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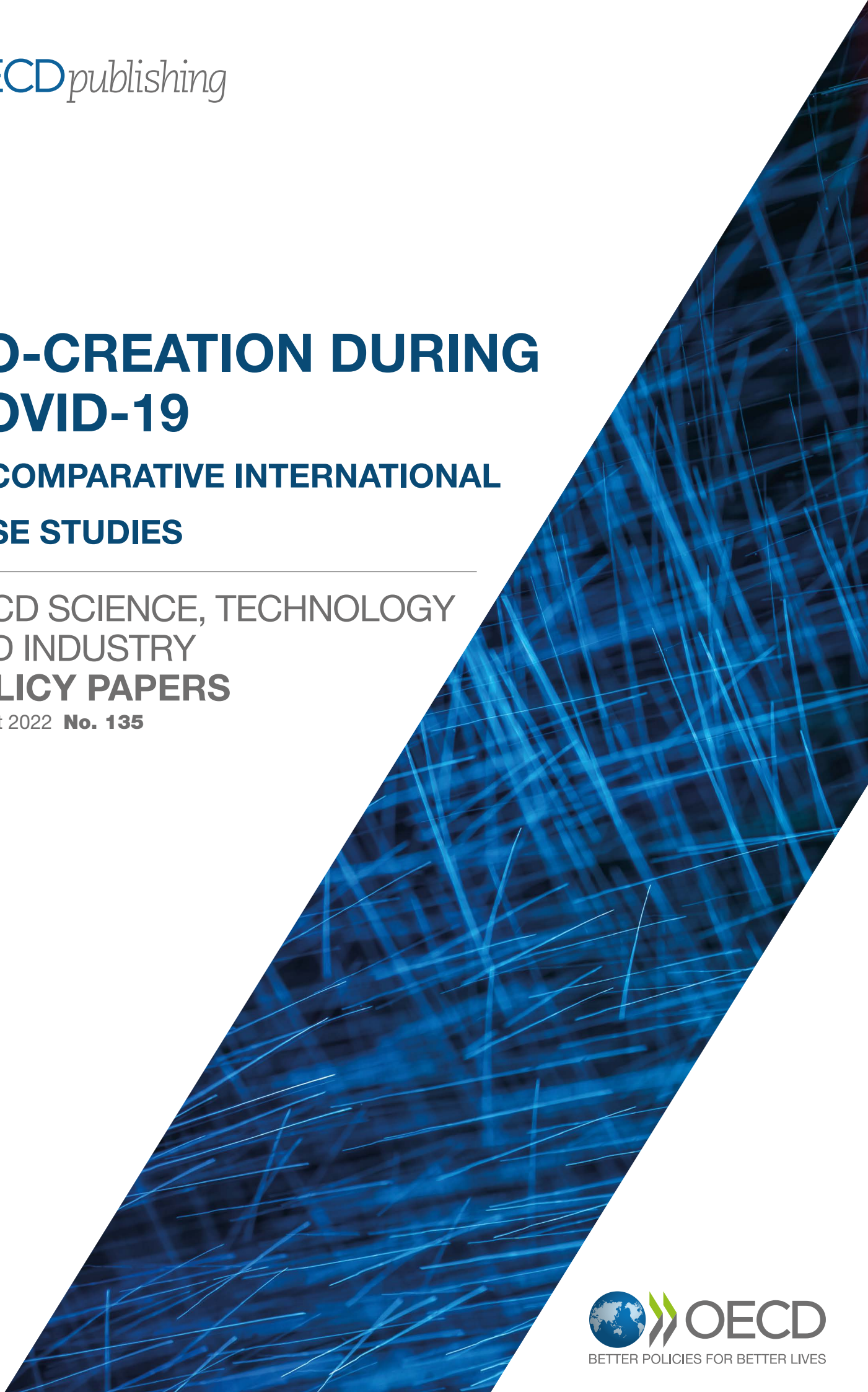

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Co-creation during COVID-19:

30 comparative international case studies

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Co-creation – the joint production of innovation between combinations of industry, research, government and civil society – was widely used to respond to the challenges raised by the COVID-19 pandemic. This paper describes 30 COVID-19 co-creation initiatives from 21 countries and three international cases. The template focuses on initiatives' core characteristics, including information on key co-creation partners and their contributions, key outcomes as well as the initiatives' size. The comparative evidence gathered through interviews with case study initiative leaders also describes what co-creation instruments were used, how networks leading to the collaboration were built, what type of cross-disciplinary co-operation took place, and what role governments played in the process and the procedures adopted to deal with the COVID-19 "exceptionality", including the urgency of producing implementable solutions. The information gathered provides a basis for analyses on co-creation initiatives during COVID-19 and for drawing potential policy implications.

Keywords: Innovation, Industry-science Linkages, Digitalisation, Civil Society

JEL: O36, O38, I18

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Executive Summary

Co-creation – the process of joint production of innovation between industry, research and other stakeholders, such as civil society – was widely used to respond to the challenges raised by the COVID-19 pandemic and led to the development of vaccines, quickly produced ventilators for COVID-19 patient treatment and data platforms that supported research, innovation and policy in dealing with the pandemic. Co-creating in the COVID-19 context required adjustments to established collaboration practices. Consequently, the COVID-19 crisis offered a testbed for new practices, technologies, operational models and partnership structures.

This report summaries insights from 30 COVID-19 co-creation initiatives from 21 countries and 3 transnational initiatives. Structured interviews with the leaders of each initiative provided in-depth evidence on the respective initiatives. The interview template focuses on initiatives' core characteristics, including information on key co-creation partners and their contributions, key outcomes as well as the initiatives' size.

The comparative evidence gathered through interviews with case study initiative leaders also describes what co-creation instruments were used, how networks leading to the collaboration were built, what type of cross-disciplinary co-operation took place, and what role governments played in the process and the procedures adopted to deal with the COVID-19 "exceptionality", including the urgency of producing implementable solutions. The information gathered provides a basis for analyses on co-creation initiatives during COVID-19 and for drawing potential policy implications.

Introduction

The COVID-19 crisis mobilised a widespread engagement in innovation activities to urgently address the challenges imposed by the COVID-19 pandemic. Co-creation – the process of joint production of innovation between two or several of the following: industry, research institutions, universities, government ministries and public sector agencies and civil society – was widely used to respond to the many COVID-19 challenges. The urgent need for solutions to COVID-19 resulted in faster-moving co-creation initiatives in science, technology and innovation ecosystems. There was also substantial experimentation in how collaborations took place, as exemplified by the wide use of hackathons, in addition to extensive digital collaboration in view of social distancing requirements (Paunov and Planes-Satorra, 2021[1]). The diverse experiences of co-creating during COVID-19 offer an interesting testbed for reviewing co-creation practices and how policy can best support co-creation in the future.

This document contributes to reviewing COVID-19 co-creation initiatives by providing detailed comparative descriptions of 30 of these initiatives from 21 countries and 3 transnational cases. The template focuses on initiatives' core characteristics, including information on key co-creation partners and their contributions, key outcomes as well as the initiatives' size. The comparative evidence gathered by interviews with case study initiative leaders also outlines the co-creation instruments used, how networks leading to the collaboration were built and what type of cross-disciplinary cooperation occurred. Interviews also served to learn about the role governments played in the process and the procedures adopted to deal with the COVID-19 "exceptionality", including the urgency of producing implementable solutions. An analytical report that provides insights and lessons learned from these case studies (De Silva et al., 2022[2]).

This paper is part of the 2021-22 OECD project "*Supporting co-creation in collaborative transitions: Exploring new tools and approaches*", conducted under the auspices of the OECD Working Party on Innovation and Technology Policy. This co-creation activity builds on prior work of the OECD (Kreiling and Paunov, 2021[3]) (OECD, 2019[4])

The remainder of this document presents, first, a short overview of the 30 cases (in section A) and, second, summaries of each initiative (in sections B, C, D and E). The template used for the case study interview is provided in Annex A: Case study template. For the comparative analysis of the case studies, a template of characteristics is used, which is provided in Annex B: Template and definitions of initiative characteristics, along with definitions of the categories.

A. Short overview of COVID-19 co-creation cases

Overview table a lists and provides a brief description of the 30 co-creation initiatives that were surveyed, covering 21 countries and 3 international cases. The selection of initiatives is based on suggestions by the delegates to the OECD's Working Party on Innovation and Technology Policy (TIP). Interviews with the initiatives' leaders were conducted between March 2021 to March 2022. The case study summaries have been validated by the initiative leaders and their country's respective delegates to the TIP.

Overview table a. Co-creation initiatives

No.	Initiative name	Country	Short description
Umbrella programmes for co-creation initiatives			
1	Innovation Clusters COVID-19 Response	Canada	Canada's Global Innovation Clusters (formerly known as Canada's Innovation Superclusters Initiative) programme, established in 2018, aims to build industry-led innovation ecosystems and leverages core funding administered by Innovation, Science and Economic Development Canada (ISED), a Canadian federal government ministry. The programme was leveraged to address the challenges of the COVID-19 pandemic and funded over 80 COVID-19-related co-creation projects, with a total investment of almost USD 173 million (CAD 220 million).
2	Pandemic Response Challenge Program (PRCP)	Canada	The National Research Council of Canada (NRC) established the COVID-19 Pandemic Response Challenge Program (PRCP) on behalf of the Government of Canada. The programme was set up to form collaborative teams of leading Canadian researchers to fast-track R&D aimed at addressing COVID-19 challenges.
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	Chile	As part of this initiative, Chile's research and development agency, ANID, issued a call for proposals for one-year projects that were linked to diagnosis, control, prevention, treatment and monitoring of COVID-19, or other aspects related to the pandemic that would help inform policy and strengthen the country's COVID-19 response capacity.
4	MEXT/RIKEN programme for COVID-19-related research	Japan	This initiative led by Japan's scientific research institution RIKEN, was a programme which promoted the joint use of the Fugaku supercomputer, research facilities and capacities of RIKEN. Universities, research institutions and companies from all over Japan were invited to respond to an open call to use those resources for COVID-19 research.
5	COVID-19 Türkiye Platform	Türkiye	The COVID-19 Türkiye Platform initiative mobilised an existing co-creation programme – the High-Technology Platforms Call – to offer accelerated funding for researchers, entrepreneurs and industry to develop innovative solutions to the COVID-19 pandemic, incl. therapeutics and vaccines, within a network structure and other approaches to support innovation, such as hackathons and scholarship programmes for collaborations.
6	High Performance Computer (HPC) Consortium	USA	The COVID-19 High Performance Computing (HPC) Consortium was a public-private consortium, which pooled resources to make high performance computing capabilities available to researchers across 17 countries to conduct research into solutions to COVID-19 pandemic.
7	ART-ER COVID-19 Project	Italy	The regional government of Emilia Romagna published a call for proposals inviting companies and research institutions to offer rapid solutions to the COVID-19 pandemic. ART-ER (a not-for-profit association whose purpose is to foster sustainable growth by developing innovation and knowledge, attractiveness, and internationalization) managed and supported the regional governments' call for proposals for projects that responded to COVID-19 under a special pandemic-programme.
Co-creation for network building initiatives			
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	Belgium	Vlaanderen Helemaal Digitaal ('Flanders All-Digital') was a government-led initiative that connected government agencies with companies and research organisations to identify digital solutions to COVID-19 challenges.
9	EUvsVirus	European Commission	The EU vs Virus was a three-day hackathon event organised by the European Commission Services (ECS) from 24 to the 26 April 2020. The hackathon aimed at mobilising solutions to challenges posed by the COVID-19 from actors from the public sector (such as government agencies and hospitals), civil society, private sector, universities and research institutions. A follow-up matchathon event organised from 22-24 May 2020 aimed at connecting winning hackathon teams to potential private sector partners and investors.

10	Fast Expert Teams vs COVID-19	Finland	The Fast Expert Teams vs COVID-19 initiative brought together experts from universities and research institutions, companies, and the public sector (including ministries and agencies) engaged in pro bono efforts to solve various challenges caused by the COVID-19 crisis, such as decontaminating high-quality respirators for reuse and remote work arrangements.
11	COVID-19 portfolio of the Knowledge Share Platform	Italy	During COVID-19, the KS platform was mobilised to help leverage available technologies to address the COVID-19 challenge with a portfolio created specifically within the platform of existing identified technologies.
12	COVID Pop-up Hub	Austria	The COVID Pop-up Hub, initiated and funded by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), enables community-based policy making by gathering experience and ideas from various actors within the innovation ecosystem. The core element was a digital discussion platform that was open to experts as well as the public for participation.
13	Tech4COVID19	Portugal	TECH4COVID19 was a national initiative that brought together start-ups and citizens, companies, non-profit organisations, and built a network of community volunteers with diverse expertise to address COVID-19-imposed challenges, including support for health professionals and hospital materials (e.g. managing provisions in areas of outbreaks), health and education services (e.g. remote services), and shopping and delivery (e.g. tracking overcrowding).
Co-creation for medical innovation initiatives			
14	Fab Helmet	Costa Rica	The Fab Helmet initiative was a collaboration of individuals from a diverse range of backgrounds (medical, legal, prototype design, art, engineering etc.) and diverse sectors (academia as well as public and private institutions in medical and legal sectors) to develop ventilation equipment for the treatment of COVID-19 patients.
15	Respira	Costa Rica	The Respira project was led by the University of Costa Rica in collaboration with the pharmaceutical company Roche, the Central American Pharmaceutical Laboratory Association and a national hospital, which aimed at producing mechanical ventilators needed to treat COVID-19 patients.
16	Exscalate4COV	Transnational	Exscalate4COV is a transnational European private-public sector consortium composed of universities and research institutions that previously collaborated in EU grant funded projects, as well as private companies and not-for-profit-organisations. The initiative was set up to identify and develop drugs to treat COVID-19 infections by leveraging state-of-the-art experimental computing facilities and AI tools.
17	Oxford-AstraZeneca Vaccine	UK	The Oxford-AstraZeneca vaccine against COVID-19 was developed and brought to the market as a result of a co-creation process that brought together the government's vaccine taskforce, InnovateUK, research from the University of Oxford and the pharmaceutical company AstraZeneca.
18	Ventilator Challenge Programme	UK	The Ventilator Challenge Programme was a large consortium established by the UK government to design and produce of ventilators for COVID-19 treatment. The consortium, which was made up of leading UK industrial, technology and engineering companies from across the aerospace, automotive and medical sectors, collaborated to design and produce medical ventilators for the UK health service.
19	Protective Mask Consortium CIIRC RP95-3D	Czech Republic	The research team of the Czech Institute of Informatics, Robotics and Cybernetics, Czech Technical University in Prague (CIIRC CTU), developed the "CIIRC RP95-3D" Protective Mask to address the shortage of protective equipment for professionals and created a university-industry consortium supported by the government to prototype, produce and distribute the masks.
20	PRONAII	Mexico	The Proyecto Nacional de Investigación e Incidencia COVID-19 ('National Research and Incidence Project COVID-19' – Pronaii) was a government-funded co-creation initiative designed to build manufacturing capabilities to produce ventilators and respiratory devices for COVID-19 treatment.
21	COVID-19 Moonshot	Transnational	The COVID-19 Moonshot is a non-profit, open-science, global consortium of scientists that aims to develop antiviral drugs against COVID-19 and future viral pandemics that are affordable and can be easily manufactured. The initial phase, co-funded by participating institutions and from crowd-sourced funds, consisted of collaborative efforts to find new molecules that could block SARS-CoV-2 (the virus causing COVID-19). The initiative subsequently engaged in further steps needed for drug development.
Co-creation for data-related innovation initiatives			
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)	Estonia	The MASC (Management of Acute Supply During Crises) project established a real-time digital inventory and demand monitoring platform with a distribution tool to manage personal protective equipment (PPE) logistics in Estonia.
23	Base de Datos COVID-19 (Database)	Chile	The Base de Datos COVID-19 (database) is an integrated database of national COVID-19 data at regional and city level, including data on the COVID-19 incidence, the health system, on mobility and on vaccination campaigns. The Ministry of Science, Technology, Knowledge and Innovation led the initiative that was implemented by research teams from eight research institutions in response to the lack of real-time COVID-19 health-related data available in Chile so as to inform policy decision.
24	Apturi COVID-19	Latvia	Initiated by a small group of tech professionals and developers, Apturi COVID-19 developed a mobile contact tracing application (aimed at identifying persons who may have come into contact with an infected person) to manage the population's exposure to COVID-19.

25	Rapid-App	Spain	The Rapid App is an employee movement-tracing app to identify potential exposures to COVID-19 and manage risks of in-person work environments. IT was developed in a collaboration of three Spanish research institutions (Ikerlan, Vicomtech and Tecnalia) and received support of the Basque Government.
26	GRAPH Network	Switzerland	The Global Research and Analyses for Public Health (GRAPH) Network initiative developed a data platform that provides real-time evidence on the evolving situation of the COVID-19 pandemic for countries in Sub-Saharan Africa. The initiative involves data management, visualisations (via a dedicated data platform, which was developed for this purpose) and analyses of country-specific pandemic developments.
27	CORD-19	USA	The COVID-19 Open Research Dataset Challenge (CORD-19) created an open access database of research articles on COVID-19.The initiative was developed by a collaboration of universities, government (White House Office of Science and Technology Policy), public sector agencies (National Institutes of Health's National Library of Medicine), research institutions, and the private sector (including Amazon Web Services, Google, Microsoft Research and IBM), as well as academic publishers and philanthropic organisations. As AI inputs and expertise to develop CORD-19 were sought under an open challenge, the CORD-19 initiative benefited from contributions from the wider innovation ecosystem.
28	Wastewater Surveillance for COVID-19	Australia	Researchers at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) partnered with the University of Queensland and regional public health authorities, Queensland Health, to investigate whether wastewater surveillance could detect COVID-19 prevalence in a community. The partnership resulted in a wastewater surveillance system across Queensland that involved wastewater catchments covering ~80% of the population.
29	Dutch ICU Data Warehouse	Netherlands	The Dutch ICU Data Warehouse (DDW) developed an electronic health record (EHR) database integrating full-admission data from critically ill COVID-19 patients from multiple hospitals in the Netherlands. The initiative gathered, analysed and pseudonymised such data from 25 large hospitals in Netherlands.
30	Corona-Warn-App	Germany	Corona-Warn-App was developed by SAP and Deutsche Telekom subsidiary T-Systems following a request by the Federal Ministry of Health and with expert advice provided by the Robert Koch Institute (RKI). The app enabled users to trace proximity to other users with confirmed COVID-19 infections to manage SARS-CoV-2 PCR and rapid antigen tests, and to store COVID-19 test and vaccine certificates.

Overview table b provides an overview of the 30 co-creation initiatives surveyed grouped into four categories: 1) "umbrella programmes for co-creation", which are large co-creation programmes set up to mobilise and fund co-creation projects to provide solutions to the COVID-19 pandemic (initiatives 1-7), 2) "projects for co-creation network building", which connects relevant actors in the form of temporary teams to co-create solutions (initiatives 8-13), 3) "projects for co-creation in medical innovation" (initiatives 14-21), and 4) "projects for co-creation in data related innovation" (initiatives 22-30).

The COVID-19 pandemic generated some exceptional circumstances for co-creation initiatives. Overview table c and Overview table d show how the co-creation initiatives analysed adapted to the special COVID-19 context.

Due to the complexity of challenges imposed by the pandemic, finding solutions required combining a diverse range of expertise, technologies, infrastructure and production facilities from various disciplines.

Overview table e and Overview table f explore this element of cross-disciplinary cooperation in the co-creation initiatives, showing the ways in which partners from different disciplines cooperated (combining expertise from different background, using technologies/infrastructure from various fields, and/or combining production facilities from different sectors), and the disciplines involved, respectively.

Leveraging existing networks, knowledge, technologies, infrastructure and policy programmes/structures was a widely adopted approach to quickly capitalise on diverse innovation capacities. Overview table g highlights these existing assets.

Streamlining processes was important for co-creation to engage in agile working to rapidly respond to emerging needs. Overview table h shows which processes were streamlined and which streamlining tools were used.

Overview table i displays the range of collaboration instruments used in the initiatives, highlighting how similar mechanisms were employed to structure co-creation, engage partners and achieve deliverables, in order to respond to COVID-19 challenges.

