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Social Formation and Participation</p>
Microbiome test	<p>'This is a rapid home testing kit for COVID-19.'</p> <p>'It displays accurate results within minutes.'</p> <p>'After receiving the kit, the user has to clean their finger with an alcohol swab and use the lancet provided to finger-prick. The cartridge provided reads the results from the blood sample thus obtained, within 5–10 minutes.'</p> <p>'The COVID-19 screening test kit is an IgG and IgM-based tool that delivers results in 5–10 minutes.'</p>	<p>Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p>

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Automatic mask machines	<p>'The Indian Council of Medical Research (ICMR) approved this kit and after proper quality checks and assurance, it will be deployed in the market.'</p> <p>'This kit is easy to use and presents accurate results within minutes. The kit, priced between ₹2,000 and ₹3,000 is cost-effective.'</p> <p>'Production and use of this machine are to overcome the shortage of N-95 masks and make India Self-Reliance.'</p> <p>'Pelican Rotocoflex of Rajkot-based industry has developed one of its kind fully-automatic machines.'</p> <p>'Various technologies such as metallurgy, new generation electronics from Siemens, pneumatics, web handling, forming/folding/welding were used and these all are within its in-house Research and development facility.'</p> <p>'The Pelican industry is targeting to manufacture over 100,000 high-quality N-95 masks per day very soon.'</p> <p>'They have a plan to bring the cost down from ₹200 to ₹70 with mass production.'</p> <p>'Capacity-25,000 N95 masks per day, without human touch.'</p> <p>'For making this purposeful there is great support from the Indian Government and active personal encouragement of the Hon'ble Chief Minister of Gujarat, Vijaybhai Rupani.'</p> <p>'For filtration the N95 masks are made of multiple fabric layers, welded together, a nose wire/metal strip inserted, ties for ear loops welded automatically, and folded in a manner that gives a good facial fit.'</p> <p>'The cost is expected to be 40% cheaper.'</p>	<p>Noble Idea Development, Social Formation and Participation, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Social Formation and Participation</p> <p>Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources</p> <p>Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p>
Covisafe	<p>'To make India self-reliant and to fight the shortage of N-95 masks in India and to eliminate the import of special automatic machines and their parts from China, this initiative shows a broader way.'</p> <p>'COVSAFE is a transparent airtight box within which COVID-19 positive patients can be transported from one place to another.'</p> <p>'It's objective is to save the doctors or the medical staff from being infected.'</p> <p>'This box has various facilities like it fits well on medical stretchers and is completely airtight and Emergency facilities like oxygen and ventilators can be easily installed on the box. Most importantly, when the coronavirus patient breathes, the air that comes out of the box is filtered.'</p>	<p>Development of Healthy Economy, Noble Idea Development, Standard of Human Life</p> <p>Noble Idea Development, Opportunities with Limited Resources, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>Development of Healthy Economy, New Technology and Innovation, Noble Idea Development</p>

*(Appendix 1 continued)*

<p>Innovations</p> <p>Foot-operated handwash machine and advanced washbasin</p>	<p>Excerpt from Social Innovation Practices</p> <p>'This is a pedal-operated liquid soap and water dispenser machine.'</p> <p>'It has a 500-litre water tank and 5-litre container for liquid handwash.'</p> <p>'This machine was developed for Karimnagar municipal corporation sanitation workers and other visiting people for a simple hands-free washing station.'</p> <p>'Telangana man develop (name—Mupparapu Raju s) and he runs a shop selling street lighting devices.'</p> <p>'The mechanism of this machine depends on the two pedals which are fixed on an iron frame and these pedals are connected to the taps using clutch cables used in the bike.'</p> <p>'The developer of this machine Mr.Raju has built 10 such machines which are presently installed outside offices of district collectors, municipal corporation, municipality offices, and police checkpoints.'</p> <p>'The first such machine was installed outside the Karimnagar municipal corporation office.'</p> <p>'Mr. Raju also had built a disinfectant or pesticide sprayer that uses solar energy for usage by sanitation staff and farmers.'</p>	<p>Major Factors Indicated</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Quality of Community Life</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p>
<p>Jeeva Setu ventilators</p>	<p>'This machine is expected to deliver 500 ml –600 ml of air per breath and 15–18 breaths per minute, as specified for COVID-19 patients.'</p> <p>'Objective to produce such ventilators is to fulfil the shortage of ventilators in the country with the solution of an affordable medical ventilator.'</p> <p>'It is a low-cost portable ventilator for COVID-19 patients.'</p> <p>'It is the first emergency ventilator developed by an engineering institute under the Kerala Technological University (KTU).'</p> <p>'The product generates a visual and audio alarm system for low supply pressure, airway pressure, leakage detection, power failure, and low battery indication.'</p> <p>'It includes all technical specifications like pressure monitoring, volume control, airflow monitoring, and backup battery mechanisms.'</p> <p>'Now it is handed over to General Hospital, Ernakulam, on 11 April 2020.'</p>	<p>New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>Noble Idea Development, Quality of Community Life</p>
<p>Low-cost PPEs the Navy's innovation</p>	<p>'Low-cost PPEs have been patented by the Intellectual Property Facilitation Cell (IPFC) of Min of Defence, in association with National Research Development Corporation (NRDC), an enterprise under Min of Science and Technology.'</p> <p>'An introductory batch of PPEs has already been produced at Naval Dockyard in Mumbai.'</p>	<p>Noble Idea Development, Opportunities with Limited Resources</p>