Overview table j highlights the various roles government institutions played, with Overview table k detailing the government's role as a provider of funding.

Each of the projects is described in detail in sections B (umbrella programmes for co-creation, C (projects for co-creation network building). D (projects for co-creation in medical innovation) and E (projects for co-creation in data related innovation).

Overview table b. Categories of COVID-19 co-creation case studies

Type	Description	Case study initiatives
Umbrella programmes for co-creation	These are government-led large programmes that offer funding, expertise, and/or resources to support the ecosystem to co-create. As these programmes are complex, they are often managed by a core team who administer the support via an open call to which several co-creation projects can apply. A key characteristic of these programmes is the combination of top-down and bottom-up approaches: on the one hand, the government, in close collaboration with national research councils defines broader challenges to be addressed by projects supporting the programmes; on the other hand, the respective projects bring in their individual innovative approaches in developing specific solutions.	1. Canada: Innovation Clusters COVID-19 response 2. Canada: Pandemic Response Challenge Programme 3. Chile: Fondo de Investigación Científica (Scientific Research Fund) COVID-19 4. Japan: MEXT/RIKEN programme for COVID-19-related research 5. Türkiye: COVID-19 Türkiye Platform 6. United States: HPC Consortium 7. Italy: ART-ER COVID-19 Project
Projects for co-creation network building	Network building for co-creation projects aim at connecting individuals/organisations to engage in co-creation to solve COVID-19 related challenges. The core task of the initiatives is consequently promoting new connections between industry, research and civil society actors and providing conditions for them to co-create.	8. Belgium: Task Force Flanders All-Digital Initiative (Platform) 9. Transnational: EUvsVirus (Hackathon) 10. Finland: Fast Expert Teams vs COVID-19 (Ad-hoc team formation/digital organising) 11. Italy: COVID-19 portfolio of the Knowledge Share Platform 12. Austria: COVID-19 Pop Up Hub (Community platform) 13. Portugal: Tech4COVID19 (Ad-hoc team formation)
Projects for co-creation in medical innovation	These are collaborative innovation projects aimed at developing medical product innovations to address the COVID-19 pandemic such as vaccines or ventilators. These required combining different skills, resources and production capacities to quickly deliver usable products (such as reducing vaccine discovery times) as well as easing regulatory procedures where possible, such as reducing approval processes.	14. Costa Rica: Fab Helmet (Ventilator) 15. Costa Rica: Respira (Ventilator) 16. Transnational: Exscalate4CoV (drug development) 17. United Kingdom: Oxford-AstraZeneca (Vaccine) 18. United Kingdom: Ventilator Challenge Programme 19. Czech Republic: Protective Mask Consortium CIIRC RP95-3D (Medical masks) 20. Mexico: Pronaii Salud (Ventilator) 21. Transnational: COVID-19 Moonshot (drug development)
Projects for co-creation in data-related innovation	These are collaborations aimed at providing access data and evidence, such as on-time statistics related to COVID-19, to support research, innovation, policy decisions and citizens to face the COVID-19 crisis. Access was provided via online platforms and mobile apps, as was the case of COVID-19 alert applications, to government, scientists, and institutions developing apps, journalists, and citizens.	22. Estonia: MASC digital platform (Digital platform) 23. Chile: COVID-19 database (Data/information platform) 24. Latvia: Apturi COVID-19 (App) 25. Spain: Rapid (App) 26. Switzerland: GRAPH Network (Data platform) 27. United States: CORD-19 (Data/information platform) 28. Netherlands: Dutch ICU Data Warehouse (Database)

		29. Australia: Wastewater Surveillance Initiative (Database) 30. Germany: Corona-Warn-App (App)

Overview table c. Elements of COVID-19 exceptionality in the co-creation initiatives

No.	Initiative name	COVID-19 exceptionality
1	Innovation Clusters COVID-19 Response	Refocused existing co-creation programmes/initiatives to COVID-19 challenge; Government as active collaborator (in individual projects); Accelerated project evaluation.
2	Pandemic Response Challenge Program (PRCP)	Accelerated project evaluation; Refocused existing co-creation programmes/initiatives to COVID-19.
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	Refocused existing co-creation programmes/initiatives to COVID-19; Government as active collaborator (via its research agency ANID); Accelerated project evaluation.
4	MEXT/RIKEN programme for COVID-19-related research	Refocused existing infrastructure to COVID-19; Big and/or real time data analytics or use of super-computing capacities; Accelerated project evaluation; Creation of large network to leverage all available expertise.
5	COVID-19 Türkiye Platform	Refocused existing co-creation programmes/initiatives to COVID-19; Accelerated project evaluation; Use of social media and/or hackathons to use contributions from a wide range of participants rapidly.
6	High Performance Computer (HPC) Consortium	Refocused existing infrastructure to COVID-19; Big and/or real time data analytics or use of super-computing capacities; Creation of large global network to leverage all available expertise.
7	ART-ER COVID-19 Project	Refocused existing co-creation programmes/initiatives to COVID-19; Accelerated project evaluation.
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	Government as active collaborator (public officials involved in idea development); Bottom-up initiative.
9	EUvsVirus	Input and contributions solicited from individuals, start-ups and/or not-for-profits; Collaboration involved direct production and product development (here: as a result of the matchathon); Use of social media and/or hackathons to use contributions from a wide range of participants rapidly.
10	Fast Expert Teams vs COVID-19	Input and contributions solicited from individuals, start-ups and/or not-for-profits, Pro-bono involvement of entrepreneurs; Bottom-up initiative.
11	COVID-19 portfolio of the Knowledge Share Platform	Refocused existing co-creation programmes/initiatives to COVID-19.
12	COVID Pop-up Hub	Refocused existing co-creation programmes/initiatives to COVID-19; Included extensive public engagement (to facilitate output adoption and/or solution development; Use of social media and/or hackathons to use contributions from a wide range of participants rapidly.
13	Tech4COVID19	Input and contributions solicited from individuals, start-ups and/or not-for-profits; Creation of large network to leverage all available expertise.
14	Fab Helmet	Used open-source inputs or provided open access to outputs to facilitate rapid response (rapid development and to facilitate updates); Pro-bono involvement of entrepreneurs; Bottom-up initiative.
15	Respira	Accelerated regulatory approval (Prototyping and pre-clinical testing instead of traditional regulatory approval process or import of pre-certified devices): Bottom-up initiative; Collaboration involved direct production and product development.
16	Exscalate4COV	Refocused existing infrastructure to COVID-19; Bottom-up initiative; Used open-source inputs or provided open access to outputs to facilitate rapid response; Creation of large global network to leverage all available expertise.
17	Oxford-AstraZeneca Vaccine	Refocused existing infrastructure to COVID-19; Accelerated regulatory approval; Government as active collaborator.
18	Ventilator Challenge Programme	Refocused existing infrastructure to COVID-19; Accelerated regulatory approval.
19	Protective Mask Consortium CIIRC RP95-3D	Accelerated regulatory approval; Collaboration involved direct production and product development.
20	PRONAII	Accelerated regulatory approval; Collaboration involved direct production and product development (integration with production process).
21	COVID-19 Moonshot	Use of social media and/or hackathons to use contributions from a wide range of participants rapidly; Creation of large global network to leverage all available expertise, Big and/or real-time data analytics (to accelerate drug discovery process); Bottom-up initiative.
22	MASC: Digital platform for managing stock and supply of personal protective equipment	Input and contributions solicited from individuals, start-ups and/or not-for-profits. Pro-bono involvement of entrepreneurs; Bottom-up initiative.
23	Base de Datos COVID-19 (Database)	Big and/or real-time data analytics (to inform policy); Government as active collaborator.

24	Apturi COVID-19	Pro-bono involvement of entrepreneurs; Included extensive public engagement (to facilitate output adoption and/or solution development); Bottom-up initiative.
25	Rapid-App	Used open-source inputs or provided open access to outputs to facilitate rapid response (open-source license shared for wider uptake).
26	GRAPH Network	Creation of large global network to leverage all available expertise; Big and/or real-time data analytics (to inform policy).
27	CORD-19	Used open-source inputs or provided open access to outputs to facilitate rapid response (open access provided to COVID-19-related publications); Use of social media and/or hackathons to use contributions from a wide range of participants rapidly; Creation of large global network to leverage all available expertise.
28	Wastewater Surveillance for COVID-19	Big and/or real-time data analytics (to inform policy); Creation of global network to leverage all available expertise.
29	Dutch ICU Data Warehouse	Big and/or real-time data analytics (for integration of health data); Bottom-up initiative.
30	Corona-Warn-App	Included extensive public engagement (to facilitate output adoption and/or solution development); Input and contributions solicited from individuals, start-ups and/or not-for-profits (here: open-source community).

Overview table d. Selected dimensions of COVID-19 exceptionality in the co-creation initiatives

No.	Initiative name	Use of social media and/or hackathons	Accelerated project evaluation and/or approval	Big and/or real time data analytics or use of super-computing capacities	Creation of large global network to leverage all available expertise	Input and contributions from individuals, start-ups, extensive public engagement and/or bottom-up initiatives
1	Innovation Clusters COVID-19 Response		☑			
2	Pandemic Response Challenge Program (PRCP)		☑			
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19		☑			
4	MEXT/RIKEN programme for COVID-19-related research		☑	☑	☑	
5	COVID-19 Türkiye Platform	☑	☑			
6	High Performance Computer (HPC) Consortium			☑	☑	
7	ART-ER COVID-19 Project		☑			
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')					☑
9	EUvsVirus	☑				☑
10	Fast Expert Teams vs COVID-19					☑
11	COVID-19 portfolio of the Knowledge Share Platform					
12	COVID Pop-up Hub	☑				☑
13	Tech4COVID19				☑	☑
14	Fab Helmet					☑
15	Respira		☑			☑
16	Exscalate4COV				☑	☑
17	Oxford-AstraZeneca Vaccine		☑			
18	Ventilator Challenge Programme		☑			
19	Protective Mask Consortium CIIRC RP95-3D		☑			
20	PRONAII		☑			
21	COVID-19 Moonshot	☑			☑	☑
22	MASC: Digital platform for managing stock and supply of personal protective equipment					☑
23	Base de Datos COVID-19 (Database)			☑		
24	Apturi COVID-19					☑
25	Rapid-App					
26	GRAPH Network			☑	☑	
27	CORD-19	☑			☑	
28	Wastewater Surveillance for COVID-19			☑	☑	
29	Dutch ICU Data Warehouse			☑		☑
30	Corona-Warn-App					☑

Overview table e. Type of cross-disciplinary cooperation in the COVID-19 co-creation initiatives

No.	Initiative name	Expertise	Technologies	Production capacities
1	Innovation Clusters COVID-19 Response	☑	☑	☑
2	Pandemic Response Challenge Program (PRCP)	☑		
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	☑		
4	MEXT/RIKEN programme for COVID-19-related research	☑	☑	
5	COVID-19 Türkiye Platform	☑	☑	
6	High Performance Computer (HPC) Consortium	☑	☑	
7	ART-ER COVID-19 Project	☑		☑
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital') initiative	☑		
9	EUvsVirus	☑		☑
10	Fast Expert Teams vs COVID-19	☑		☑
11	COVID-19 portfolio of the Knowledge Share Platform	Not applicable		
12	Covid Pop-up Hub	☑		
13	Tech4COVID19	☑		☑
14	Fab Helmet	☑	☑	☑
15	Respira	☑	☑	☑
16	Exscalate4COV	☑	☑	
17	Oxford-AstraZeneca Vaccine	☑	☑	☑
18	Ventilator Challenge Programme	☑	☑	☑
19	Protective Mask Consortium CIIRC RP95-3D		☑	☑
20	PRONAII	☑		☑
21	COVID-19 Moonshot	☑		☑
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)	☑		
23	Base de Datos COVID-19 (Database)	Not applicable		
24	Apturi COVID-19	☑		
25	Rapid-App	Not applicable		
26	GRAPH Network	☑		
27	CORD-19	☑	☑	
28	Wastewater Surveillance for COVID-19	☑	☑	
29	Dutch ICU Data Warehouse	☑		
30	Corona-Warn-App	☑	☑	

Overview table f. Cooperation across disciplines in the COVID-19 co-creation initiatives

No.	Initiative name	Disciplines involved
1	Innovation Clusters COVID-19 Response	Project-specific cross-discipline collaboration.
2	Pandemic Response Challenge Program (PRCP)	Project-specific cross-discipline collaboration.
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	Project-specific cross-discipline collaboration.
4	MEXT/RIKEN programme for COVID-19-related research	Computer science/software development, epidemiology/medical sciences.
5	COVID-19 Türkiye Platform	Project-specific cross-discipline collaboration.
6	High Performance Computer (HPC) Consortium	Computer science/software development, epidemiology/medical sciences/biochemistry.
7	ART-ER COVID-19 Project	Project-specific cross-discipline collaboration (e.g. between textile/fashion industry and medical science).
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	Software development (for developing the platform); policy expertise.
9	EUvsVirus	Hackathon and matchathon participants came from diverse disciplinary backgrounds.
10	Fast Expert Teams vs COVID-19	Respective expert teams brought together expertise in data science, 3D-printing, medical device building, social science (surveys), among others, as well as production capacities (for masks).
11	COVID-19 portfolio of the Knowledge Share Platform	No cross-disciplinary cooperation.
12	Covid Pop-up Hub	Respective partners contributed their expertise to the commonly discussed themes (e.g. digital tools for distancing, scenario-building for Economic Buffers, community-based innovation for State interventions and artificial intelligence for Digital Health).
13	Tech4COVID19	Legal advice, logistics support, public relationship management, programming skills to domain expertise in the area of health.
14	Fab Helmet	Mechanical manufacturing and medical devices and regulation were combined in the production of the Helmets.
15	Respira	Different partner in the project contributed with different specialties, e.g. existing technologies at the Costa Rican university were paired with the knowledge of technical design coming from abroad and then applied with the guidance of medical specialists.
16	Exscalate4COV	Computing, coding, big data analysis, computer-generated drug design.
17	Oxford-AstraZeneca Vaccine	Medical/vaccine research, regulatory expertise, bio-industrial manufacturing.
18	Ventilator Challenge Programme	Technology, engineering, aerospace, automotive and medical sectors; regulatory expertise, healthcare, medical device development, data modelling, product design and engineering, public sector procurement, logistics and supply chain design.
19	Protective Mask Consortium CIIRC RP95-3D	Expertise in healthcare, 3D printing, data management, moulding, design, sterilisation and disinfection.
20	PRONAII	Medical device manufacturing, epidemiology, regulatory expertise.
21	COVID-19 Moonshot	Computer modelling, simulations, online tools; chemistry; pharmacology among others.
22	MASC: Digital platform for managing stock and supply of personal protective equipment	Sales, law, information technology (IT), software development, medicine and pharmacology.
23	Base de Datos COVID-19 (Database)	No cross-disciplinary cooperation.
24	Apturi COVID-19	Epidemiologists; software developers, data privacy lawyers, marketing experts.
25	Rapid-App	No cross-disciplinary cooperation.
26	GRAPH Network	Public health, socio-economic, geographic, demographic, policy (needed to provide a comprehensive picture of the developments in Africa during the pandemic, incl. academic understanding of different fields of knowledge to be made accessible through the platform); software development (to establish the platform).
27	CORD-19	Medical, AI, machine learning and data retrieval technologies.
28	Wastewater Surveillance for COVID-19	Waste-water surveillance, data management and integration, as well as microbiology, chemistry, genomics and epidemiology.
29	Dutch ICU Data Warehouse	Computing/digital platform development; medical expertise.
30	Corona-Warn-App	Software development; data science, epidemiology/medical sciences.

Overview table g. Existing assets used in the COVID-19 co-creation initiatives

No.	Initiative name	Networks	Technologies/Infrastructure	Programme/model
1	Innovation Clusters COVID-19 Response	☑	☑	☑
2	Pandemic Response Challenge Program (PRCP)	☑		☑
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	☑		☑
4	MEXT/RIKEN programme for COVID-19-related research	☑	☑	
5	COVID-19 Türkiye Platform	☑	☑	☑
6	High Performance Computer (HPC) Consortium		☑	
7	ART-ER COVID-19 Project	☑		☑
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	☑		
9	EUvsVirus	☑		
10	Fast Expert Teams vs COVID-19	☑		☑
11	COVID-19 portfolio of the Knowledge Share Platform			☑
12	Covid Pop-up Hub	☑		☑
13	Tech4COVID19	Not applicable		
14	Fab Helmet		☑	
15	Respira		☑	
16	Exscalate4COV	☑	☑	
17	Oxford-AstraZeneca Vaccine	☑	☑	
18	Ventilator Challenge Programme		☑	
19	Protective Mask Consortium CIIRC RP95-3D		☑	
20	PRONAII		☑	
21	COVID-19 Moonshot	☑	☑	
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)	☑		
23	Base de Datos COVID-19 (Database)	Not applicable		
24	Apturi COVID-19	☑		
25	Rapid-App	☑	☑	
26	GRAPH Network	☑		
27	CORD-19		☑	
28	Wastewater Surveillance for COVID-19	☑	☑	
29	Dutch ICU Data Warehouse		☑	
30	Corona-Warn-App		☑	

Overview table h. Streamlining of processes in the COVID-19 co-creation initiatives

		Streamlined processes		Streamlining tools			
No.	**Initiative name**	**Project evaluation and approval**	**Regulatory approval**	**Temporary, task-oriented team creation**	**Open access/ open source**	**Data integration**	**Licensing contracts of intellectual property**
1	Innovation Clusters COVID-19 Response	☑					
2	Pandemic Response Challenge Program (PRCP)	☑					
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	☑					
4	MEXT/RIKEN programme for COVID-19-related research	☑					
5	COVID-19 Türkiye Platform	☑		☑	☑		
6	High Performance Computer (HPC) Consortium				☑		
7	ART-ER COVID-19 Project	Not applicable					
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')			☑			
9	EUvsVirus			☑			
10	Fast Expert Teams vs COVID-19			☑			
11	COVID-19 portfolio of the Knowledge Share Platform						☑
12	Covid Pop-up Hub			☑			
13	Tech4COVID19			☑			
14	Fab Helmet		☑				
15	Respira				☑		
16	Exscalate4COV	☑			☑		
17	Oxford-AstraZeneca Vaccine		☑				
18	Ventilator Challenge Programme		☑				☑
19	Protective Mask Consortium CIIRC RP95-3D	☑	☑				
20	PRONAII		☑				
21	COVID-19 Moonshot				☑		
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)					☑	
23	Base de Datos COVID-19 (Database)	Not applicable					
24	Apturi COVID-19				☑	☑	
25	Rapid-App	☑			☑	☑	
26	GRAPH Network			☑			
27	CORD-19				☑	☑	
28	Wastewater Surveillance for COVID-19					☑	
29	Dutch ICU Data Warehouse					☑	
30	Corona-Warn-App	Not applicable					

Overview table i. Collaboration instruments used in the COVID-19 co-creation initiatives

No.	Initiative name	Building or offering access to networks	Funding / Scholarships	Integrating data	Integrating resources (digital and/or material)	Interacting via a digital platform	Issuing a call for participation	Matching partners (and/or end users)	Organising a hackathon
1	Innovation Clusters COVID-19 Response	☑	☑				☑	☑	
2	Pandemic Response Challenge Program (PRCP)	☑	☑		☑				
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19		☑				☑	☑	
4	MEXT/RIKEN programme for COVID-19-related research	☑			☑		☑		
5	COVID-19 Türkiye Platform	☑	☑	☑	☑	☑	☑		☑
6	High Performance Computer (HPC) Consortium	☑			☑			☑	
7	ART-ER COVID-19 Project	☑	☑				☑		
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')					☑		☑	
9	EUvsVirus							☑	☑
10	Fast Expert Teams vs COVID-19	☑						☑	
11	COVID-19 portfolio of the Knowledge Share Platform			☑		☑			
12	Covid Pop-up Hub					☑			
13	Tech4COVID19	☑	☑						
14	Fab Helmet	☑			☑				
15	Respira	☑			☑				
16	Exscalate4COV	☑			☑		☑		
17	Oxford-AstraZeneca Vaccine	☑			☑				
18	Ventilator Challenge Programme	☑			☑		☑		
19	Protective Mask Consortium CIIRC RP95-3D				☑				
20	PRONAII	☑	☑						
21	COVID-19 Moonshot			☑					☑
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)	☑							
23	Base de Datos COVID-19 (Database)			☑	☑				
24	Apturi COVID-19	☑			☑				
25	Rapid-App			☑	☑		☑		
26	GRAPH Network	☑	☑	☑		☑			
27	CORD-19	☑		☑	☑				
28	Wastewater Surveillance for COVID-19			☑	☑				
29	Dutch ICU Data Warehouse			☑					
30	Corona-Warn-App		☑		☑				