*(Appendix 1 continued)*



Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'It's the main objective is to endow our front-line health care professionals with comfortable PPEs.'</p> <p>'The developed PPE by the Indian Navy is made out of special fabric that allows a high level of protection with high breathability against other normal PPEs available in the market. For this reason, it is more suitable for the hot and humid weather conditions that prevailed in India. The technology has also been tested and validated by the ICMR-approved Testing Lab.'</p> <p>'A team of Innovators from the Navy is working in close coordination with IPFC which was set up under Mission Raksha Gyan Shakti.'</p> <p>'For the mass production of this low-cost PPE, efforts are now ongoing by a core team of Navy, IPFC, and NRDC.'</p>	<p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p>
Ruhdaar the low-cost frugal innovator	<p>'The developer of this machine will not charge any royalty for the product.'</p> <p>'The developers have been taking assistance from the Design Innovation Centre (DIC) at IUST, using locally available materials the team has been able to design a low-cost ventilator.'</p> <p>'Their idea was to design and develop a low-cost alternative to a conventional ventilator.'</p> <p>'A team of engineering students from IIT Bombay, NIT Srinagar and Islamic University of Science and Technology (IUST), Awantipora, Pulwama, Jammu, and Kashmir.'</p> <p>'Their team has tested the machine with the basic parameters such as tidal volume, Breaths per Minute, and Inspiratory: Expiratory Ratio which are successful and it also designs to monitor pressure continuously during its operation.'</p> <p>'Rudhaar has the calibre to provide necessary facilities like adequate breathing support to save the life of a critically ill COVID-19 patient. For the necessity of the situation, the team will now go for medical testing of the prototype. Once it will approve, then it will be taken for mass production by the small-scale industry for the betterment of this industry.'</p>	<p>Noble Idea Development, Social Formation and Participation</p> <p>Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Social Formation and Participation</p> <p>Change in Social Norms and Values, Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Change in Social Norms and Values, Noble Idea Development</p> <p>Development of Healthy Economy, Noble Idea Development, Sustainable Development</p>
Safe swab phonebooth testing	<p>'Safe swab: Phonebooth testing.'</p> <p>'The authorities are hoping to be able to test around 10,000 samples a week with the introduction of the booths.'</p> <p>'Efforts are made to protect health care workers.'</p> <p>'They have installed a plasma air sterilizer which will purify the air inside and kill the virus.'</p>	<p>Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Sustainable Development</p>

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'The booth will not only save time but protect health care workers as well who collect swabs.'</p> <p>'This booth is different from the South Korean booth. This booth facilitates the doctors to stand inside it and collects the samples. So there is no need to disinfect the booth after every swab collection as it takes very few minutes to collect the swab.'</p> <p>'This has been designed such that it can withstand the monsoon too.'</p> <p>'After installing the booth at Kasturba Hospital, they are planning to install it at KEM Hospital and Seven Hills Hospital.'</p> <p>'Even if there is a shortage of PPEs, doctors can still stand inside the booth and collect samples.'</p>	<p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Quality of Community Life</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Opportunities with Limited Resources</p>
Sanitizer tunnels	<p>'Jugad Road Sprayers, Disinfectant Tunnels.'</p> <p>'This tunnel has been assembled at the municipal corporation's workshop with the help of workers who assembled decontamination tunnels and converted small vehicles into boom sprayers to sanitize roads.'</p> <p>'It is developed by the municipal corporation's workshop, Srinagar, J and K.'</p> <p>'They are installing them in hospitals and public places to contain the spread of CO-VID-19 in Srinagar after fabricating 100 decontamination and sanitization tunnels.'</p> <p>'It's cost-effective as it does not take much to fabricate a tunnel.'</p> <p>'It cost them ₹20,000 for each installation, the decontamination tunnels are priced well.'</p> <p>'The Srinagar civic body has installed decontamination tunnels at hospitals that have been declared as COVID-19 treatment centres.'</p> <p>'The tunnel has three nozzles that spray one part per million sodium hypochlorite solution for the three to five seconds that people take to pass through it. It has a tank capacity of 500 litres, which allows it to work non-stop for over 15 hours.'</p> <p>'Indian Railways loco shed in Maharashtra's Bhusaval.'</p> <p>'Vehicle sanitization tunnel.'</p> <p>'The state's first vehicle sanitization tunnel was installed at the Gobindghat inter-state barrier in Paonta Sahib in Sirmaur district, Himachal Pradesh.'</p> <p>'The main objective of this vehicle tunnel is to disinfect the vehicle like trucks as they are travelling across the states.'</p> <p>'A tunnel is 20 feet high, 16 feet wide, and 20 feet long where even large vehicles can enter after going through the instructions displayed there.'</p> <p>'The vehicles carrying food, vegetables, etc., will be sanitized only through the sides while others will be sanitized from the top as well.'</p>	<p>Noble Idea Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Development of Healthy Economy, Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development</p>

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Qkopy	<p>'It is India's first organic disinfectant tunnel on the main road of Gowribidanur town.'</p> <p>'It is the first of its kind tunnel that uses an organic fumigant instead of Sodium Hypochlorite, is 20 feet high, and was completed with polythene sheets.'</p> <p>'This app is launched by the Kerala Government with a partnership with QKopy online, which will help to share all the updated data related to Coronavirus or COVID-19 around the state.'</p> <p>'It sends COVID-19 updates and travel information via phone notifications, and SMS to older phones as less than half of India's population have no smartphones. These messages are delivered both in English and in Malayalam, the local language.'</p> <p>'The app will focus on general announcements, information, and updated guidelines for travellers, details about the quarantine protocol, and also health and safety tips for visitors to the state.'</p> <p>'Within a day of the launch of this service, the State Government was able to disseminate authentic updates and instructions to over two lakh people instantly.'</p>	<p>Noble Idea Development, Opportunities with Limited Resources</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Sustainable Development</p> <p>Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Standard of Human Life, Sustainable Development</p> <p>Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life</p> <p>New Technology and Innovation, Noble Idea Development</p>
Marutdrone Tech	<p>'Marut Dronetech Private Limited, a startup, founded by IIT Guwahati alumni has developed and deployed drones.'</p> <p>'This drone is equipped with Disinfectant spray to prevent the virus from transmission or re-emergence from contaminated areas.'</p> <p>'Its objective is to disinfect the public spaces to prevent Coronavirus.'</p> <p>'Marut has covered eight districts, across Telangana State.'</p> <p>'Drones are fitted with cameras and speakers.'</p> <p>'This drone Successfully disinfected 1900 km, using 9800 litres of chemical spanning.'</p> <p>'Drones are calibrated with infrared cameras that will test temperature measurements.'</p> <p>'Marut has also operated in other border districts with the help of Trichy Municipal Corporation and Andhra Pradesh Govt.'</p> <p>'With a capacity of 15 drones and 18 pilots, Marut drones help attack the COVID-19 spread, 5 times faster than human methods!'</p> <p>'Drone Patrol Teams can keep a track of people through installed cameras on drones.'</p>	<p>New Technology and Innovation, Noble Idea Development, Quality of Community Life, Standard of Human Life</p> <p>Change in Social Norms and Values, New Technology and Innovation, Noble Idea Development</p> <p>Noble Idea Development, Quality of Community Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources, Standard of Human Life</p> <p>New Technology and Innovation, Noble Idea Development</p> <p>Development of Healthy Economy, Noble Idea Development, Quality of Community Life</p> <p>Noble Idea Development, Opportunities with Limited Resources, Quality of Community Life</p> <p>Noble Idea Development, Standard of Human Life</p>