Overview table j. Role of the government in the COVID-19 co-creation initiatives

No.	Initiative name	Provider of funding	Negotiator/network builder	Legitimiser	Collaborator in innovative co-creation
1	Innovation Clusters COVID-19 Response	☑	☑		☑
2	Pandemic Response Challenge Program (PRCP)	☑	☑		
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	☑	☑		☑
4	MEXT/RIKEN programme for COVID-19-related research	☑			☑
5	COVID-19 Türkiye Platform	☑	☑		☑
6	High Performance Computer (HPC) Consortium	☑	☑	☑	
7	ART-ER COVID-19 Project	☑			
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	☑	☑		☑
9	EUvsVirus		☑		
10	Fast Expert Teams vs COVID-19	☑	☑	☑	
11	COVID-19 portfolio of the Knowledge Share Platform	☑			
12	Covid Pop-up Hub	☑	☑	☑	☑
13	Tech4COVID19		☑		
14	Fab Helmet			☑	
15	Respira		☑		
16	Exscalate4COV	☑		☑	
17	Oxford-AstraZeneca Vaccine	☑			☑
18	Ventilator Challenge Programme	☑	☑		
19	Protective Mask Consortium CIIRC RP95-3D	☑			
20	PRONAII	☑	☑		
21	COVID-19 Moonshot	No role of the government			
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)			☑	☑
23	Base de Datos COVID-19 (Database)		☑		☑
24	Apturi COVID-19		☑	☑	☑
25	Rapid-App	☑			
26	GRAPH Network	☑	☑		
27	CORD-19		☑		
28	Wastewater Surveillance for COVID-19	☑	☑	☑	☑
29	Dutch ICU Data Warehouse	No role of the government			
30	Corona-Warn-App	☑		☑	☑

Overview table k. Government funding of COVID-19 co-creation initiatives

No.	Initiative name	Provider of funding	Ministry	Agency	International	Regional government
1	Innovation Clusters COVID-19 Response	☑	☑			
2	Pandemic Response Challenge Program (PRCP)	☑	☐	☑	☐	☐
3	Fondo de Investigación Científica (Scientific Research Fund) COVID-19	☑	☐	☑	☐	☐
4	MEXT/RIKEN programme for COVID-19-related research	☑	☑	☐	☐	☐
5	COVID-19 Türkiye Platform	☑	☐	☑	☐	☐
6	High Performance Computer (HPC) Consortium	☑	☐	☑	☐	☐
7	ART-ER COVID-19 Project	☑	☐	☐	☐	☑
8	Task Force Vlaanderen Helemaal Digitaal ('Flanders All-Digital')	No government funding				
9	EUvsVirus	No government funding				
10	Fast Expert Teams vs COVID-19	☑	☐	☑		
11	COVID-19 portfolio of the Knowledge Share Platform	☑	☑	☐		
12	Covid Pop-up Hub	☑	☑	☐		
13	Tech4COVID19	No government funding				
14	Fab Helmet	No government funding				
15	Respira	see note	☐	☐	☑	
16	Exscalate4COV	☑	☐	☐	☑	
17	Oxford-AstraZeneca Vaccine	☑	☑	☐	☐	
18	Ventilator Challenge Programme	☑	☑	☐	☐	
19	Protective Mask Consortium CIIRC RP95-3D	☑	☐	☑	☐	
20	PRONAII	☑	☐	☑	☐	
21	COVID-19 Moonshot	No government funding				
22	MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)	No funding data available				
23	Base de Datos COVID-19 (Database)	No funding data available				
24	Apturi COVID-19	Funding not disclosed				
25	Rapid-App	☑	☐	☐	☐	☑
26	GRAPH Network	☑	☐	☐	☑	☐
27	CORD-19	No government funding				
28	Wastewater Surveillance for COVID-19	☑		☑		
29	Dutch ICU Data Warehouse	No government funding				
30	Corona-Warn-App	☑	☑			

Note: Case 15 (Respira) received funding from multiple international embassies, but the government of Ministry of Science and Technology of Costa Rica acted as a network builder (see Overview table j); in case 16 (Exscalate4COV), funding was provided by the EU; and case 26 (GRAPH Network) was funded by the WHO.

B. Umbrella programmes for co-creation initiatives

Umbrella programmes for co-creation are government-led large programmes that offer funding, expertise, and/or resources for co-creation.

1. Canada – Innovation Clusters COVID-19 Response

Short description

Canada's *Global Innovation Clusters* (formerly known as Canada's Innovation Superclusters Initiative) programme, established in 2018, aims to build industry-led innovation ecosystems, and leverages core funding administered by Innovation, Science and Economic Development Canada (ISED), a Canadian federal government ministry. The programme supports independent, not-for-profits (Clusters) to serve as ecosystem anchors in order to speed up growth in five promising industries in Canada: digital technologies, plant proteins, advanced manufacturing, the use of artificial intelligence in supply chains and the ocean economy. Clusters bring together private companies of all sizes, academic institutions, government and not-for-profit organisations to create new possibilities for innovation and collaboration and encourage large-scale co-creation projects and capacity building initiatives. The Clusters are funded via five-year contribution agreements with the Government of Canada, with each Cluster an independent, not-for-profit entity overseen by its own industry-led board of directors.

Starting in early 2020, the programme was leveraged to address the challenges of the COVID-19 pandemic and funded over 80 COVID-19-related co-creation projects, with a total investment of almost USD 173 million (CAD 220 million). The projects sought to address pressing COVID-19 related challenges, such as producing personal protective equipment, medical devices, COVID-19 test kits and health monitoring systems.

More information available at: Canada's Supercluster projects: COVID-19 response

Key takeaways

The programme addressed the COVID-19 challenge by leveraging an existing network of collaborators to find and co-create solutions to COVID-19 challenges.

The programme's arrangements and funding structure were amended in order to direct funds more rapidly to a dedicated COVID-19 stream of projects. These amendments included providing flexibilities in order to rapidly access funds and simplifying requirements on funding conditions.

Co-creation dimension(s) of the initiative

The initiative involved two dimensions of co-creation among ecosystem actors. First, the programme provides funding to the Clusters, which were formed on the basis of collaborative partnership between companies, academic institutions and not-for-profits. Second, individual projects which receive funding from the Clusters themselves must also be collaborative in nature and involve two or more of the following: private companies (at

least one SME), academic institutions, public-sector institutions and not-for-profit organisations.

Characteristics, participating institutions and their contributions and outcomes

Table 1.a Initiative characteristics

Categories	Overview	Description
Initiative size	80+ COVID-19-related co-creation projects	
Funding sources	Public and private	• The Government of Canada, via Innovation, Science, and Economic Development Canada (ISED) and co-investment by companies. • Cluster industry partners co-funded almost USD 65 million (CAD 80 million) of this total, with government funding totalling nearly USD 108 million (CAD 140 million).
Timeline	March 2020-March 2021	Cluster COVID-19 response programme has ended; programme continues in relation to non-COVID-19 initiatives
Initiating organisation(s)	Government ministry	Government of Canada, via Innovation, Science, and Economic Development Canada (ISED).
Existing pre-COVID	Yes	Clusters programme was established in 2018 and has been ongoing since then and is currently funded to 2028.
Basis for and means of collaboration	Building or offering access to networks; Funding/Scholarships	• ISED provided funding for Clusters to engage in collaborative projects, matched by industry co-investment. • Existing networks developed within the programme were leveraged to build partnerships for COVID-19 solutions.
Streamlining of processes	Project evaluation and approval process	The programme's arrangements and funding structure were amended to provide quicker access to funds – simplifying requirements on funding conditions in order to direct funds more rapidly to the dedicated COVID-19 stream of projects.
Cooperation across disciplines	• Type: Programme building on diverse expertise. • Disciplines: Project-specific cross-discipline collaboration.	
Leveraging existing assets	Network; Programme/Model	• Clusters' existing networks were used to develop new collaborations. • Existing projects supported by the programme were pivoted to address pandemic challenges. • ISED and/or Cluster expertise and processes were leveraged to determine project criteria, priorities and assess projects.
Role of the government (here: ISED and other public sector institutions, such as Health Canada)	Provider of funding; Network builder/Negotiator; Collaborator in innovative co-creation	• ISED provided funding for projects, which helped de-risk key investments and facilitated involvement by industry partners. • In individual projects, public sector institutions participated in co-creation (e.g. Health Canada, the Public Health Agency of Canada). • ISED acted as collaborator by engaging with Clusters on project criteria and identifying priority areas. • ISED also leveraged existing networks to identify collaborations.
Intermediary role(s)	Government/public institution; Not-for-profit organisation	• ISED and the individual Clusters both acted as intermediaries in helping to build collaborations, formalized through contractual partnership agreements. (ISED's agreement with the Clusters; the Clusters with project proponents).
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19 challenge; Government as active collaborator; Accelerated project evaluation.	

Table 1.b Overview of key partners

Name of key partner	Type of institution	Country	Contribution
Research institutions, public hospitals and not-for-profit organisations	Research institutions, public sector agencies and non-profit organisations	Canada	Provided expertise, and engaged in co-creation as, for instance, the COVID-19 cloud project (see description in outcomes) that involved 2 universities, a hospital and 7 research institutions, which collaborated with 4 private companies.
Clusters' industry partners	Private sector companies	Canada	• Provided co-funding for COVID-19 projects: - Digital Cluster: 23.7 million USD (29.50 million CAD); - Advanced Manufacturing Cluster: 40.3million USD (50.09 million CAD); - Scale AI Cluster: 1.4 million USD (1.70 million CAD). • Provided expertise and resources and engaged in collaborative research/innovation with other company partners, research institutions and not-for-profit organisations.
Innovation, Science, and Economic Development Canada (ISED), a department of the Government of Canada	Government ministry	Canada	• Provided funding to address COVID-19 challenges across the following Clusters: - Digital Cluster: USD 72 million (CAD 89.60 million); - Advanced Manufacturing Cluster: USD 98 million (CAD 121.62 million); - Scale AI Cluster: USD 3.8 million (CAD 4.70 million). • Engaged with Clusters about their potential contributions to emerging pandemic response needs. • Acted as observers on Cluster project selection committees to support coordination with other rapidly moving COVID-19 response initiatives.
Innovation Clusters: Digital, Advanced Manufacturing, Scale AI	Independent, not-for-profits funded via contribution agreements with the Government of Canada	Canada	• Brought together private sector, academic institutions, government and not-for-profit organisations to address the challenges of the COVID-19 pandemic. • Developed project selection criteria for dedicated COVID-19 project streams, selected projects and oversaw their implementation.

Table 1.c Outcomes

Co-creation outcome categories	Outcomes to address COVID-19 and others
Technologies, innovations	Approximately 80 COVID-19 co-creation projects, which developed pandemic related products, such as personal protective equipment, medical devices, COVID-19 test kits and health monitoring systems. For example, the COVID-19 Cloud project enabled scientific and medical communities to share their research and find the latest COVID-related research in real time on a cloud-based global network.
Knowledge, capabilities	The experience with the COVID-19 response fostered learning on how to leverage existing programmes and mobilise them to address new priorities, including changes to increase flexibilities for quicker project implementation and outcomes.
Networks	The project fostered new partnerships and connections for projects relating to the COVID-19 pandemic. For example, an emergency food distribution network was created – a scalable and responsive marketplace designed to expedite and simplify matching and delivery of food to a connected network of farmers, suppliers, buyers and charities.

2. Canada – Pandemic Response Challenge Program (PRCP)

Short description

The National Research Council of Canada (NRC) established the COVID-19 *Pandemic Response Challenge Program (PRCP)* on behalf of the Government of Canada. The programme was set up to form collaborative teams of leading Canadian researchers to fast-track R&D aimed at addressing specific COVID-19 challenges. It was part of a suite of 'Challenge' programmes, in which the NRC is partnering with the private and public sectors, academia and other research organisations in Canada and internationally to advance transformative, high-risk, high-reward research that addresses Canadian priorities. The PRCP offered grants and funding contributions for collaborative research teams under four pillars: Rapid detection and diagnosis (1), Therapeutics and vaccines (2), Digital patient care and pandemic analytics (3), Enabling adaptive responses (e.g. develop technologies for medical practitioners and develop made-in-Canada solutions to ensure necessary supplies needed for COVID-19 treatment) (4).

More information is available at: Pandemic Response Challenge program - National Research Council Canada

Key takeaways

The initiative illustrates the benefits of established networks and platforms ('Challenge' programmes and funding) for collaboration, which can support rapid mobilisation and the response to crises.

The initiative shows how the involvement of an institution with research support capabilities can boost collaborations. In this case, the involvement of the National Research Council (NRC) and its researcher staff supported specific projects by contributing based on their expertise and resources (e.g. virtual advisory on developing COVID-19 testing capabilities, such as verifying test protocols were adhered to, or lending necessary equipment).

Co-creation dimension(s) of the initiative

The Canadian NRC worked closely with government ministries and agencies, the Public Health Agency of Canada, the Ministry for Innovation, Science and Economic Development Canada, and Health Canada, to implement the COVID-19 pandemic *Response Challenge Program* leveraging its pre-existing scientific collaboration networks. In these collaborative projects, the NRC also leveraged its industrial network and expertise from its research centres and existing programmes, such as the Industrial Research Assistance Program, to identify potentially useful technologies and solutions.

Characteristics, participating institutions and their contributions and outcomes

Table 2.a Initiative characteristics

Categories	Overview	Description
Initiative size	14 research centres; 27 collaborative projects with 18 different academic and private institutions; an additional 40 NRC lead projects; 150 NRC researchers engaged full time on the program.	
Funding sources	Public	USD 11.8 million (CAD 15 million) by the National Research Council (NRC).
Timeline	March 2020 - March 2022	
Initiating organisation(s)	Government agency	National Research Council of Canada (NRC).
Existing pre-COVID	No	
Basis for and means of collaboration	Building or offering access to networks; Funding/Scholarships; Integrating resources (digital and/or material)	• NRC offered funding for collaborative projects with its research centres. • NRC leveraged its networks to build collaborative partnerships. • Various resources for research (such as NRC labs) were jointly used to test outputs of the projects (such as respirators).
Streamlining of processes	Project evaluation and approval process	COVID-19 project collaborations were fast tracked and given priority by NRC with a team of external advisors engaged for every core project and providing guidance on project progress.
Cooperation across disciplines	• Type: Programme building on diverse expertise; • Disciplines: Project-specific cross-discipline collaboration	
Leveraging existing assets	Network; Expertise	• NRC leveraged industrial networks through its research centres and existing programmes. • Existing NRC expertise was used to develop and deliver on collaborative projects with external partners.
Role of the government (here: NRC)	Provider of funding; Network builder/Negotiator	NRC (in its role as a government agency) acted as a network builder in connecting actors from across its research centres and networks including government, hospitals/healthcare organizations, industry and universities.
Intermediary Role(s)	Government/public institution	NRC acted as intermediary between other government bodies, its own networks, research centres and other actors such as companies.
COVID-19 exceptionality	Accelerated project evaluation; Refocused existing co-creation programmes/initiatives to COVID-19.	

Table 2.b. Partners

Name of partner	Type of institution	Country	Contribution
National Research Council	Government agency	Canada	• Built a team of Canadian and international researchers to fast-track development and delivery on R&D projects. • Provided advice and R&D services for specific collaborative projects; • Provided funding for eligible collaborations.
Various research centres of the National Research Council	Public research institutions	Canada	Contributed to individual projects using resources within the existing research centres of the NRC (made up of 14 research centres with 4 117 staff), such as using their own labs to test respirators in the "Ensuring Safe Effective N95 Respirators" project supported by PRCP, developing spike protein reference material for COVID-19 serological tests, and consulting on research concepts for projects.
Federal departments and agencies (including Innovation, Science and Economic Development; Public Health Agency of Canada; Health Canada)	Government ministries & agencies	Canada	• Informed of public sector's pandemic needs. • Contributed expertise, networks and/or resources available to respective projects.
Universities/companies	Academia and companies	Canada	Contribute expertise, networks and/or resources: • A project example includes a collaboration between the NRC and the private company Dorma Filtration to produce N95 respirator masks using 3D-printing and digital technology. • Another example of a project is a collaboration between researchers from the University of Waterloo and the National Research Council of Canada (NRC) using artificial intelligence (AI) to aid in the patient chest imaging screening process to detect the severity of COVID-19 infections.

Table 2.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Several pandemic response projects responded to priority public health needs, including the development of reference materials for COVID-19 serological testing and N95 respirators. • An NRC diagnostic solutions platform was implemented as part of the COVID-19 pandemic response monitoring system. The outcomes of this project included open access AI models to aid in the patient chest imaging screening process and a database of systematically processed X-ray, CT scan and ultrasound images. These tools could also help develop new AI screening solutions for other lung infections.
Knowledge, capabilities	• NRC organisational knowledge gained on how to respond quickly to changing conditions in the evolving COVID-19 context, as well as how to operate in a virtual environment using mainly digital tools for remote work and how to operate. • Capability from projects include how to detect and characterize COVID-19 infections in R&D and clinical settings.
Networks	Enhanced relationships across companies, academia and public actors from the programme, improving opportunities as outcomes of projects could spur future collaborations, brought demand requirements to inform supply chain network to find and deliver COVID solutions, and build future resilience.

3. Chile – Fondo de Investigación Científica (Scientific Research Fund) COVID-19

Short description

As part of this initiative, Chile's research and development agency, ANID, issued a call for proposals for one-year projects that were linked to diagnosis, control, prevention, treatment, monitoring of COVID-19 or other aspects related to the pandemic, that would help inform policy responses and strengthen the country's COVID-19 response capacity. The programme was open to all disciplines and to researchers from public research centres, students, citizens and entrepreneurs with and without company affiliation. The process of proposal evaluation of the 1 056 applications to approval was reduced from the average 100 days for ANID proposals to less than two weeks by involving the Chilean Ministry of Science, Technology, Knowledge and Innovation (MINCYT) and peer reviewers in the evaluation. Each of the 75 approved projects was supported with up to USD 125 000 USD (approx. 100 million Chilean Pesos). Projects came from such diverse areas as medicine and health sciences, natural science, social sciences and humanities, engineering and technology, humanities and agriculture and ranged from the identification of biomarkers of immune response and therapeutic targets for COVID-19 to developing strategies for pandemic control by adapting housing policies in urban areas to isolation and social distancing measures. The initiative also aimed to connect grant recipients with potential external beneficiaries via roundtables with invitations share in the agency's network (e.g. civil society, companies and government).

More information is available at: Fondo de Investigación Científica COVID19 (minciencia.gob.cl)

Key takeaways

The fast tracking of applications was facilitated by the existing systems already in place to process proposal information, review applications and evaluate proposed projects.

Additional staff was temporarily assigned to project selection, administrative procedures were streamlined, and best practices were used to project application approval processes within and between government agencies in order to speed up the selection process.

Co-creation dimension(s) of the initiative

Co-creation occurred at two levels, firstly at the programme level where the research and development agency (ANID) collaborated with the Government Ministry of Science, Technology, Knowledge and Innovation (MINCYT) and involved peer reviewers to evaluate and approve project proposals to be funded by the programme. Secondly, approved grant recipients (researchers, students or entrepreneurs) collaborated with prospective final users from the private sector, government and civil society, developing products (e.g. COVID-19 tests), or informing health care (e.g. on treatment timeline based on immune response markers) or policy (e.g. housing support best suited for social distancing).

Characteristics, participating institutions and their contributions and outcomes

Table 3.a. Initiative characteristics

Categories	Overview	Description
Initiative size	156 people involved in total; 75 projects funded	10 staff from MINCYT; 50 staff from ANID, 96 external evaluators from universities/research institutions making up panels to peer review project proposals.
Funding sources	Public	Public funding provided through Chilean National Agency for Research and Development (ANID).
Timeline	April 2020 - December 2021	From the end of 2020 funded projects were implemented and received technical support from ANID to disseminate their findings and connect with potential users until the end of 2021.
Initiating organisation(s)	Government agency	Chilean National Agency for Research and Development (ANID).
Existing pre-COVID	No	
Basis for means of collaboration	Funding/Scholarships; Issuing a call for participation; Matching partners (and/or end users)	• ANID offered funding for collaborative projects; • After projects were developed, ANID connected projects to users of research findings.
Streamlining of processes	Project evaluation and approval process	• Staff were reallocated internally (in ANID) to process the fast-tracking and evaluation of COVID-19 projects, and this was supported by existing systems to approve and evaluate research proposals – this was possible as the agency was undergoing a process of reorganisation itself due to the MINCYT having just been created in 2018; the large reliance of external evaluators in order to review the high volume of project proposals, however, was not out of the ordinary.
Cooperation across disciplines	• Type: Programme building on diverse expertise • Disciplines: Project-specific cross-discipline collaboration	
Leveraging existing assets	Network; Programme/Model	• ANID leveraged its staff and model (panels of external evaluators, criteria and processes) of reviewing and evaluating projects to fast-track applications for COVID-19 challenges. • ANID leveraged networks to identify potential partnerships and develop new connections for projects' implementation.
Role of the government (here: MINCYT and ANID)	Provider of funding; Network builder/Negotiator; Collaborator in innovative co-creation	• ANID was involved as collaborator (as a public research institution) and provided funding for projects. • MINCYT and ANID used networks to promote and support programme and COVID-19 projects.
Intermediary role(s)	Government/public institution	• ANID acted as intermediary between its research networks, government bodies and other partners by building new connections.
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19; Government as active collaborator (via its research agency ANID); Accelerated project evaluation.	

Table 3.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Ministry of Science, Technology, Knowledge and Innovation (MINCYT)	Government ministry	Chile	• Developed the strategic guidelines for the programme. • Provided communication and awareness for the programme. • Supported the evaluation of project applications.
Chilean National Agency for Research and Development (ANID)	Government agency	Chile	• Managed the programme, including the issue of the call, the review of received applications and the disbursement of funds to approved applicants. • Developed a network to connect projects with users of research findings. • Identified priorities and needs for the initiative. • Outreach to potential partnerships for funded projects.
Peer reviewers / external evaluators	Universities/Public research institutions	Chile	• Offered scientific expertise to projects. • Evaluated project applications.

Table 3.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	The programmes 75 projects resulted in the development of: • Patents, for example, a patent for a new high sensitivity molecular test for confirmation of indeterminate and negative SARS-CoV-2 results or the development of an ecological facemask by researchers in the University of Concepcion. • New products and solutions, for example a project developed a method to identify SARS-COV-2 in sewage across for territories in the region Metropolitan of Santiago developed by researchers in the Catholic University of Valparaiso.
Knowledge, capabilities	• Knowledge and policy insights gained from analyses and data developed by projects, for example comparative analysis on how the impacts of the COVID-19 pandemic affected the implementation and outcomes on child protection systems in Chile, Colombia and Uruguay. Other analysis conducted under researcher projects included analysis on the fiscal consequences and economic stress due to COVID-19. • Procedures manual for the programme developed from insights and experiences i.e. on how to fund projects quickly. • Organisational knowledge on agile policymaking, i.e. responding to changing circumstances and necessities (such as including capacities of entrepreneurs to facilitate the implementation of research ideas into products where feasible).
Networks	COVID-19 project consortia network, connecting researchers of the projects to companies or other beneficiaries such as civil society.

4. Japan – MEXT/RIKEN programme for COVID-19-related research

Short description

This initiative led by Japan's scientific research institution RIKEN, is a programme which mobilised actors to promote the joint use of the Fugaku supercomputer, research facilities and capacities of RIKEN. Universities, research institutions, and companies from all over Japan were invited to respond to an open call to use those resources for COVID-19 research.

The programme was initiated by President Hiroshi Matsumoto of RIKEN, in collaboration with the Ministry of Education, Culture, Sports, Science and Technology (MEXT), and involved an open call for funding under the President's Discretionary Fund, which is an internal fund for projects developed within RIKEN, although this COVID-19 call for proposals allowed external collaborators from both the private sector and academia. The programme mobilised RIKEN's technologies, incl. the Fugaku supercomputer, then not fully operational to be deployed for its intended task, for specific research-related co-creation projects. This included sharing Fugaku supercomputing facilities, which was jointly developed between RIKEN and the company Fujitsu Limited based on the initiative of MEXT, starting in 2014. These projects focused on developing therapies and conducting other relevant research to address the health crisis posed by the COVID-19 pandemic.

A number of universities, research institutions and private companies responded to the call to engage with RIKEN to the supercomputing facility. One example of a project was conducted by researchers from Hoshi University. They investigated the molecular dynamics of drug-protein interactions to develop drugs to treat COVID-19. Other co-creation projects included i) analysing the pattern of the spread of aerosols and droplets to evaluate the effectiveness of measures such as face shields for preventing infection in restaurants and pubs, public transportation, etc. ii) data simulations on key SARS-CoV-2 proteins such as the spike protein and 3CL protease that are targets of candidate drug compounds, and iii) analysing people's movements and the impacts of mobility restrictions in mental wellbeing.

More information is available at: 2020-21 COVID-19 Projects | RIKEN Center for Computational Science RIKEN Website

Key takeaways

The project is an example of cross-disciplinary co-creation aimed at combining domain-specific expertise in the area of health with supercomputing capacities.

This initiative illustrates the potential of leveraging existing computing research infrastructures in the context of a crisis that needs to be addressed quickly.

Co-creation dimension(s) of the initiative

Co-creation occurred as part of the programme that led to collaborations with external researchers from industry and research institutions with the use of RIKEN research facilities and collaborations with RIKEN researchers.

Characteristics, participating institutions and their contributions and outcomes

Table 4.a. Initiative characteristics

Categories	Overview	Description
Initiative size	About 100 (of the approx. 3 000) RIKEN researchers engaged in COVID-19 collaborative projects	RIKEN researchers supported projects and provided expertise.
Funding sources	Public funding	Exact amount not disclosed, a few million USD of government funds provided by MEXT.
Timeline	March 2020 - March 2021	The MEXT program to make Fugaku available for COVID-19-related research on a trial basis ended in March 2021 as full operations of Fugaku began. The research projects were continued using allocated resources of Fugaku.
Initiating organisation(s)	Public research institution	RIKEN
Existing pre-COVID	No (but the infrastructure already existed)	Supercomputer Fugaku was developed since 2014.
Basis for and means of collaboration	Building or offering access to networks; Integrating resources (digital and/or material); Issuing a call for participation	• RIKEN used existing networks both nationally and internationally as mechanism to bring together actors. • RIKEN provided access to its supercomputing and other research capacities.
Streamlining of processes	Project evaluation and approval process	• MEXT and RIKEN jointly set research themes which allowed the open call to be quickly launched. • COVID-19 projects were given priority use of the supercomputer to other projects.
Cooperation across disciplines	• Type: Expertise and technologies (use of computing infrastructure). • Disciplines: computer science/software development, epidemiology/medical sciences.	
Leveraging existing assets	Network; Infrastructure	• RIKEN research networks to support projects. • Supercomputer for use on COVID-19 projects and other research infrastructure.
Role of the government (here: MEXT)	Provider of funding; Collaborator in innovative co-creation	MEXT provided funding and selected research themes for COVID-19 related research to be conducted as part of the project.
Intermediary Role(s)	Government/public institution	RIKEN acted as intermediary between its researchers and other partners such as Universities, other government bodies and the private sector.
COVID-19 exceptionality	Refocused existing infrastructure to COVID-19; Big and/or real time data analytics or use of super-computing capacities; Accelerated project evaluation; Creation of large network to leverage all available expertise.	

Table 4.b. Partners

Name of the Partner	Type of institution	Country	Contribution
RIKEN	Public Research institution	Japan	• Launched the initiative. • Provided research infrastructure and technologies, including the supercomputer Fugaku, the Spring-8 radiation facility and its free-electron laser SACLA to COVID-19 projects. • Supported research projects by providing RIKEN researchers' support to users of RIKEN's research infrastructure.
Spring-8/SACLA Office	National infrastructure systems operated by RIKEN on behalf of the Japanese government	Japan	Issued an open call for research proposals related to COVID-19.
Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT)	Government ministry	Japan	• Provided funding. • Selected research themes for COVID-19 related research to be conducted as part of the project.

Table 4.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	The use of supercomputer Fugaku to the development of: • Identification of several candidate drugs for COVID-19 (from a database of drugs already used or trialled for other diseases). • Identification of proteins for potential treatments based on simulations on the COVIDC-19 target. • Insights into potential therapies of COVID-19 based on simulation of molecular dynamics of COVID-19 proteins.
Knowledge, capabilities	• Publication of data on interactions between COVID-19 proteins and drug candidate compounds, which aims to contribute to the development of therapeutic agents against COVID-19. • Database of relationships between biological processes of viral infection and the aggravation of infectious diseases including COVID-19, to enable prompt data dissemination for infectious disease research.
Networks	Collaboration with research institutions, universities, and companies in Japan and internationally. For example, RIKEN was involved in the High Performance Computing Consortium (Case 6), which brought together global supercomputing capacities to tackle COVID-19 challenges.

5. Türkiye – COVID-19 Türkiye Platform

Short description

The *COVID-19 Türkiye Platform* initiative mobilised an existing co-creation programme – the High-Technology Platforms Call – to offer accelerated funding for researchers, entrepreneurs, and industry to develop innovative solutions to the COVID-19 pandemic, incl. therapeutics and vaccines, within a network structure, and other approaches to support innovation, such as hackathons and scholarships programmes for collaborations.

The programme was led by two public bodies, the Ministry of Industry and Technology (MoIT) and TÜBİTAK, Türkiye's main governmental research and innovation agency that provides funding and other types of support to students, researchers, entrepreneurs, and companies to develop innovative solutions. The Platform is established as a co-creation based medical innovation oriented High Technology Platform in the urgency of COVID-19 battle and led by TÜBİTAK Marmara Research Centre (MRC) Genetic Engineering and Biotechnology Institute (GEBI). Moreover, the platform engaged 436 researchers from 49 organisations spanning academia and private industry for vaccine and drug development co-creation projects. Of these engagements, 118 were from universities, 67 from public R&D units, 38 from private industry and 213 are young scholars. The Platform involved 7 immunity-oriented vaccine development and 10 treatment-oriented drug development projects. Moreover, the Platform is integrated with a scholarship programme for young researchers (STAR), which supported 167 university students in the COVID-19 related projects. Under the leadership of TÜBİTAK, COVID-19 Türkiye Platform accelerated a holistic approach and met all RDI based needs of the ecosystem in order to find a cure for COVID-19. In addition, the project carried out rapid calls for SMEs, for the contributions of the social sciences and humanities, support for entrepreneurs, and hackathons to solicit innovative ideas (i.e. Coronathon Türkiye) to address the wide ranging socio-economic impacts of the pandemic. Outcomes are shared with the researchers and public opinion. The Platform also included offering opportunities from emerging technologies such as high performance computing (HPC), artificial intelligence (AI), and big data.

Furthermore, the initiative involved civil society engagement via a web portal and virtual conferences. The MoIT and TÜBİTAK established a joint virtual scientific portal, the COVID-19 Türkiye Data Portal. The portal promotes transparency and openness around the scientific developments regarding COVID-19. With open access to datasets and a "Scientific Sharing Platform", the portal provides information on the various competences of the Turkish ecosystem across disciplines and sectors, which may be of interest to potential collaborations and partnerships.

Key takeaways

The initiative illustrates how mobilising existing co-creation mechanisms and offering funding to both institutions and individuals can be key to developing innovations to address crises, such as the COVID-19 pandemic.

The initiative illustrates how the urgency of mobilising research and innovation communities resulted in the adoption of new approaches to building connections. These include the organisation of hackathons and emphasis on sharing platforms to enable co-creation by providing information on available competencies, but also to share data and relevant research information.

Co-creation dimension(s) of the initiative

Co-creation occurred as the programme brought together innovative actors under a number of projects. One of these projects was the STAR initiative, which brought young researchers into the ecosystem and promoted collaborations between SMEs, entrepreneurs and research institutions under funding calls for solutions to the pandemic, including solutions to the socio-economic impacts.

Co-creation also occurred through virtual conferences which were held with the co-chairmanship of the Ministry of Industry and Technology of Türkiye and the TÜBİTAK President, bringing together researchers and the public to support science-based communications of vaccines, drug and diagnostic opportunities, and to share progress of the developments. In addition, the COVID-19 Türkiye Data Portal supported co-creation within the ecosystem with open access to datasets and "Scientific Sharing Platform".

Characteristics, participating institutions and their contributions and outcomes

Table 5.a. Initiative characteristics

Categories	Overview	Description
Initiative size	17 projects, 436 researchers (Medical Innovation High Technology Platform) 46 projects, 50 SMEs (Rapid call for SMEs) 97 projects, 332 researchers (Rapid call for social impact of COVID-19)	17 COVID-19 vaccine and drug projects funded; 436 researchers from 49 organisations were involved in the COVID-19 Türkiye Platform (Medical Innovation High Technology Platform). With the integrated supports and events, the scale of the Platform widened further participation from different actors of the ecosystem which also included civil society engagement. For instance, 46 projects led by 50 SMEs were supported via rapid call for SMEs and 332 researchers were supported in 97 projects via rapid call for social impact of COVID-19.
Funding sources	Public	Public funding provided by the main governmental R&D and innovation funding agency, TÜBİTAK (up to Phase III of vaccine and drug projects) under the auspices of MoIT and the Health Institutes of Türkiye, TÜSEB (support for phase III of clinical trials and realization of final products), under the auspices of the Ministry of Health. Exact funding amount not disclosed.
Timeline	March 2020 – ongoing (as of May 2022 (time of report completion))	
Initiating organisation(s)	Government ministry and Government agency	Ministry of Industry and Technology (MoIT) and TÜBİTAK.
Existing pre-COVID	Yes	Overarching programme and open calls were refocused to COVID-19 challenges.

Basis for and means of collaboration	Funding/Scholarships; Integrating data; Integrating resources (digital and/or material); Interacting via a digital platform; Issuing a call for participation Organising a hackathon;	• COVID-19 Türkiye Platform accelerated R&D and innovation processes based on the mobilisation of research infrastructure and skilled human resources using an existing funding mechanism, namely "High Technology Platforms Call".
		• The Platform included open access to digital infrastructures and the integration of new opportunities from emerging technologies such as high performance computing (HPC), artificial intelligence (AI) and big data.
		• Government funding through three rapid and fast track calls launched
		  ○ A rapid call under the Intern Researcher Scholarship Programme (STAR) with a focus on supporting the participation of young scholars in COVID-19-related research topics.
		  ○ A rapid funding mechanism for SMEs for research activities on COVID-19 diagnosis, protective and medical equipment, as well as ICT solutions under a fast track call.
		  ○ A rapid Social Science Research Call on the impact of COVID-19 to identify the impact of the COVID-19 pandemic on socio-economic developments.
		• 'Coronathon Türkiye' hackathon held in March 2020 was organised online and brought together organisations such as the MoIT, universities and companies to solicit ideas and solutions.
		• Virtual conferences with wide participation were held to exchange and promote knowledge and co-creation. Three virtual conferences were held in April, May and December 2020 bringing together the private sector, government and researchers to exchange on drug development, drug repurposing, innovative treatments and vaccine development for COVID-19. In February 2021, another virtual conference was held regarding the projects which are supported by COVID-19 Social Science Research Call and a booklet was published.
		• A digital platform and data portal were developed to promote projects and their transparency.
		• Output data from projects was made openly available on a data web portal and digital platform to share insights and scientific developments.

Streamlining of processes	Project evaluation and approval process	COVID-19 projects were given priority to develop and deliver solutions.
Cooperation across disciplines	• Type: Programme building on diverse expertise • Disciplines: Project-specific cross-discipline collaboration	
Leveraging existing assets	Network; Programme/Model	• Existing programme leveraged to bring together actors as a network towards COVID-19 challenges. • Existing programmes by TÜBİTAK and MoIT were leveraged to bring together actors to participate in the fast track calls and hackathons.
Role of the government (here: Ministry of Industry and Technology and TÜBİTAK)	Provider of funding; Network builder/Negotiator; Collaborator in innovative co-creation	• Government funding through TÜBİTAK (TÜSEB for Phase III clinical trials). • Network building through the TÜBİTAK High Technology Platforms Call. • TÜBİTAK engaged as a collaborator with other innovation actors. • TÜBİTAK MRC-GEBI led medical innovation High Technology Platform.
Intermediary Role(s)	Government/public institution	• TÜBİTAK acted as intermediary in refocusing existing programme, projects and staff towards projects for COVID-19 solutions.
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19; Accelerated project evaluation; Use of social media, virtual conferences and/or hackathons to use contributions from a wide range of participants rapidly.	

Table 5.b. Partners

Name of the Partner	Type of institution	Country	Contribution
TÜBİTAK MRC-GEBI (TÜBİTAK Marmara Research Centre-Genetic Engineering and Biotechnology Institute) (core partner)	Government agency	Türkiye	Led the medical innovation High Technology Platform.
TÜBİTAK (Scientific and Technological Research Council of Türkiye) (core partner)	Government agency	Türkiye	• Supported pre-clinical studies of vaccine and drug projects. • Provided financial contributions. • Prepared and launch necessary mechanisms and calls. • Organised events and launched data portal.
Ministry of Industry and Technology (core partner)	Government ministry	Türkiye	Oversaw the programme.

Project researchers from 49 organisations (32 universities, 9 public R&D institutes and 8 companies) (core partners)	Public research institutions, universities, companies	Türkiye	Grant recipients and collaborators on projects spanning vaccine candidate development, drug re-purposing and development, and innovative therapies against COVID-19.
TÜSEB (Presidency of Turkish Health Institutes) (stakeholder for Phase III clinical trials)	Government agency	Türkiye	Provided financial contributions for Phase III clinical trials.

Table 5.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Development of specific technologies from funded projects including intensive care devices, diagnostics, masks, medicines, substances and tools for disinfection, personal protective clothing. • Development of immunity-oriented vaccine candidates (7 projects) and treatment-oriented drug candidates (10 projects) for COVID-19. Development of two innovative vaccine candidates (VLP and inactive) which were included in the list of clinical-stage vaccine candidates of the World Health Organization • Establishment of the COVID-19 Türkiye web portal, an open source scientific sharing platform of COVID-19 data for competent researchers and for citizens.
Capabilities	• Immunity-oriented vaccines and treatment-oriented drugs for COVID-19. • Informatics applications and vaccine development and application methods.
Networks	• The Platform included a wide network structure including researchers from academia and private industry, within integrated programmes for entrepreneurs, and SMEs. • New networks within the ecosystem developed with young researchers through the STAR Intern Researcher Program, as young scholars are supported to participate in COVID-19 research projects. • COVID-19 Türkiye Data Portal and "Scientific Sharing Platform" ensured another network for competent researchers sharing their COVID-19 related data for wider use and collaboration opportunities based on co-creation. • Virtual conferences are held with wide participation of the different actors from the ecosystem including civil society engagement.

6. United States – High Performance Computer (HPC) Consortium

Short description

The *COVID-19 High Performance Computing (HPC) Consortium* was a public-private consortium which pooled resources to make high performance computing capabilities available to researchers across 17 countries to respond to the COVID-19 pandemic. The consortium was spearheaded by the White House Office of Science and Technology Policy in partnership with the National Science Foundation (NSF) and the U.S. Department of Energy (DOE), and pooled expertise and computing capacities for COVID-19 challenges by partnering with companies (12 large US technology companies), 16 universities and research institutions, as well as national laboratories. The HPC Consortium enabled researchers to access powerful high-performance computing resources to accelerate understanding developed methods for combating COVID-19. It brought together 43 large technology companies, universities and research institutions to provide over 100 international project teams across 17 countries with computational resources. Examples of initiatives include a project by researchers at Utah State University, the Texas Advanced Computing Centre and other research partners that modelled the way virus particles disperse in an enclosed room. Another project from researchers from the University of Tennessee Knoxville, Google and Oak Ridge National Laboratory identified pre-approved drug compounds that could inhibit the coronavirus.