<p>Innovations Breakcorona and coronasafe-network</p>	<p>Excerpt from Social Innovation Practices 'On behalf of the Kerala Government, Kerala Set-up Mission has called for innovative ideas and solutions to defeat the Global Pandemic.' 'The initial step of CoronaSafe Network is to develop and spread awareness and take precautions to bust fake news and myths.' 'By seeking ideas and solutions from proven sources, it has the potential for usage in the fight against CoronaVirus.' 'The CoronaSafe Network portal also gives real-time updates on COVID-19 cases and also guides directions to the test centres. The page provides links to a list of leading media houses covering news on the topic.' 'When you zoom in to a state, it shows more detailed information on cases, including-Observation of the Total number of patients Hospitalized patients, Home Isolation Patients, Total number of confirmed cases, Patients cured or discharged and number of Deaths.'</p>	<p>Major Factors Indicated New Technology and Innovation, Noble Idea Development Development of Healthy Economy, Noble Idea Development, Quality of Community Life Noble Idea Development, Opportunities with Limited Resources, Sustainable Development Development of Healthy Economy, New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources Change in Social Norms and Values, Noble Idea Development, Standard of Human Life</p>
<p>Infection-proof fabric</p>	<p>'The "infection-proof fabric" is developed by The Indian Institute of Technology (IIT) and to be used at hospitals to prevent hospital-acquired infections (HAIs).' 'The main objective for the development of this type of fabric is to build up an affordable, novel textile-processing technology, which converts regular cotton fabric into the infection-proof fabric.' 'There is financial support by the Department of Science and Technology, Ministry of Human Resource Development, IIT Delhi and Department of Biotechnology in the form of grants and fellowships.' 'They are currently in the process of conducting large-scale manufacturing trials in the Delhi-NCR region. They have collaborated with AIIMS, Delhi to pilot their products.' 'They are also in early talks with some of the largest hospital chains in India for further pilots and strategic collaborations.'</p>	<p>New Technology and Innovation, Noble Idea Development New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources Development of Healthy Economy, Noble Idea Development Development of Healthy Economy, Noble Idea Development, Quality of Community Life Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p>
<p>Digital stethoscope</p>	<p>'At IIT Bombay an innovative module was developed which converts conventional stethoscopes into digital ones.' 'Any conventional stethoscope can be converted into digital one by attaching AyuSynk to it and this will amplify chest sounds and send them wirelessly from patients to doctors without physical tubing.' 'The basic version of the digital stethoscope can also be connected to mobile or laptop through a wire or via Bluetooth.' 'Some digital stethoscopes have been delivered to KEM Hospital in Mumbai by the Ayu Devices team.' 'Apollo Hospital in Hyderabad has also requested the device.'</p>	<p>New Technology and Innovation, Noble Idea Development New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources New Technology and Innovation, Noble Idea Development Development of Healthy Economy, Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development Noble Idea Development, Quality of Community Life</p>

(Appendix 1 continued)

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
Nocca robotics, aerobiosis innovations, Agya healthcare	<p>'Over 1,000 units of the digital stethoscope are currently in use across the country, many of them in primary health centres and telemedicine companies.'</p> <p>'IIT Kanpur with start-up Nocca Robotics has developed a customized ICU—grade ventilator for handling coronavirus patients.'</p> <p>'Nocca Robotics has also collaborated with Indian medical device makers Avi Healthcare and Polybond for the manufacturing of ventilators.'</p> <p>'The main focus of this start-up is to minimize the risk of death due to a shortage of ventilators in ICU.'</p> <p>'It comes under Make in India initiatives.'</p> <p>'These ventilators will go through UL and TUV tests. As it is a piece of critical medical equipment, testing and strong standards are of paramount importance.'</p> <p>'Tender given to AgYa Healthcare in Noida to manufacture 10,000 ventilators in a month, by the end of May by the Indian Govt.'</p> <p>'They are giving importance to develop a portable, low-cost ventilator, which will enable patients to take the ventilator home with ease.'</p> <p>'To date, around 600 AgYa ventilators have been installed in hospitals pan India and they also have a good presence in Tier-II and III cities.'</p>	<p>Noble Idea Development, Quality of Community Life, Standard of Human Life, Sustainable Development</p> <p>Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Change in Social Norms and Values, Noble Idea Development</p> <p>Change in Social Norms and Values, Noble Idea Development</p> <p>Noble Idea Development, Social Formation and Participation, Standard of Human Life, Sustainable Development</p> <p>New Technology and Innovation, Noble Idea Development, Opportunities with Limited Resources</p> <p>Development of Healthy Economy, Noble Idea Development, Opportunities with Limited Resources</p> <p>Development of Healthy Economy, Noble Idea Development, Standard of Human Life, Sustainable Development</p>
KlinicApp and practo	<p>'Founded on 15 December 2015 (E-diagnostic firm).'</p> <p>'Each 'SARS-COV-2 Detection' package costs ₹4,500 as per the Indian Council of Medical Research guidelines, and results are made available in 48 hours.'</p> <p>'KlinicApp is focused on scaling up its capacity in all major cities, to a sufficient number of tests per day.'</p> <p>'KlinicApp has deployed 100 phlebotomists on the ground for collecting samples in Mumbai. They are trained as per ICMR guidelines and are equipped with disposable safety suits (PPEs) and other adequate gear.'</p> <p>'KlinicApp is now doing the home test for coronavirus (COVID-19) in Mumbai. The service is being provided in tie-ups with government-approved labs like Thyrocare and Metropolis.'</p> <p>'The tests are done only on doctor's prescriptions.'</p> <p>'KlinicApp has launched doorstep COVID-19 testing in Mumbai and plans to extend the services in Pune and Delhi in a week.'</p> <p>'Digital healthcare platform Practo has tied with private lab chain Thyrocare to carry out COVID-19 detection tests for ₹4,500.'</p> <p>'Their personnel will collect the samples from the patient's homes directly and within 48 hrs, the test result will be made available on the Practo website.'</p>	<p>Noble Idea Development</p> <p>Development of Healthy Economy, Noble Idea Development</p> <p>Noble Idea Development, Quality of Community Life</p> <p>Noble Idea Development, Social Formation and Participation</p> <p>Development of Healthy Economy, Noble Idea Development</p> <p>Noble Idea Development, Standard of Human Life</p> <p>Noble Idea Development, Opportunities with Limited Resources</p> <p>Noble Idea Development, Sustainable Development</p> <p>Noble Idea Development, Opportunities with Limited Resources</p>

(Appendix 1 continued)

*(Appendix 1 continued)*

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	<p>'The service is already available in Mumbai and Pune and will be extended to other cities soon.'</p>	<p>Noble Idea Development, Sustainable Development</p>
Aarogyasetu	<p>'The Government of India launched the Aarogya Setu mobile App on 02 April 2020.'                      'The mechanism used in this app is a Blue Tooth-based contact tracing. It records details of all the people who have come in contact with you in your routine activities. If anyone of your contacts tests positive, the application will alert you.'                      'The main purpose is to protect Indian citizens from mass spread coronavirus.'                      'The App is available in 12 languages and on Android, iOS, and KaiOS platforms.'                      'Many food-delivery services, Urban Company (Service provided app) have mandated the use of the Aarogya Setu app for their personnel.'                      'It provides a list of ICMR-approved laboratories with a COVID-19 testing facility. It gives state-wise figures of confirmed, recovered, and deceased COVID-19 cases in the country.'                      'The Central Industrial Security Force (CISF) is planning to include the app in their standard operating procedure (SOP).'</p>	<p>Noble Idea Development                      New Technology and Innovation, Noble Idea Development                      Noble Idea Development, Standard of Human Life, Sustainable Development                      Noble Idea Development, Sustainable Development                      Noble Idea Development, Quality of Community Life                      Noble Idea Development, Social Formation and Participation</p>
Asimov robotics	<p>'An autonomous robot donated to the COVID-19 ward of the Emakulam government medical college hospital by Malayalam actor Mohanlal's Viswasanthi Foundation.'                      'The robot can carry a payload of up to 25 kg and is capable of achieving a maximum speed of 1m per sec.'                      'The purpose of this project is to reduce the interaction between COVID-19 patients and health workers by serving food and medicines as well as to address the shortage of PPE kits.'                      'The KARMI-Bot is not a standalone product. The operation of this Robotics is depending upon the distributed sensor network. It uses AI (Artificial Intelligence) and ML (Machine Learning) as well to come to a decision and on this basis, it responds and operates.'                      'It is a 'Make In India initiative.'                      'KARMI-Bot urges the patient to press the 'Go' button following which it moves to the next patient. 'If a patient doesn't press the button within 30 seconds, then the KARMI-Bot will automatically move to the next patient in line.'</p>	<p>Noble Idea Development, Sustainable Development                      Noble Idea Development, Social Formation and Participation                      New Technology and Innovation, Noble Idea Development                      Noble Idea Development, Standard of Human Life                      Noble Idea Development                      Noble Idea Development                      Noble Idea Development                      Noble Idea Development                      Noble Idea Development, Opportunities with Limited Resources</p>

*(Appendix 1 continued)*

*(Appendix 1 continued)*

Innovations	Excerpt from Social Innovation Practices	Major Factors Indicated
	‘The aim was to create a cost-effective model of a robot.’ ‘It can perform all the duties of nurses and sanitation workers inside the isolation wards, verbally converse with the patients, hand over food and medicines, and connect them with the doctors via video calls if they wish to speak.’ ‘The robot is developed by ASIMOV robotics, a company working under maker village of Kerala start-up mission.’	Development of Healthy Economy, Noble Idea Development Noble Idea Development, Opportunities with Limited Resources
		Noble Idea Development

**Source:** Researcher’s results.

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