More information available at: COVID-19 HPC Consortium (covid19-hpc-consortium.org)

Key takeaways

This initiative demonstrates the key role of the government in using its convening power to bring together expertise and generating the conditions to deliver effective outcomes.

The initiative also illustrates the possibility of building international public-private collaborations in response to a common challenge where maximising computing capacities and expertise shared across public and private sectors was important.

Co-creation dimension(s) of the initiative

Co-creation occurred in this initiative across two dimensions. Firstly, those with computing facilities located close to one another pooled them and made them available to selected research projects. Additionally, several projects received assistance from experts offering computing resources, such as private companies, universities and research institutions with relevant HPC knowledge and expertise.

Characteristics, participating institutions and their contributions and outcomes

Table 6.a. Initiative characteristics

Categories	Overview	Description
Initiative size	100 international project teams	Project teams made up of staff from large private sector technology companies, public research institutions and universities came together to make use of the supercomputing power provided.
Funding sources	Public	• Government funding from the NSF, DOE, and other agencies; • The NSF-funded resources (and services/expertise) made up the largest fraction of resources used by projects.
Timeline	March 2020 - May 2022	• Early March 2020: NSF announced that it would be making all of its computing resources accessible to the scientific community immediately. • 23 March 2020: The White House announced the launch of the COVID-19 High Performance Computing (HPC) Consortium. • As of 1 May 2022, the COVID-19 HPC Consortium is no longer accepting requests for allocations of resources and services to support the pandemic response.
Initiating organisation(s)	Government ministry / government agency	Building on the National Science Foundation initiative, the White House Office of Science and Technology Policy, in partnership with National Science Foundation, the U.S. Department of Energy, and others, announced the launch of the COVID-19 High Performance Computing (HPC) Consortium in late March 2020.
Existing pre-COVID	No	
Basis for and means of collaboration	Building or offering access to networks; Integrating resources (digital and/or material); Matching partners (and/or end users)	• NSF leveraged its networks and services to bring together public and private organisations to use supercomputing resources and expertise. • The initiative's partners made their computing resources accessible to the scientific community and further expanded resources to include supercomputing centres and programs in Europe, including the computing power of the Partnership for Advanced Computing in Europe (PRACE) and the UK Research and Innovation public body and Australia.
Streamlining of processes	Project formation – open access/open source	Shared, open-access use of pooled supercomputing capacities made project progress easier and faster.
Cooperation across disciplines	• Type: Expertise and technologies (use of computing infrastructure) • Disciplines: computer science/software development, epidemiology/medical sciences/biochemistry	
Leveraging existing assets	Infrastructure	Supercomputing capacities pooled across NSF-funded research centres, institutes and universities.
Role of the government (here: White House Office of Science and Technology Policy and National Science Foundation (NSF))	Provider of funding; Network builder/Negotiator; Legitimiser	• White House Office of Science and Technology Policy acted as network builder and publicly endorsed the initiative; • NSF, DOE and others provided funding and resources, leveraged its networks.
Intermediary Role(s)	Government/public institution	NSF acted as intermediary across research institutions and universities in the United States and internationally.
COVID-19 exceptionality	Refocused existing infrastructure to COVID-19; Big and/or real time data analytics or use of super-computing capacities; Creation of large global network to leverage all available expertise.	

Table 6.b. Partners

Name of the Partner	Type of institution	Country	Contribution
White House Office of Science and Technology Policy	Government ministry	United States	Officially initiated the project and connected partners form private sector, academia and public sector institutions.
Large US technology companies (i.e. IBM, Amazon, Google, HP) and other company partners	Company	United States	• Provided technical expertise on using computing capacity (incl. via cloud services) for supercomputing projects. • Volunteered free computing capacity and resources.
National Science Foundation (NSF)	Government agency	United States	• The NSF-funded Extreme Science and Engineering Discovery Environment (XSEDE) project served as the hub by providing a portal and associated services to match researchers to computing resources. • As a co-lead, the NSF played a key role in coordinating and managing the use of its computing resources including those of other federal agencies, company and academia.
U.S. Department of Energy National Laboratories	Government agency	United States	Providing the pooled computing facilities of the departments' research centres.
Frontera, at the Texas Advanced Computing Center (TACC); Bridges at the Pittsburgh Supercomputing Center (PSC); Cheyenne at the NCAR-Wyoming Supercomputing Center; Comet at the San Diego Supercomputer Center (SDSC); Jetstream at the Indiana University Pervasive Technology Institute (PTI); and Stampede at TACC	Public research institutions (Computing centres under auspices of the NSF)	United States	Providing computing systems resources.

Table 6.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Scientific knowledge produced from the 100 projects included publications, software, data. For example, a project involved modelling COVID-19 variants and impact of public health measures. Another project predicted how COVID-19 is transported and the risk of infection from inhalation which was performed using supercomputing capacities. • A portal was developed to indicate available computing capacities and request access to them.
Knowledge, capabilities	• New capabilities to integrate computing resources and coordinating computing facilities across institutions; • Capabilities in cross-institutional collaborations in the context of HPC.
Networks	Network developed which connected HPC resources.

Note: Full list of collaborators: Who We Are | COVID-19 HPC Consortium (covid19-hpc-consortium.org)

7. Italy – ART-ER COVID-19 Project

Short description

ART-ER (Attractiveness Research Territory Emilia-Romagna) is the Joint Stock Consortium and a not-for-profit organisation which gathers regional shareholders: the Emilia-Romagna Region, universities and research centres, the Union of the Chambers of Commerce and other local representatives. Its purpose is to foster sustainable growth by developing innovation and knowledge, attractiveness and internationalisation. The organisation, officially established in 2018, administrated Italian and European regional development funds via a number of sector-specific clusters of local business and research ecosystem stakeholders, among them clusters on mechanics / mechatronics, green tech, big data and AI, health and wellbeing, construction, or agri-food. In July 2020, the regional government of Emilia Romagna published a call for proposals inviting companies and research institutions to offer rapid solutions to the COVID-19 pandemic. The focus was on projects that would develop technologies at high technology readiness levels. ART-ER managed and supported the regional governments' call for proposals that responded to COVID-19 under a special pandemic-programme. The programme funded 86 projects, under four themes: early diagnosis, elderly care system, solidification of the environment and personal protective equipment.

Key takeaways

ART-ER leveraged close links with the regional ecosystem and played an active role in developing the call for proposals, bringing actors together to submit proposals and working together with actors for completion of these projects.

Co-creation dimension(s) of the initiative

Co-creation occurred at two levels: first, the regional government worked closely with the ART-ER to develop the calls and second, the accepted projects led to co-creation across participating partners.

Characteristics, participating institutions and their contributions and outcomes

Table 7.a. Initiative characteristics

Categories	Overview	Description
Initiative size	86 projects; 20 people from ART-ER	
Funding sources	Public and private	EUR 9 million was offered by the regional government and the EUR 2.5 million in financial and in-kind contributions from participating companies and research centres.
Timeline	July 2020 to March 2021	The government grants were made available for nine months starting from July 2020.
Initiating organisation(s)	Government agency	ART-ER, funded by the Ministry of Economic Development Industries & Research.
Existing pre-COVID	Yes	ART-ER was officially established in 2018 and supported various sectoral clusters, incl. one on health and well-being under which the COVID-19 projects were administered.
Basis for and means of collaboration	Building or offering access to networks; Funding/Scholarships; Issuing a call for participation	The collaboration occurred in the form of funding specific projects by different networks, which had applied to the call for participation.
Streamlining of processes	Not applicable	
Cooperation across disciplines	• Type: Programme building on diverse expertise/production capacities (e.g. for mask production) • Disciplines: Project-specific cross-discipline collaboration (e.g. between textile/fashion industry and medical science)	
Leveraging existing assets	Network; Programme/ Model	ART-ER's regional ecosystem network helped the call for proposals reach relevant participants.
Role of the government (here: Ministry of Economic Development of Italy and regional government of Emilia-Romagna)	Provider of funding	
Intermediary Role(s)	Not-for-profit organisations	ART-ER assisted several project proposals in finding partners (in so far as they did not already have established partnerships as part of the previous work in clusters).
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19; Accelerated project evaluation.	

Table 7.b. Overview of key partners

Name of key partner	Type of institution	Country	Contribution
Regional government - Emilia Romagna	Local/regional government	Italy	• EUR 9 million funding. • Development and management of the call for proposal.
ART-ER (Attractiveness Research Territory Emilia-Romagna), is a not-for-profit entity funded by the Ministry of Economic Development of Italy	Not-for-profit organisation	Italy	• Co-developed the call for proposal with the regional government. • Simulated the already established links with the ecosystem to submit proposals. • Supported the approved projects. • Helped promoting project results (e.g. promoting some products) also via webinars.

Table 7.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, Innovations	• New forms of facemasks, respirators, hand sanitizers, tools and instruments. • Some projects sped up the modernisation of specific industries, such as the biomedical sector using digitalisation.
Knowledge, capabilities.	Experience on the certification and for validation of technology in the pharmaceutical and biomedical sectors.
Networks	Development of a larger network compared to the pre-COVID-19 period.

C. Co-creation for network building initiatives

Co-creation for network building are initiatives that promote the creation of new teams of diverse actors to co-create innovations. The mechanisms used include hackathons, which are events involving possibly large numbers of participants in generating in teams ideas and solutions primarily through technology and innovation, as well as digital platforms that bring collaborators together.

8. Belgium – Task Force *Vlaanderen Helemaal Digitaal* ('Flanders All-Digital')

Short description

Vlaanderen Helemaal Digitaal ('Flanders All-Digital') was a government-led initiative that consisted of connecting government agencies with companies and research organisations to identify digital solutions to COVID-19 challenges. The initiative built up a platform on which those needing help could identify those with potential solutions.

The online platform was created by Belgium's Interuniversity Microelectronics Centre (IMEC), an international research institution conducting R&D activities in the fields of nano-electronics and digital technology, under the Task Force Flanders All-Digital initiative of the Flemish Government's Flanders Information Agency with support from the Flemish Information and ICT Policy Steering Board. The platform aimed to connect companies, universities and research institutions offering software solutions with companies or government agencies who were facing pandemic-imposed software-related challenges. Companies, research institutions and public sector organisations (such as schools) were invited to register their pandemic-associated problems on the platform, those providing solutions were also invited to share them. For example, restaurants requiring a digital solution to register their customers could use the platform to connect businesses with software and technology developers. Many schools and universities in need of digital solutions for online teaching could identify companies and research institutions that had potential solutions.

The platform served as a space to connect potential partnerships. The exchanges between the parties after being connected and exchanging initially occurred on the platform. During the four-month project, 400-500 connections of demands and solutions were built. By mid-July 2020, 57 confirmed collaborations were reported to the government (i.e. those that worked together beyond an immediate solution).

Key takeaways

This initiative illustrated how digital platform tools proved useful to share information on the demand and supply of solutions to support the application of innovations.

Co-creation dimension(s) of the initiative

The Flemish government and IMEC worked collaboratively to set up the project which included the development of the digital platform. Another dimension of co-creation occurred between parties engaged in using the platform, as it supported co-creation by matching those requiring specific software applications with those having the capacities to jointly develop those solutions.

Characteristics, participating institutions and their contributions and outcomes

Table 8.a. Initiative characteristics

Categories	Overview	Description
Initiative size	4 full-time staff	IMEC (Private Research institution) and the Flemish Government each allocated 6 staff members (part-time: 2 full-time equivalents) temporarily to the initiative.
Funding sources	No explicit financial contribution from any collaborator involved.	
Timeline	March 2020-June 2020	Project completed in June 2020, but collaborations went on until at least early 2021.
Initiating organisation(s)	Government agency	Flanders Information Agency
Existing pre-COVID	No	
Basis for and means of collaboration	Interacting via a digital platform; Matching partners (and/or end users)	IMEC with input from the Task Force Flanders All-Digital developed the digital platform to connect and match relevant parties seeking solutions to those with the capacity and expertise to offer solutions to specific digital challenges.
Streamlining of processes	Temporary, task-oriented team creation	The Flemish Government's digital agency quickly formed a team through its Task Force Flanders All-Digital.
Cooperation across disciplines	• Type: Expertise • Disciplines: Software development (for developing the platform); policy expertise	
Leveraging existing assets	Network	Existing networks and taskforce teams with the Flanders Information agency were leveraged to develop and operate the digital platform alongside IMEC.
Role of the government (here: Flanders Information Agency via the Taskforce)	Negotiator/network builder; Collaborator in innovative co-creation	Flanders Information Agency through the taskforce acted as co-developer of digital platform and as network builder via the platform connecting digital solutions to digital needs.
Intermediary Role(s)	Government/public institution; Association	ICT policy steering board and the Flanders Digital Agency both acted as intermediaries in the between the government taskforce and the private research institution in the development of the platform.
COVID-19 exceptionality	Government as active collaborator (through public agency); Bottom-up initiative.	

Table 8.b. Overview of key partners

Name of key partner	Type of institution	Country	Contribution
Flanders Information Agency (Flemish government's digital agency)	Government agency	Belgium	• Set up the Task Force Flanders All-Digital for digital solutions to COVID-19 which created the Vlaanderen Helemaal Digitaal initiative. • Contributed to the development of the digital platform. • Provided staff to work on the initiative to manage the platform and help identify potential connections.
IMEC (Interuniversity Microelectronics Centre)	Private R&D organisation	Belgium	• Conducted research and contributed to the development on the platform where digital problems and solutions could be posted, and parties could be connected. • Consulted with the task force, business associations and relevant think tanks to post digital solutions.
Flemish Information and ICT Policy Steering Board	Cross-governmental collaboration body	Belgium	• Contributed to the establishment of the initiative as part of the Task Force Flanders All-Digital. • Provided support and oversight of the initiative.
Business associations including the association of digital (Voka), of electrical machinery (Voka, Agoria, Unizo and many others)	Industry Association	Belgium	Raising awareness about the initiative among members.

Table 8.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	A digital platform was developed where those facing digital challenges could post them and connect with those having potential solutions.
Knowledge, capabilities	• Experience gained on how to rapidly leverage a digital tool. • Experience gained on facilitating building connections of those requiring and those offering specific solutions.
Networks	New collaborations between companies and government agencies: Flanders Digital Agency and Flemish Information and ICT policy steering board who worked together on the digital taskforce under which the initiative was established.

9. Transnational – EUvsVirus

Short description

The *EU vs Virus* was a three-day hackathon event organised by the European Commission Services (ECS) from 24 to the 26 April 2020. The hackathon aimed at mobilising solutions to challenges posed by the COVID-19 from actors from the public sector (such as government agencies and hospitals), civil society, private sector, universities and research institutions. A follow-up matchathon event organised from 22-24 May 2020 aimed at connecting winning hackathon teams to potential private sector partners and investors.

The European Commission, in close consultation with EU countries, selected the challenges to be addressed and sub-challenges and posted a call for groups to respond. One challenge was "Health & Life" with sub challenge categories that included protective equipment, production of ventilators, and the development of cheap rapid testing. Another challenge was "Social & Political Cohesion" with sub challenge categories such as the protection of isolated/at risk groups and mitigating the spread of misinformation. 2 164 projects were submitted by teams from companies, civil society groups, academia, research institutions or public sector institutions/agencies. Of these, 120 winners were selected and invited to attend a matchathon, an online event (held on 21 May 2020) hosted on the European Innovation Council's (EIC) platform. The matchathon event was aimed to develop and scale the co-creation solutions developed during the initial hackathon by matching winning project teams with company partners with capabilities to develop those products and investors to provide the needed funding. In addition, the EC initiative coordinators also offered training webinars to the winning teams on such issues as how to build a business plan or pitch an idea. This initiative resulted in the 120 teams forming partnerships with 2 235 individuals from companies, the public sector, academia and investors.

More information is available at: Pan-European Matchathon (euvsvirus.org) and https://www.euvsvirus.org/finalreport.pdf

Key takeaways

The initiative's endorsement by the European Commission supported the quality and quantity of co-creation initiatives proposed during the hackathon.

Co-creation dimension(s) of the initiative

The hackathon and matchathon involved co-creation as it connected many stakeholders from across Europe, including experts from companies, civil society actors, not-for-profit institutions, academia, research institutions and the public sector to jointly develop innovative solutions to the COVID-19 challenge.

Characteristics, participating institutions and their contributions and outcomes

Table 9.a. Initiative characteristics

Categories	Overview	Description
Initiative size	120 teams formed involving 2 235 people; 300 staff;	• Coordination of the hackathon and matchathon events were done by a core team of 20 official EC staff and approximately 150-200 volunteers from public and private organisations across Europe. • The hackathon event resulted in 120 winning teams invited thereafter to the matchathon event, which connected teams to partners (1 448 from private sector, 374 from academia/research, 521 public sector and 10 venture capitalists).
Funding sources	Private	Prize funds of a total of USD 107 000 (EUR 100 000) to winning teams were provided by companies.
Timeline	March 2020 – June 2020	Hackathon and matchathon events concluded.
Initiating organisation(s)	Cross-governmental collaboration body	European Commission Services (ECS)
Existing pre-COVID	No	
Basis for and means of collaboration	Organising a hackathon; Matching partners (and/or end users)	Both the hackathon and subsequent matchathon events were used to bring together teams to collaborate and to connect winning teams and partners to enable the scale up of initiatives.
Streamlining of processes	Temporary, task-oriented team creation	Temporary teams were formed in order to work on their proposals during the Hackathon.
Cooperation across disciplines	Network/Team building	Teams were made up of a range of different actors to support and leverage different skillsets for initiative development.
Leveraging existing assets	• Type: Expertise and production capacities (matchathon) • Disciplines: Hackathon and matchathon participants came from diverse disciplinary backgrounds	
Role of the government (here: European Commission Services)	Negotiator/network builder	ECS acted as negotiator in determining in consultation with member states the priority themes or challenges for the hackathon and as networker in bringing together different actors to participate in the event.
Intermediary Role(s)	Government/public institution	• ECS acted as intermediary between member states, national curators in organising the hackathon event and the priority themes. • ECS acted as intermediary between private and public sector partners and winning teams in matching relevant partners to scale up projects.
COVID-19 exceptionality	Input and contributions solicited from individuals, start-ups and/or not-for-profits; Collaboration involved direct production and product development (here: as a result of the matchathon); Use of social media and/or hackathons to use contributions from a wide range of participants rapidly.	

Table 9.b. Partners

Name of the Partner	Type of institution	Country	Contribution
European Commission Services	Cross-governmental collaboration body	EU	• Organisation of the hackathon including development of challenges to be addressed, selection of winners, identification of companies and investors.
National curators (member states representatives)	Public sector agency	EU	Supporting the organisation of the hackathon.
Companies	Private sector	Countries across Europe	• Engagement of their communities and staff, promotion of the hackathon within their teams. • Acceleration programmes, engaging with hackathon teams. • Involvement with the evaluation of projects. • Offering prizes for winners: EUR 100 000.
EIC (European Innovation Council)	Public sector agency	EU	Organising and coordinating the matchathon event for the winning 120 teams from the hackathon.
Hackathon team participants	Companies, public sector organisations, academia, public and private research institutions, individuals (general public, civil society)	Countries across Europe	Engage in collaborative innovation activity.

Table 9.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Projects from the initiative developed solutions to COVID-19 challenges. Projects included for example Dattum, a global collaborative ecosystem that facilitates the sourcing of trusted COVID-19 data from hospitals around the world. Dattum's focus later was to leverage high granularity data and provide heterogeneous analytics for: treatment schemes, medical experiments, vaccine evolution. • A platform (EIC COVID-19) listing all projects gathered during the hackathon was presented.
Knowledge, capabilities	• The EC webinars held provided training to project teams in how to develop a business case, pitch an idea and engage with partner collaborators. • Expertise developed within the EC on coordinating and bringing parties together in the form of a hackathon.
Networks	Establishment of 120 projects, with a total of 2 235 partners involved across these teams encompassing company partners (1 448) academia (374), public sector (521) and venture capitalists (10).

10. Finland – Fast Expert Teams vs COVID-19

Short description

The *Fast Expert Teams vs COVID-19* initiative brought together experts from universities and research institutions, companies and the public sector (including ministries and agencies) to engage in pro bono efforts to solve various challenges caused by the COVID-19 crisis. The initiative relied on the use of digital tools, including temporary virtual collaborative platforms, to overcome the geographic distances of the experts involved.

The initiative, which was started and led by Professor Kirsimarja Blomqvist of LUT University, deployed volunteer expertise from across universities and research institutions, companies, and the public sector. With the Ministries of Economic Affairs and Employment, Finance, and Transport and Communications iCOVID-19 challenges that could be resolved with this approach were identified. Professor Blomqvist used her networks and experience to form teams comprised of experts from relevant universities, research institutions and companies to collaborate virtually and address the identified COVID-19 challenges. Eight expert teams were formed to focus on topics such as utilisation of data, artificial intelligence, 3D printing to respond to COVID-19 challenges and decontaminating high-quality respirators for reuse. One of the expert teams in the initiative was also involved in conducting a survey to understand and develop insights on the state of remote working in Finland.

A report for Finnish ministries and "Committee for the Future" of the Parliament of Finland is available at: FAST EXPERT TEAMS vs. CORONA (futuremote.fi)

Key takeaways

This initiative's focus on co-creation allowed for a faster speed of the innovation process, with some outputs in just a few weeks rather than months or years, e.g. a respirator decontamination project took six weeks from the idea of using an innovation from another field to a full-scale pilot plant (with the cross-sectoral core team being set up in 24 hours).

This initiative also demonstrates the importance of reducing the complexity associated with intellectual property right agreements in collaborations. The use of an existing standard contract for the intellectual property rights for collaborations on innovation projects was important for optimising the projects' fast mobilisation.

Participants' motivation outside of direct personal benefits to engage in the co-creation challenge namely to combat the COVID-19 challenges under the mission "Let's prevent Finland's paralysis", led to participants engaging in mostly pro-bono work and was a major driver of the initiative's progress.

Co-creation dimension(s) of the initiative

Multidisciplinary co-creation occurred as diverse experts were mobilised together in cross-sectoral teams comprising experts from universities, research institutions, companies, public sector agencies and government ministries which were actively formed to tackle specific challenges relating to COVID-19.

Characteristics, participating institutions and their contributions and outcomes

Table 10.a. Initiative characteristics

Categories	Overview	Description
Initiative size	8 teams; 100 experts	8 teams of 100 experts with range of skillsets brought together for 6 weeks to tackle specific COVID-19 challenges.
Funding sources	Public	Public funding provided additional costs for exploring AI and communications: USD 21 400 (EUR 20 000) in government funding; the previous non-COVID-19-focused Fast Expert Teams in a Digital Platform Economy (FAST) research project received funding from Business Finland.
Timeline	March 2020 - May 2020	After 6 weeks the temporary teams reported the solutions to the challenges to parliament and ministries. After the initiative, the new digital form of temporary organising has been used in other similar initiatives from non-crisis context in 2021 (80 work life experts and six teams) and 2022.
Initiating organisation(s)	Individual (academic/expert)	Professor Blomqvist of LUT University started the initiative and collaborated with government ministries, academia and companies to establish expert teams.
Existing pre-COVID	No	Previous research project on digital platform economy /digital organising (prior to COVID-19).
Basis for and means of collaboration	Building or offering access to networks; Matching partners (and/or end users)	Professor Blomqvist leveraged her networks to deploy volunteer expertise from across research, private and public sector communities to work on the specific challenges of each temporary team formed.
Streamlining of processes	Temporary, task-oriented team creation	Fast creation of expert teams and digital community building from various institutions possible during the pandemic, but based on existing personal network and relationships with experts from different sectors.
Cooperation across disciplines	• Type: Expertise and production capacities • Disciplines: Respective expert teams brought together expertise in data science, 3D-priting, medical device building, social science (surveys), among others, as well as research, testing, educational and logistics capacities (for masks)	
Leveraging existing assets	Network; Programme/model	Existing standard contract was used for the respirator decontamination team for IP; digital community and other; networks were available, but the new digital double-layered organising structure was piloted in practice first time; teams were based on shared interest, identification, trust and collaboration norms.
Role of the government (here: various ministries, agencies and local government (see below))	Provider of funding; Network builder/Negotiator; Legitimiser	• Government had funded previous research on the topic and civil servants were invited as active participants both to define and solve problems on the temporary teams; they also participated in follow-up projects on national preparedness, hybrid work and initiated a workbook on how to organise Fast Expert teams. • Government endorsed the initiative by providing additional funding to cover expenses for communicating results and conducting exploratory work.
Intermediary Role(s)	University	• Professor Blomqvist of LUT University used her role as professor to act as intermediary between academic private and public sector partners to build and lead the Fast Experts Team initiative.
COVID-19 exceptionality	Input and contributions solicited from individuals, start-ups and/or not-for-profits); Pro-bono involvement of entrepreneurs; Bottom-up initiative; Refocused existing co-creation programmes/initiatives to COVID-19.	

Table 10.b. Partners

Name of the Partner	Type of institution	Country	Contribution
LUT University, Tampere University, Aalto, VTT, Jyväskylä University, Finnish Institute for Occupational Health, and University of Eastern Finland	Universities & Public research institutions organisations	Finland	• Professor Blomqvist of LUT University led the initiative. • Volunteer expertise to help build solutions – identifying and organising expertise related to 3D printing solutions.
Ministry of Economic Affairs and Employment; Ministry of Finance, Ministry of Transport and Communications	Government Ministries	Finland	Funding contributions to cover project costs.
Gofore, Humap, Solved, Skillhive, Howspace (digital technology SMEs)	Companies	Finland	Volunteer expertise.
Finnish Academy of Science and Letters (Finnish academic society)	Public sector agency	Finland	Volunteer expertise and networking.
Sitra Lab	Public sector agency	Finland	Covering facility costs relating to the project.
Regional Council of Häme	Local government	Finland	Volunteer expertise and networking.

Table 10.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Insights on how to leverage 3D printing capacities to manage decontamination and re-use respirators. • New digital form of organising (a double-layered temporary digital structure of a temporary digital community and temporary expert teams).
Knowledge, capabilities	• Information gained from a national working from home survey - four rounds of national surveys were conducted alongside team formation. • Experienced gained in ad-hoc digital community and team formation, such as shared leadership, collaboration design, project management and multidisciplinary engagement. • Based on the experiences, Prof. Blomqvist's booklet on "How to organize fast digital co-creation in communities and teams" for cross-sectoral collaboration will be available in September 2022. • A template for minimal contracting in cross-sectoral co-creation was developed in a subsequent initiative conducted in 2021.
Networks	New expert network with the capacity to operate online and build cross-sectoral social capital among unfamiliar experts coming from different networks (structural, cognitive and relational).

11. Italy – COVID-19 portfolio of the Knowledge Share Platform

Short description

The *Knowledge Share (KS)* initiative is an online co-creation patent platform established in 2016 with the aim of connecting Italian research to companies worldwide. The KS platform allows researchers to showcase their patents and technologies to companies and investors alike in order to establish potential private sector connections and collaborations to transform their inventions into commercially viable innovations. Technology transfer events showcasing existing technologies and webinar sessions dedicated to relevant issues (i.e. Tech Share Days) are organised to promote these research-private sector collaborations. The KS team is managed by Netval (a university and public research association), in partnership with the Italian Patent and Trademark Office (UIBM), an office of the Ministry of Economic Development, and in collaboration with the Politecnico di Torino. The platform holds more than 1 600 patents and connects those who hold patents (researchers) with potential users in the private or public sector. Over 90% of universities and public research institutions in Italy are using KS, which has published 1 662 patents on the platform. There are also over 3 000 company users comprising investors, and private companies registered in the KS, with over 5 000 users per month, and there have been over 100 connections made. During COVID-19, the KS platform was mobilised to help leverage available technologies to address the COVID-19 challenge with a portfolio created specifically within the platform of existing technologies identified.

Key takeaways

The initiative illustrates the use of the platform to improve connecting researchers and companies to use more research insights for innovation.

Co-creation dimension(s) of the initiative

The *Knowledge Share* IP platform aims to foster co-creation between researchers and the private sector by offering new connections and promotes the translation of research into innovation.

Characteristics, participating institutions and their contributions and outcomes

Table 11.a. Initiative characteristics

Categories	Overview	Description
Initiative size	5 full time staff; 3 partner organisations.	
Funding sources	Public and academia	Politecnico di Torino USD 32 000 (EUR 30 000) and Italian Patent and Trademark Office / Ministry of the Economic Development USD 430 000 (EUR 400 000) for the development of the Knowledge Share platform – funding shares for COVID-19 portfolio unavailable.
Timeline	Spring 2020 – ongoing (as of May 2022)	The platform was established around 2016 and has been used to support addressing COVID-19 challenges since Spring of 2020.
Initiating organisation(s)	Research institution, University	Politecnico di Torino; Netval.
Existing pre-COVID	Yes, since 2016	
Basis for and means of collaboration	Integrating data; Interacting via digital platforms	Use of an existing intellectual property (IP) platform designed to facilitate interaction between university technology transfer offices, academic researchers, and companies (managed by Netval [a university and public research association], in partnership with the Italian Patent and Trademark Office [UIBM]).
Streamlining of processes	Licensing contracts of intellectual property	Previously used process on IP sharing for COVID-19 portfolio, allowed for quicker use of the technologies.
Cooperation across disciplines	Not applicable	
Leveraging existing assets	Programme/Model	An existing knowledge share platform was applied for the COVID-19 case.
Role of the government (here: via UIBM)	Provider of funding	Funding from the Ministry of Economic Development, administered through the Italian Patent and Trademark Office (UIBM).
Intermediary Role(s)	University; Association	University association Netval facilitated the matching process between universities and companies.
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19.	

Table 11.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Politecnico di Torino	University	Italy	• Financial contribution for the development of the KS; • Established KS as a model in the Italian tech transfer ecosystem providing human capital, IT, networks and intellectual property.
Netval	Association	Italy	The association (of universities, research centres, and technology transfer offices) provided support in development and increasing the use of the model.
Italian Patent and Trademark Office (under the aegis of the Ministry of the Economic Development)	Government office	Italy	• Financial contribution for the development of the KS; • Helped develop the platform and foster the network between companies and researchers in Italy.

Table 11.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Developed a specific COVID-19 portfolio of technologies on the existing Knowledge Share digital platform which presents information on potential technologies that could be used to help tackle the COVID-19 crisis.
Capabilities	Capabilities on identifying relevant technologies to specific crisis needs – based on an existing pool of technologies and patents.
Networks	Potential networks made between researchers and companies to translate research into innovations.

12. Austria – COVID-19 Pop-up Hub

Short description

The COVID Pop-up Hub, initiated and funded by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK), enables community-based policy making by gathering experience and ideas from various actors within the innovation ecosystem. The core element was a digital discussion platform administered by partner organisations, but open to experts as well as the public for participation. The initiative also used many channels to communicate with interested people (such as videos and social media of the participating organisations). The purpose of the Hub was to be a collaborative think tank, aimed at understanding unexpected social, environmental and economic consequences of the pandemic; identifying opportunities, expertise, technologies and networks to find solutions; and developing innovative solutions in four key areas: Digital Health, Distancing, Economic Buffers and State Intervention.

More information is available at: COVID-Popup Hub | Discuto

Key takeaways

The Pop-Up Hub's low-threshold open model, couple with the outreach via various digital channels, facilitated broad participation and inclusion of different perspectives. This stimulated ideational (strategies, ideas), material (small pilot projects) and organisational (new partnerships and networks) innovation through cooperation between experts and the public.

The temporary (pop-up) organisational (especially virtual) framework enabled stakeholders to interact more quickly and develop strategies, innovations and the necessary organisational networks. Community-based policy making enabled by the Hub supported the identification of topics to be addressed by policy both in the short term, such as through the Research Technology and Innovation programmes of BMK, but also for medium- and long-term development paths, and open up perspectives for the topic setting.

The model adopted by the COVID Pop-up Hub to bring ecosystem actors together and engage in online interactions for evidence-based policy can make the broader, interested public or specific target groups better integrated. Including feedback from public and experts in this way can further be crucial for government to understand key socio-economic trends to tailor their support to changing requirements.

Co-creation dimension(s) of the initiative

Co-creation occurred among stakeholders (companies, public research institution, ministry and citizens) in the process of participatory idea and concept development to support government decision-making.

Characteristics, participating institutions and their contributions and outcomes

Table 12.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Up to 25 participants per virtual discussion / workshop	One expert from each collaborating organisation leading one of the themes; public participation through the discussions.
Funding sources	Public	Funding of USD 100 000 provided by the government: Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).
Timeline	September 2020 – ongoing (as of May 2022 (time of report completion))	Phase 1: COVID-19 Pop-up Hub started in September 2020 and ran until the end of April 2021. Phase 2: COVID-19 Pop-up Lab – started in September 2021 and continued - It is now named as a Lab since the team is working on it beyond the COVID-19 pandemic with long-term plan.
Initiating organisation(s)	Government ministry	Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK).
Existing pre-COVID	No	The organisations that led different themes had been engaged in community-based policy making prior to this project.
Basis for and means of collaboration	Interacting via a digital platform	Creating a temporary, virtual hub in the form of a digital platform to hold discussions on the various issues with experts, the publicand the organisation.
Streamlining of processes	Temporary, task-oriented team creation	Teams and discussion groups were put together based on their experience with respective topics and interests, making it possible to start the idea development quickly.
Cooperation across disciplines	• Type: Expertise • Disciplines: Respective partners contributed their expertise to the commonly discussed themes (e.g. digital tools for distancing, scenario-building for Economic Buffers, community-based innovation for State interventions and artificial intelligence for Digital Health)	
Leveraging existing assets	Programme/Model; Networks	Use of models for participatory idea and concept development; networks of collaborators to involve participants.
Role of the government (here: BMK)	Provider of funding, Legitimiser; Collaborator in innovative co-creation, Network builder/Negotiator	• Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) endorsed and funded the project and brought four partners together for the project. • Government also involved in co-developing the themes/challenges and engaged in the participatory idea and concept development process with other stakeholders.
Intermediary Role(s)	Intermediary organisations (e.g. PRIs); Private sector	All collaborators acted as intermediaries crowding-in participants through their networks.
COVID-19 exceptionality	Refocused existing co-creation programmes/initiatives to COVID-19; Included extensive public engagement (to facilitate output adoption and/or solution development; Use of social media and/or hackathons to use contributions from a wide range of participants rapidly.	

Table 12.b. Overview of key partners

Name of key partner	Type of institution	Country	Contribution
Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK)	Government ministry	Austria	• Brought the partners together to develop ideas and concepts within the Hub. • Co-developed the themes/challenges to be addressed (Digital Health, Distancing, Economic Buffers and State Intervention).
Austrian Institute of Technology (AIT)	Research institution	Austria	Co-developed ideas and concepts and led discussion on theme of Distancing, specifically contributing based on experience and expertise in technologies for remote working and interaction.
Red Swan Consultancy	Company	Austria	Co-developed ideas and concepts and led discussions on the theme of Economic Buffers, specifically contributing based on expertise in and experience with methodology of future scenarios for foresight exercises.
Cbased	Company	Austria	Co-developed ideas and concepts and led discussions on the theme of State interventions, specifically contributing based on their experience of community based innovation.
Data Intelligence Offensive	Company	Austria	Co-developed ideas and concepts and led discussions on the theme of Digital Health, specifically contributing based on their experience expertise on Artificial Intelligence.
Nexyo	Company	Austria	Co-developed ideas and concepts and led discussion on theme of health data, specifically coordinated synergies with the project CAPE10 (https://cape10.at) which is led by one of Austria's leading medical experts.

Table 12.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies and Innovations	Virtual platform and online formats that enable citizen participation and informational videos via the established social media channels.
Knowledge and Capabilities	Enhanced experience in participatory idea and concept development.
Networks	Networks developed from the participants on the online platform: over 600 people attended the 13 conversations, 10 workshops, and expert interviews held.

13. Portugal – Tech4COVID19

Short description

TECH4COVID19 was a national initiative bringing together start-ups, citizens, companies and non-profit organisations to build a network of community volunteers with diverse expertise to address various COVID-19-imposed challenges. The initiative established three categories, incl. supporting health professionals and hospital material (such as finding accommodation for health care workers relocated to outbreak hotspots), health and education services (such as medical consultations and COVID-19 symptom tracking via video), and shopping and deliveries (such as tracking the occupancy of local stores to avoid overcrowding).

This initiative had more than 5 360 volunteers working on 72 projects (36 fully developed projects and 36 ideas under development) in the period from May to September 2020. A number of projects were then used by the government and other professional stakeholders. Some project teams have formed separate spin-outs.

The initiative was initially formed on the basis of an informal conversation between the founders of Portuguese technological start-ups. Subsequently, with support of Startup Portugal, a public-private initiative for designing the national strategy for entrepreneurship, they built a large network of volunteers from 250 companies across Portugal. This was eventually registered as the APCT (Associação de Apoio à Comunidade Tech4COVID19), a non-profit association acting as a formal vehicle to support the community and official projects of the Tech4COVID19 initiative.

More information is available at: Tech4Covid19 · A comunidade tecnológica portuguesa combate a Covid-19.

Key takeaways

Voluntary pro-bono support from experts was key to several projects with limited financial resources.

Government's adoption of solutions predominantly developed by start-ups helped promote the wider adoption of those solutions.

Co-creation dimension(s) of the initiative

The projects' volunteers participated in built teams of diverse backgrounds.

Characteristics, participating institutions and their contributions and outcomes

Table 13.a. Initiative characteristics

Categories	Overview	Description
Initiative size	5 469 volunteers involved in 72 projects	
Funding sources	Private	USD 225 000 (EUR 210 000) was gathered through corporate sponsorships and crowdfunding.
Timeline	February 2020 to September 2020	• The initiative started in February 2020 when a group of entrepreneurs got together to see how they could help address COVID-19 challenges and then created a network. • From February 2020 to May 2020 the initiative mainly focused on crowdsourcing funding. • From May to September 2020 different projects were started and some projects became independent spinoffs.
Initiating organisation(s)	Individuals (professionals)	A group of entrepreneurs.
Existing pre-COVID	No	
Basis for and means of collaboration	Building or offering access to networks; Funding/scholarships	Building a network of diverse volunteer contribution across 72 projects; funding said projects.
Streamlining of processes	Temporary, task-oriented team creation	Based on their respective expertise and capabilities, project participants collaborated in their functions to achieving their given task, ensuring quick delivery.
Cooperation across disciplines	• Type: Expertise and production capacities • Disciplines: Legal advice, logistics support, public relationship management, programming skills to domain expertise in the area of health	
Leveraging existing assets	Technologies; Networks; Knowledge.	The initiative leveraged the expertise, technologies and networks from across various skill sets and industries to support technology developments from a diverse range of projects.
Role of the government	Network builder/Negotiator	Government offered support to projects when required in terms of putting the teams in touch with relevant parties and engaging in negotiations with external parties to delivery certain projects.
Intermediary Role(s)	Private sector	The core team of entrepreneurs who initiated the project acted as intermediaries by bringing partners together and coordinating among projects.
COVID-19 exceptionality	Input and contributions solicited from individuals, start-ups and/or not-for-profits; Creation of large network to leverage all available expertise.	

Table 13.b. Overview of key partners

Name of key partner	Type of institution	Country	Contribution
Individuals/professionals	Individuals (industry professionals)	Portugal	Provided leadership of the various aspects and capabilities across the initiative. 5 360 volunteers involved in 34 projects.
The next big idea; SAPO	Media outlets	Portugal	Provided key media support to enable more outreach.
Individuals and Industry sponsors such as EDP; NOVARTIS; Santander; NOS PrimeIt; Sonae Industria; Boston Consulting Group; AMT; PTUSP; Retail Consult	Private sector Civil society	International; Portugal	Provided funding support of USD 225 000 (EUR 210 000) by 6 428 donors (over the course of the initiative) from private sector sponsorships and crowd funding.

Table 13.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Technological output of the projects included for example: • Platforms for digital health platform fund raising; System tracking platforms; short distance urgent drone delivery of medicines and phone tracker to show crowded places; visualisation of real time data and information; systems to match accommodation needs of doctors and providers of accommodation.
Knowledge, capabilities.	Peer to peer lending mechanisms.
Networks	The initiative acted as a network to provide support specific projects.

D. Co-creation for medical innovation initiatives

The initiatives included in this section refer to co-creation initiatives to produce medical product innovations against COVID-19. The initiatives include co-creation in vaccine development, medical devices such as mechanical ventilators, and drug discovery for COVID-19 treatment.

14. Costa Rica – Fab Helmet

Short description

The *Fab Helmet* initiative was a collaboration of individuals from a diverse range of backgrounds (medical, legal, prototype design, art, engineering, etc.) and diverse sectors (academia, as well as public and private institutions in medical and legal sectors) to develop non-invasive ventilation equipment to treat COVID-19 patients. This initiative was started by individual designers who leveraged their networks trying to help Costa Rica address the COVID-19 health crisis.

The initiative prototyped non-invasive mechanical ventilation in the form of helmets for patients with COVID-19. It was initiated by two designers who developed a draft design of a ventilator helmet and contacted Fabrication Laboratory (Fab Lab Kä Träre), of Costa Rica's UNED University, to develop the prototype. Fab Lab Kä Träre leveraged its networks to bring together relevant expertise to work on the project and provide resources such as production capacities and capabilities, and exchanging with different groups working on the design across the country. The project also involved medical expertise such as intensive care doctors, respiratory therapists, and facial surgeons, who participated in the clinical validations of the ventilator helmet. Notably, the Central American Silicone Suppliers (CASS), a private company in the silicone technology sector, offered research expertise, and prototyped and developed one of the helmet elements with silicone. Intellectual property lawyers supported the process and identified relevant IP for the product's development.

Key takeaways

The project illustrates the importance of knowledge co-creation that involves manufacturers being engaged from the beginning of the development process. Some key participants with manufacturing capabilities were absent at the very beginning of the process due to not having been identified as such. Once it became apparent in the design process that these participants were needed, contact was made, and production continued.

Intermediary institutions with capabilities to co-create and organise networks can enhance effective co-creation of innovative solutions. Fab Lab, which is part of UNED, a university in Costa Rica, led the co-creation process. This proved essential for the initiative to operate effectively.

The initiative shows the importance of the public medical sector being involved for medical innovation. For better responsiveness to address future crises, the Health Ministry of Costa Rica expressed interest in working with Fab Labs to facilitate co-creation with hospitals in the development of other medical innovations in the future.

Co-creation dimension(s) of the initiative

The ventilation helmet equipment was co-created by a team of experts from academia, private companies, medical professionals and designers with support from other expertise including legal/IP professionals.

Characteristics, participating institutions and their contributions and outcomes

Table 14.a. Initiative characteristics

Categories	Overview	Description
Initiative size	25 people	• The project involved 25 people. • 200 helmet ventilators were produced up to April 2021 after which the project was finalised.
Funding sources	Academia	USD 50 000 from Fabrication Laboratory (Fab Lab Kä Träre) – UNED, a public university funded the initiative.
Timeline	April 2020 to April 2021	• April 2020: the grass roots team requests project to the Fab Lab Kä Träre. • April to October 2020: Work is carried out on prototypes of the helmet, considering different designs to leverage inputs relying on functional and existing materials in the country, while achieving the quality needed for their use for patient treatment. • October 2020: The Minister of Health authorises the emergency use of the ventilator helmets and their components developed by the Fab Lab Kä Träre of the UNED. • November 2020: The UNED Fab Lab manufacturing laboratory obtains the sanitary operating permit from the Ministry of Health authorising it to manufacture the medical devices. The manufacture of the first 100 Helmets begins. • December 2020: The UNED manufacturing laboratory obtains the health registration for the helmet from the Ministry of Health and delivers the first 100 helmets to the College of Physicians and Surgeons. • February to April 2021: Another 100 helmets are produced and delivered for use in national hospitals and the project was finalised.
Initiating organisation(s)	Individuals (professionals)	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks	• Research and manufacturing infrastructure; Networks to integrate production capacities. • Fab Labs of the world shared resources and supplies among themselves.
Streamlining of processes	Open access/open source	• The valves used in the helmet designs were open source, facilitating exchange and collaboration with other groups working on similar projects. • Fabrication Laboratories all over the world provided open-source inputs, sharing designs of the different resources created to address the medical needs that arose from COVID-19.
Reason for multidisciplinarity	• Type: Expertise, technologies and production capacities • Disciplines: mechanical manufacturing and medical devices and regulation were combined in the production of the Helmets	
Leveraging existing assets	Infrastructure	• Existing production infrastructures/capabilities leveraged to produce helmets.
Role of the government (here: Minister of Health)	Legitimiser	• Minister of Health authorised the emergency use of the Helmets and their components before the production even began.
Intermediary Role(s)	University	• Universidad Estatal a Distancia (UNED), Costa Rica
COVID-19 exceptionality	Used open-source inputs or provided open access to outputs to facilitate rapid response (rapid development and to facilitate updates); Pro-bono involvement of entrepreneurs; Bottom-up initiative.	

Table 14.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Fabrication Laboratory (Fab Lab Kä Träre) - UNED	University	Costa Rica	• Led the whole process. • Provided funding. • Created prototypes of the helmets (design, redesign, prototyping, and manufacturing). • Manufactured 200 ventilator helmets. • In charge of processing the emergency use permit, as well as the sanitary permit and the sanitary registration of the helmet (incl. working on all the necessary documents).
Medical experts, such as ICU doctors, respiratory therapist, a maxillofacial surgeon; intensivists doctors	Public sector	Costa Rica	• Accompanied the whole process to support the design from the initial stages. • Supported with the writing of the technical sections of the documents for the health registration of the helmet. • Supported with questions about design, materials, operation and others for its approval for use. • Contributed expertise in the development of dental devices (stereolithographic models) and medical devices (orthoses) with the Fab Lab. • Carried out the validation of the functional prototype.
Designer, first prototype creator, artist and maker	Individuals (professionals)	Costa Rica	• Designed the first prototype on which the laboratory worked. • Connected doctors with the UNED Fab Lab team. • Researched, prototyped and developed one of the helmet elements with silicone.
Intellectual property lawyers	Individuals (professionals)	Costa Rica	Provided legal advice for the development of the helmet, and advice on requirements for the use of existing prototypes.
Central American Silicone Suppliers C.A.S.S.	Company	Costa Rica	Researched, prototyped and produced helmet elements with silicone.

Note: Individuals contributing to the project included: Diana Hernández Montoya, Ana María Sandoval Poveda, Esteban Castro Granados, Luis Fernando Rodríguez Benavides, Amanda Monge Vilchez, Esteban Campos Zumbado, Farith Tabash Pérez, Luis Diego Gómez Quesada, Jorge Espitaleta Gómez, Alberto Cubero Mata, José Miguel Ramírez Carro, Jorge Oviedo Quirós, Nicolás Bautista, Roberto Solano, Jonathan Torres, Rodolfo Alfaro y Simón Valverde

Table 14.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Development of 200 non-invasive ventilator helmets for COVID-19 patients and equipment required to produce them. • The following documents: 1. The User's Manual for the helmet, for any specialist who would use the product. 2. The data sheets of the equipment and materials used to create the helmets. 3. All the documents required for the sanitary registration, emergency use and sanitary permit.
Knowledge, capabilities	• Experience developed in relation to linking product design to fabricating prototypes. • New experience in adapting administrative processes and procedures to the emergency situation acquired by participating institutions.
Networks	Networks developed between UNED Fab Lab, medical professionals, legal/IP professionals, designers, members of civil society, government and companies.

15. Costa Rica – Respira

Short description

The Respira project was led by the University of Costa Rica in collaboration with the pharmaceutical company Roche, the Central American Pharmaceutical Laboratory Association (Federación Centroamericana de Laboratorios Farmacéuticos – Fedefarma) and a national hospital, which aimed at producing mechanical ventilators needed to treat COVID-19 patients.

The University of Costa Rica initiated the project to design and construct at least 50 mechanical ventilators for public hospitals to treat COVID-19 patients. The initiative began without funding, but later secured USD 90 000 (CRC 66 170 000) from Roche, a large Swiss-based private pharmaceutical company, the Central American pharmaceutical association (Fedefarma) and from the embassies of the People's Republic of China (hereafter "China"), Germany, Korea and Switzerland. The funding and in-kind support secured allowed the UCR to produce a small number of 10 ventilators which were donated to the public health system. This co-creation initiative represents the first time Costa Rica has developed and manufactured Class C mechanical ventilators (previously imported) using only local materials and supplies.

Key takeaways

This initiative highlighted the importance of simplifying medical regulatory processes when quick solutions are needed.

The initiative illustrates the importance of connecting research and production capacities to produce necessary medical products.

Co-creation dimension(s) of the initiative

Co-creation occurred in the Respira initiative between the University of Costa Rica (UCR), Roche, a multinational pharmaceutical company, Fedefarma, a Central American pharmaceutical laboratory association, and Costa Rica's metropolitan hospital to develop and produce a prototype of a mechanical ventilator using only locally sourced materials.

Characteristics, participating institutions and their contributions and outcomes

Table 15.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Information not available	
Funding sources	Private (and international government)	• USD 90 000 (CRC 66 170 000) in financial contributions from company (Roche). • Public funds from embassies of China, Germany, Korea, Switzerland • Industry association (pharma).
Timeline	Spring 2020 – April 2021	• May 2020: The alliance began its work. • August 2020: Training in clinical research and pre-clinical tests. • July 2020: Clinical tests. • August - March 2021: Prototype development followed by the production of ventilators. • April 2021: 10 low cost class C mechanical ventilators were developed and provided to the public health service.
Initiating organisation(s)	University	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks	Research and manufacturing infrastructure; Networks to integrate production capacities.
Streamlining of processes	Regulatory approval	• Previously, no regulatory approval process for medical devices existed in Costa Rica, as all medical devices were imported and came usually pre-certified, e.g. from the U.S. • The medical devices were able to be produced as prototypes and tested in pre-clinical conditions.
Cooperation across disciplines	• Type: Expertise, technologies and production capacities • Disciplines: Different partners in the project contributed with different specialties, e.g. existing technologies at the Costa Rican university were paired with the knowledge of technical design coming from abroad and then applied with the guidance of medical specialists	
Leveraging existing assets	Technologies	• Different faculties at the university helped the project with access to different types of technologies, e.g. laser machines to cut. • Different electromechanical components were available in Costa Rican industry.
Role of the government (here: Ministry of Science &Technology)	Network builder/Negotiator;	• The Costa Rican Ministry of Science & Technology Colab set up an organisational initiative organise a group of researchers, of the universities in Costa Rica that would like to build ventilators, mechanical ventilators; • The government helped streamline regulatory processes.
Intermediary Role(s)	University	University of Costa Rica took over the role of intermediary from the government, leading the initiative and actively seeking partners and contributions.
COVID-19 exceptionality	Accelerated regulatory approval (Prototyping and pre-clinical testing instead of traditional regulatory approval process or import of pre-certified devices): Bottom-up initiative; Collaboration involved direct production and product development.	

Table 15.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Respira team, University of Costa Rica	University	Costa Rica	Designed and developed the prototype and produced the mechanical ventilator.
Roche (pharmaceutical company that responded to the call made by the government of Costa Rica at the beginning of the COVID-19 pandemic)	Private sector	Costa Rica	• Provided financial support (USD 20 000); • Supported project management, including providing expertise in clinical research procedure design, logistics, quality control and best practice compliance production protocols. • Provided access to networks, including the Ministry of Health, the National Health Research Council and private health clinics.
Embassies - German, Swiss, Chinese and Korean	Embassy	Costa Rica	Financial contributions
Federación Centroamericana de Laboratorios Farmacéuticos Fedefarma (Central American Federation of Pharmaceutical Laboratories)	Association	Costa Rica	Financial contribution
Metropolitan Hospital	Hospital	Costa Rica	Director of the Clinical Investigation Unit of the hospital provided guidance for conducting the clinical testing and meeting the regulatory requirements for medical devices.
Ministry of Science, Technology and Telecommunications	Government	Costa Rica	Promoted co-creation activities between project teams working on different COVID-19 activities by enforcing economical resources to support project grant programs.

Table 15.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Development of 10 low-cost class C mechanical ventilator made in Costa Rica.
Knowledge, capabilities	Experience gained on clinical research of medical devices, pre-clinical tests of medical devices and regulatory learning on the process.
Networks	Connections established between the researchers at the University of Costa Rica and the Ministry of Health, Ministry of Science, Technology and Telecommunications, private clinics, and National Research Council and company.

16. Transnational – Exscalate4CoV

Short description

Exscalate4COV is a transnational European private-public sector consortium composed of universities and research institutions that previously collaborated in EU grant funded projects, as well as private companies and not-for-profit-organisations. The initiative aimed to identify and develop drugs to treat COVID-19 infections by leveraging state-of-the-art experimental computing facilities and AI tools. Outcomes of the initiative include the development of a software tool (called a drug box) which virtually screens drugs for their effectiveness in potential to treat COVID-19 patients, and a clinical trial that identified promising candidate drugs.

More information is available at: Home (exscalate4cov.eu)

Key takeaways

This initiative, which brings together a multidisciplinary team, illustrates how existing networks were leveraged to address the COVID-19 challenge.

The initiative illustrates pooling expertise and resources across countries to build teams to address common COVID-19 challenges.

Co-creation dimension(s) of the initiative

This initiative combined resources, networks and the expertise of researchers from universities, companies and research institutions across Europe. It combines supercomputing resources and artificial intelligence with state-of-the-art experimental facilities for medical research, including facilities to conduct clinical trials and validations and expertise in the relevant fields of medical science.

Co-creation took place across a mix of scientific fields collaborating closely to develop COVID-19 therapies. Multi-disciplinary expertise across computing, coding, big data analysis, computer-generated drug design, validation and optimisation of virtual screening, evaluation of the antiviral effect of compounds against the novel coronavirus (SARS-CoV-2), and clinical trials, among many others, were carried out by the collaborative efforts of companies, research institutions, universities and not-for-profit organisations.

Characteristics, participating institutions and their contributions and outcomes

Table 16.a. Initiative characteristics

Categories	Overview	Description
Initiative size	17 universities as well as public and private research institutions from 7 countries	Universities and research institutions from Belgium, Germany, Italy, Poland, Spain, Sweden, Switzerland.
Funding sources	International government	The funding for the project was provided by the EU as part of EU emergency funding in response to the coronavirus pandemic USD 3.4 million (EUR 3 million) via the H2020 programme.
Timeline	Since February 2020 – ongoing (as of May 2022 (time of report completion))	The project began in February 2020 after an EU call to the scientific community to find therapies for COVID-19. The project tested more than 70 billion molecules against SARS-CoV-2 by December 2020 with a clinical trial of a candidate drug having started in October 2020. The scope was then expanded to screen against other viruses related to the coronavirus exceeding 1 trillion molecules being tested by March 2021. The initiative was ongoing as of May 2022 (time of report completion).
Initiating organisation(s)	Research institution, University	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks; Issuing a call for participation	Computing capacities integrated; Built a team for further collaboration; Issued a call for participation.
Streamlining of processes	Project evaluation and approval process; Open access/open source	• The call of proposals by the European Commission was published and proposal submissions were evaluated much quicker than in the past. • Software needed for the project was provided to all participating institutions allowing for a common infrastructure for the project.
Cooperation across disciplines	• Type: Expertise, technologies • Disciplines: Computing, coding, big data analysis, computer-generated drug design	
Leveraging existing assets	Technologies; Networks	• The existing supercomputing and life science community (network), incl. its respective infrastructure.
Role of the government (here: European Commission)	Legitimiser; Provider of funding	The call for proposals by the European Commission, offering European research funding, underscored the importance of the initiative.
Intermediary Role(s)	Private sector	• Dompé Farmaceutici (an Italian bio-pharmaceutical company) coordinated the initiative due to offering use of its software tool.
COVID-19 exceptionality	Refocused existing infrastructure to COVID-19; Bottom-up initiative; Used open-source inputs or provided open access to outputs to facilitate rapid response; Creation of large global network to leverage all available expertise.	

Table 16.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Universities (KU Leuven, University of Naples Federico II, Politecnico di Milano, Università degli Studi di Milano, Università degli Studi di Cagliari, Royal Institute of Technology)	Universities	Belgium, Italy, Sweden	- Evaluated the antiviral effect of existing drugs against COVID-19 for their use. - In support of the evaluation of antiviral effect they provided technical resources for the platform and / or code adaptation, and worked on the deployment and tuning of the GROMACS molecular dynamics code for coronavirus proteins leveraging the competences available in the BioExcel Center of Excellence.
Research Institutions (Fraunhofer IME, Elettra Sincrotrone Trieste, National Institute for Infectious Diseases (INMI) "Lazzaro Spallanzani", International Institute of Molecular and Cell Biology, National Institute for Nuclear Physics, Barcelona Supercomputing Centre, Forschungszentrum Jülich, SIB Swiss Institute of Bioinformatics)	Research institutions	Germany, Italy, Poland, Spain, Switzerland	• Provided access to molecule libraries, biochemical screening and support for genomic screening. • Conducted supportive research quality control, supported data collection. • Conducted big data analysis, analysis of COVID-19, detection capabilities, molecular co-evolution analysis and identification of host-pathogen interactions. • Contributed expertise and infrastructure, supporting the production and tuning on high performing computing infrastructure. • Developed of a fully automated, scalable and validated workflow for structural modelling of viral proteins. • Supported the set-up of regulatory plan, clinical consultation, production of viral samples and contribution to screening of antiviral activities of compounds.
Cineca - Non-profit consortium of 70 Italian universities, 9 national research institutions, and the Ministry of Education, University and Research (MIUR)	Public research institutions	Italy	Operated and provided expertise for high performance computing, and technical support.
Dompé Farmaceutici, Bio-pharmaceutical company	Company	Italy	• Created and coordinated the Exscalate4COV platform based on the EXSCALATE (EXaSCale smArt pLatform Against paThogEns) platform, developed in 2010 as a proprietary software for computer aided drug design, and made it available openly for the purpose of virtually screening drugs for COVID-19 treatment. • Performed computer aided drug design and provided viral proteins for biochemical experiments.
Associazione Big Data - Consortium of 15 public research institutions	Academia	Italy	• Supported CINECA with high performance computing production and application. • Brought in expertise of universities to the project.
Chelonia S.A, Business Management company	Company	Switzerland	Managed of information, dissemination of activities at project level .

Table 16.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Developed software to virtually screening the compound structures of key target protein structures to support identifying use of drugs for COVID-19 treatment. • Identified candidate molecules to target COVID-19 developed and one approved clinical trial – Raloxifene. • More than 70 billion molecules tested on 15 active interaction sites of the virus by evaluating more than a thousand billion interactions in 60 hours with testing procedures of more than 1 trillion molecules. • Built a repository for publications originating from the project activities and a molecular library.
Knowledge, capabilities	Expertise in identification of pharmaceutical compounds in a context of a large collaboration.
Networks	Connected 17 universities and research institutions from seven European countries.

17. United Kingdom – Oxford-AstraZeneca Vaccine

Short description

The *Oxford-AstraZeneca* vaccine against COVID-19 was rapidly developed and authorised for use within one year, a process which can typically take up to 15 years. The development processes differed from the norm in many ways, in terms of the government's involvement in mobilising expertise for vaccine development, providing funding and helping with approval processes to the speed up the vaccine delivery. The vaccine development brought together the government's vaccine taskforce, InnovateUK, research from the University of Oxford and the pharmaceutical company AstraZeneca.

In January 2020, researchers from the University of Oxford approached the government and the Bio-Industries Association (BIA) in order to seek help in the development process of a vaccine against COVID-19. They jointly established a consortium (BIA Task Force). The Vaccine Taskforce Team was then created, which involved Innovate UK working with the University of Oxford and the pharmaceutical company AstraZeneca. The objective was to exchange on the funding of vaccine development as well as setting up the scaling up for the clinical supply and developing the manufacturing process. The mission of the taskforce was also to expedite the process as much as possible while maintaining the usual safety standards.

More information is available at: The story behind the Oxford-AstraZeneca COVID-19 vaccine success – UKRI

Key takeaways

Co-creation helped accelerate the discovery, clinical trial processes, and regulatory approval stages.

The project points to the role of government in bringing together and working with relevant parties (e.g. third party manufacturers, regulators and members of vaccine task force) to speed up medical innovation processes in the emergency context of COVID-19.

Co-creation dimension(s) of the initiative

The first dimension of co-creation involved the University of Oxford, who developed the vaccine, working with the pharma industry, the BIA Task Force, which combined expertise on vaccine development from biotech companies across the UK. This was followed with co-creation in a consortium called the Vaccine Task Force Team formed by University of Oxford, AstraZeneca, Innovate UK and the UK government . Vaccine Task Force Team consortium was involved in the scaling up for clinical supply and developing the manufacturing process for the vaccine.

Characteristics, participating institutions and their contributions and outcomes

Table 17.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Information not available	
Funding sources	Public	Government funding of USD 37.4 million (28 million British Pound Sterling) was provided.
Timeline	January – November 2020 (first approval of the vaccine)	• Phase 1: Drug discovery/exploratory stage: This research typically lasts anywhere from two to four years, as the process is complicated by, for example, mutating pathogens, challenges related to finding an appropriate delivery method or difficulties in activating an immune response. The discovery stage took weeks rather than years as scientists at the University of Oxford were able to leverage technologies developed pre-pandemic. • Phase 2: Pre-clinical trial stage: Often lasts around one to two years and is critical for proceeding onto human clinical trials. The University of Oxford team were able to start clinical trials much earlier than usual and ran phases two and three in parallel. • Phase 3: Clinical trials: These typically take five to nine years. • Phase 4: Regulatory approval: Usually taking one to two years. The regulatory approval process took place alongside clinical trials and ran for approximately eight months in total (reached 30 December 2020 in the UK). • Phase 5: Large-scale manufacturing: Takes between six months and three years to regularise. The consortium expedited the regularisation – as of January 2022, more than 2.5 billion doses of the vaccine have been released to more than 170 countries worldwide.
Initiating organisation(s)	University	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks	• Research and/or manufacturing/production infrastructure, computing power, and expertise were integrated. • Networks across a wide range of expertise from different organisations including across Government (through the vaccine taskforce, and funding from the UK treasury), and public sector agencies (Innovate UK), companies (pharmaceutical sector), academia and research institutions (University of Oxford), and company associations (Bio-Industries Association) were involved.
Streamlining of processes	Regulatory approval	• Regulators simplified regulatory approval process. • Vaccine taskforce, involving key governmental officials, helped identify policy action needs to support rapid vaccine development and deployment.
Cooperation across disciplines	• Type: Expertise, technologies, production capacities • Disciplines: medical/vaccine research, regulatory expertise, bio-industrial manufacturing	
Leveraging existing assets	Networks; Technologies	• Existing networks such as the bioindustry association taskforce (which included bio-sector companies, research bodies, venture capitalists and the Jenner Institute of the University of Oxford) were capitalised to urgently seek required expertise. • Pre-existing technologies such as MERS Vaccine and vaccine discovery and manufacturing infrastructure and capabilities were used.
Role of the government (here: Vaccine Taskforce)	Provider of funding; Collaborator in innovative co-creation	The role of the government extended from being a funder to a collaborator, being involved in activities such as offering necessary policy support, coordinating manufacturing process development, and sourcing required infrastructure resources and networks through the BIA taskforce.
Intermediary Role(s)	Government/public institution Association	• Government connected relevant parties across the vaccine development and manufacturing process via the BIA taskforce. • Bio-industries association, especially during the first phase, brought the stakeholders of the UK bio industry in support of Oxford's development.
COVID-19 exceptionality	Refocused existing infrastructure to COVID-19; Accelerated regulatory approval; Government as active collaborator.	

Table 17.b. Partners

Name of the Partner	Type of institution	Country	Contribution
University of Oxford	University	United Kingdom	Developed the vaccine based on research and technological capabilities.
AstraZeneca (AZ) (Pharmaceutical company)	Private sector	United Kingdom	Manufactured and distributed the vaccine at large scale.
UK Government (Cabinet Office) and Innovate UK (research and innovation government agency)	Government	United Kingdom	● Submitted a large, advanced pre-order for doses of the developed vaccine (100 million doses). ● Invested USD 37.4 million (28 million British Pound Sterling) through Vaccine Taskforce and Innovate UK. ● Coordinated the process by senior ministerial engagement, such as the Ministerial Group .
Vaccine Taskforce	Government agency	United Kingdom	Contributed expertise and capabilities spanning vaccine development, project management, venture capital and financing the initiative.

Table 17.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Development of the Oxford-AstraZeneca COVID-19 vaccine.
Knowledge, capabilities	• Experience in operating a government's taskforce for emergency response. • Established sponsorship oversight mechanisms to rapidly deliver outcomes.
Networks	Co-creation and connections made across public agency (Innovate UK), private company (AstraZeneca), and academic communities (University of Oxford) led by government through its vaccine taskforce with venture capitalist expertise to deploy rapid vaccine development structures.

18. United Kingdom – Ventilator Challenge Programme

Short description

The *Ventilator Challenge Programme* was a large consortium established by the UK government to design and produce ventilators for COVID-19 treatment. The consortium, which was made up of leading UK industrial, technology and engineering companies from across the aerospace, automotive and medical sectors, collaborated to design and produce medical ventilators for the UK health service. It was established by the UK Government, led by the Cabinet Office, with engagement from other ministries (Department of Health and Social Care, Ministry of Defence's trading entity, Foreign & Commonwealth Office and the Department for International Trade and HM Treasury). The UK Government launched the *Ventilator Challenge Programme* with a call by the Prime Minister and by the Secretary of State for Health, to manufacturers and medical device companies to produce ventilators needed for COVID-19 treatment. The government received offers from more than 5 000 private companies with over 7 500 members of staff contributing to the effort. With the joint effort of the partners involved, 15 000 ventilators were produced within the 15 weeks following the call, at a cost that was 20% lower than the price paid on the market. The initiative also created a database of 5 400 ventilator materials and component suppliers. Evidence of the scale and magnitude of this operation is reflected by the example of medical devices manufacturer Penlon, which was enabled to make more ventilators in one day than it used to make in 10 months by moving production capabilities within the consortium from other companies to support the manufacturing at Penlon. An element helping this, and other producers was the shipment of over 40 million ventilator parts from 21 countries within 3 weeks.

More information is available at: VentilatorChallengeUK

Key takeaways

Leveraging the use of existing technologies that are either directly or indirectly relevant to producing ventilators proved important in these initiatives, including the manufacturing capacities, logistics, design expertise and relevant technologies of automotive and aerospace manufacturing companies.

The involvement of the government in using its convening power and network helped bring together the relevant expertise and delivering outcomes.

Co-creation dimension(s) of the initiative

The project involved co-creation to increase production of medical ventilators with significant contributions from a long list of partners (see Annex) from universities, to engineering and technology companies, working collaboratively alongside government agencies within the consortium, and across international supply chains. This consortium also used legal/finance experts and consulting support in setting up and project managing the initiative.

Characteristics, participating institutions and their contributions and outcomes

Table 18.a. Initiative characteristics

Categories	Overview	Description
Initiative size	120 government officials in core team, 7 500 staff contributed from participating businesses overall	• UK-based initiative with inputs from global suppliers from 21 countries. • 120 people in the core team from across government ministries and a 7 500 staff in the supply chain and wider consortium.
Funding sources	Public	Public funding from UK Treasury of USD 668.4 million (GBP 500 million).
Timeline	March to July 2020	• 30 March 2020: The consortium launched the UK Ventilator Challenge Programme. • 2 April 2020: Decision to scale up production to 15 000 ventilators. • 16 April 2020: Penlon, a medical devices manufacturer, received approval to produce ventilators (adapted Penlon anaesthesia machine to function as a mechanical ventilators), which enabled the scale-up of production of ventilator at other sites. • 5 July 2020: Project was completed.
Initiating organisation(s)	Cross-government collaborative body (taskforce)	Initiated by the UK Government, led by the Cabinet Office, with engagement from other ministries (Department of Health and Social Care, Ministry of Defence's trading entity, Foreign & Commonwealth Office and the Department for International Trade and HM Treasury).
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks; Issuing a call for participation/solutions	• The government´s call for support was well responded with over 5 000 private companies offering their support and over 7 500 members of staff contributing to the effort. Diverse expertise, resources, and networks were integrated. • Additionally, 5 400 ventilator materials and component suppliers were involved.
Streamlining of processes	Licensing contracts of intellectual property; Regulatory approval	• The UK regulator, Medicines and Healthcare Products Regulatory Agency (MHRA) streamlined the approval process by exchanging with initiative participants. • This involved the creation of a Technical Design Authority (TDA) to make recommendations about the choice of ventilator designs in view of reducing approval processes. • The introduction of a simple and efficient licensing procedure for the ventilators' design helped speed up the manufacturing of ventilators.
Cooperation across disciplines	• Type: Expertise, technologies, production capacities • Disciplines: technology, engineering, aerospace, automotive and medical sectors; regulatory expertise, healthcare, medical device development, data modelling, product design and engineering, public sector procurement, logistics, and supply chain design	
Leveraging existing assets	Technologies	• Use of existing technologies and production capacities relevant to producing ventilators from industries such as medical, automotive and aerospace were used and adapted.
Role of the government (here: Cabinet Office, Treasury and various other offices)	Provider of funding; Network builder	• Government funding at the design and production stages. • Government engaged in building networks of partners to speed up the design and production of ventilators by combining respective expertise and capabilities.
Intermediary Role(s)	Government/public institution	• Power, network and convening power of the government.
COVID-19 exceptionality	Refocused existing infrastructure to COVID-19; Accelerated regulatory approval.	

Table 18.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Cabinet Office	Government agency	United Kingdom	Led the government programme to procure ventilators for the UK.
Department of Health and Social Care	Government agency	United Kingdom	• Procured manufacturing parts from international suppliers. • Shared information on where ventilators were needed.
Ministry of Defence's agency within the department that manages the purchase and supply of UK defence equipment	Government ministry	United Kingdom	Ensured the ventilators were correctly distributed.
DHL	Company	United Kingdom	Designed and implemented an end-to end supply chain.
UK Treasury	Government agency	United Kingdom	USD 668.4 million (GBP 500 million) funding provided.
Foreign & Commonwealth Office and the Department for International Trade	Government agency	United Kingdom	Coordinated international procurement of inputs for ventilator production.
NHS e-learning team with other manufacturers	Public sector agency and company	United Kingdom	Developed manuals and training resources such as videos, written guides and a support helpline on how to use ventilators.
Private consultancy firms (e.g. PA consulting)	Company	United Kingdom	Provided paid and pro-bono support such as project management expertise to enable the effective delivery of the government programme.

Table 18.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Rapid production of ventilators at approx. 400 devices a day, 15 000 in total. • Adapted of anaesthesia machines to function as a mechanical ventilator. • Designed several viable new emergency ventilator designs. • Established new large-scale manufacturing facilities for ventilators across the UK. • Developed a database of 5 400 materials and component suppliers relevant for ventilator production. • Set up new supply chains and logistics network for input supplies. • "Medicines and Healthcare Products Regulatory Agency" approval for the ventilator produced in three weeks, and receipt of international quality seal of approval by way of CE health and safety marking.
Knowledge, capabilities	• Developed guidance on setting up and scaling production of devices needed urgently in future crises. • Experience in operating production in a context of social distancing.
Networks	New networks created between medical device designers, companies with production capacities and the public health sector.

19. Czech Republic – Protective Mask Consortium CIIRC RP95-3D

Short description

At the start of the first wave of the COVID-19 pandemic in March 2020, the research team of the Czech Institute of Informatics, Robotics and Cybernetics at the Czech Technical University in Prague (CIIRC CTU) developed the "CIIRC RP95-3D" Protective Mask to address the shortage of protective equipment for professionals. They created a university-industry consortium, supported by the government, to prototype, produce and distribute the masks. The 3D printable body of the mask was produced in just one week via special 3D HP MultiJet Fusion printers and the mask model was certified as a personal protective device with the FF3 level of protection.

In cooperation with industrial partners, such as Škoda Auto and Siemens, who provided production capacities, the mask was produced in the Czech Republic. 45 000 masks were provided to the Czech Ministry of Health. A spin-off of CTU was created for this project, Trix Connections, which conducted further research with more than 40 Czech manufacturing companies to develop a process that would allow producing a much larger number of masks.

More information is available at: CIIRC CTU Anti COVID-19 | CIIRC (cvut.cz)

Key takeaways

Existing networks of the National Centre for Industry 4.0 and the CIIRC CTU made the university-industry collaboration possible.

The project illustrates the role an intermediary institution can play to help put together university collaborations with industry. Trix Connection, the spin-off company of the CIIRC CTU, engaged in technology transfer and communication and enabled collaborators to engage in rapid co-creation.

Co-creation dimension(s) of the initiative

Co-creation between industry and CIIRC CTU resulted in the prototyping and production of the masks. The 3D-printing template enabled both distributed production of the mask (with inputs from various companies and sources) as well as global sharing and production.

Characteristics, participating institutions and their contributions and outcomes

Table 19.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Information not available	
Funding sources	Private and Public	• Direct funding from agencies such as Cardam, joint venture of the Institute of Physics of the Academy of Sciences of the Czech Republic and the industrial companies Beneš a Lát and Česká zbrojovka Group (USD 643 000 / EUR 600 000), and the Ministry of Education, Youth and Sports (MEYS) via the Technology Agency of the Czech Republic (TACR), a government agency (USD 182 000 / EUR 170 000). • In-kind support from industry (production facilities) as well as public sources (using materials and funds from other previous public grants).
Timeline	March 2020 - April 2020	March 2020 - Project launch and development of model, prototype, safety certification obtained and creation of spin-off TRIX Connection to support the development of the prototype created, production of ventilators started and delivered to Czech Ministry of Health, launch of website to download 3D print data for free. April 2020 - Mass production launched (injection moulding) – Czech companies led by TRIX Connection, production of 45 000 pcs for Czech Ministry of Health.
Initiating organisation(s)	Research institution, University	Czech Institute of Informatics, Robotics and Cybernetics (CIIRC), a research institution of Czech Technical University (CTU) in Prague was the initiator and leader of the initiative.
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material)	The consortium brought together resources (research expertise, technical infrastructure, computing power, human capital) from public and private sectors to develop 3D-printed masks.
Streamlining of processes	Regulatory approval; Project evaluation and approval process	• The permission to re-purpose funding for other projects from the Technology Agency of the Czech Republic (TACR) supporting applied research and innovation made it possible to increase the budget of projects already in implementation (which is usually not possible) enabled initiators to rapidly move forward with the project. • In addition, the project proposal approval time by TACR was reduced to 1 month from the usual 3 months.
Cooperation across disciplines	• Type: Technologies, production capacities • Disciplines: Expertise in healthcare, 3D printing, data management, moulding, design, sterilisation and disinfection	
Leveraging existing assets	Infrastructure; Network	Existing 3D-printing infrastructure of the university and industry network were leveraged for the project.
Role of the government (here: Ministry of Health)	Provider of funding	Government provided funding for the development of the mask and in support of production and ordered 45 000 masks.
Intermediary Role(s)	University	Czech Institute of Informatics, Robotics and Cybernetics, a research institution of Czech Technical University in Prague managed the collaboration.
COVID-19 exceptionality	Accelerated regulatory approval; Collaboration involved direct production and product development	

Table 19.b. Partners

Name of key partner	Type of institution	Country	Contribution
Czech Institute of Informatics, Robotics and Cybernetics (CIIRC) research institution of Czech Technical University (CTU) in Prague	University	Czech Republic	• Project lead conducting the main research and development activities associated with the project, including testing procedures for certification. • Overseeing the R&D process. • Dealing with administration and financial issues and engaging in internal and external communication.
CzechInvest	Government agency	Czech Republic	• Supported certification with expertise on the process. • Facilitated links of the university with external filter producers. • Coordinated companies involved in the production of the mask.
TRIXConnections, (Spin-off of the Czech Technical University (CTU) in Prague)	University spin-off	Czech Republic	• Developed the mask for mass production. • Assisted external producers of the mask in setting up production. • Coordinated the distribution of the injection moulding model abroad. • Overseeing technology transfer (from research at university to manufacturing by industry).
Faculty of Electrical Engineering, the University of West Bohemia in Pilsen	University	Czech Republic	Specialised research team participated in the optimisation of the silicone parts of the mask that were not possible to be 3D printed.
Škoda Auto - Automobile company	Company	Czech Republic	• Optimised 3D printing of the masks for quicker production of masks. • Produced masks.
3Dees Industries	Company	Czech Republic	Provided technical support and coordinated the production, assembly, and logistics of the mask with all seven HP 3D printer owners involved in the Czech Republic.
Siemens – Tech company	Company	Czech Republic	• Produced 3D part of the mask on its 3D printers - 40 pcs/day. • Supported the production of 3D parts of the mask to other subsidiaries.
3D Tech – Tech company	Company	Czech Republic	Helped develop and produce silicone seal moulding form.
HP Czech Republic – Tech company	Company	Czech Republic	• Supported the certification and manufacturing process and distribution of the printing data. • Supported making the mask's 3D printing data available outside the Czech Republic.
CARDAM, a joint venture of the Institute of Physics of the Academy of Sciences of the Czech Republic and the industrial companies Beneš a Lát and CZG	Company	Czech Republic	• Invested in the preparation of moulds for mass production of the mask. • Managed the production logistics for mass production enabling daily production capacity 5-10 000 pcs per day. • Coordinated the certification process of mask.
SIGMA - A Czech producer of pumps and pumping equipment as well as specialised products in the field of ecology, rescue and respiratory protective filters	Company	Czech Republic	Produced particle protective filters capturing bacteria and viruses necessary to produce masks.
TAČR - Agency of the Czech Republic (innovation agency)	Government Agency	Czech Republic	Provided COVID-19 grants for the initiative.
Beneš a Lát (foundry)	Company	Czech Republic	Invested into moulds for the mass production model.
Czech Society of Cardiology	Association	Czech Republic	Provided user feedback to help improve the quality of the masks.
Ministry of Health	Government ministry	Czech Republic	Bought 45 000 masks.

Table 19.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies and Innovations	600 3D printed masks produced within two weeks, 45 000 ordered by Ministry of Health Mould design for 3D masks for wider replication.
Knowledge and Capabilities	Experience in innovation management and technology transfer (incl. licensing) associated gathered by university researchers and staff and industry participants. Expertise in 3D product innovation processes, prototyping and development.
Networks	University-Business interactions (In the 3D printing production, almost 20 institutions involved and in the mass production, more than 40 companies involved).

20. Mexico – Proyecto Nacional de Investigación e Incidencia COVID-19 (Pronaii)

Short description

The *Proyecto Nacional de Investigación e Incidencia COVID-19* ('National Research and Incidence Project COVID-19' – Pronaii) was a government-funded co-creation initiative designed to build manufacturing capabilities to produce ventilators and respiratory devices for COVID-19 treatment. The initiative produced the first ventilator in five months' time in the first phase of the COVID-19 pandemic (from May 2020 to September 2020) and 1 130 units of two types of respiratory devices in nine months' time.

Key takeaways

The project illustrates the role of government agencies, in this case CONACYT, in helping to enable collaborations by actively engaging in searching for contributors to the project's objectives, including by connecting expertise from public research centres and government ministries.

In the case of this project the need to streamline regulatory processes to fast-track the deployment of newly developed devices helped identify ways to make the regulatory process more efficient in the future while keeping quality and safety controls.

Accurate and reliable data on suppliers of inputs, expertise needed for device production and information on user needs were essential for the project, illustrating the need for as precise information as possible on the innovation ecosystem.

Co-creation dimension(s) of the initiative

The initiative involved collaboration of government agencies, with a public research institution and a private company who collaborated to produce medical equipment for COVID-19 treatment. Characteristics, participating institutions and their contributions and outcomes.

Characteristics, participating institutions and their contributions and outcomes

Table 20.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Information not available	
Funding sources	Public	• Nation Council of Science and Technology Research Centers System (CONACYT) – USD 5 million (MXN 100 million). • INSABI (Institute of Health for Well-being) – USD 11.4 million (MXD 227 million).
Timeline	May 2020 – February 2021	
Initiating organisation(s)	Government agency	The project was initiated by the Nation Council of Science and Technology Research Centers System (CONACYT).
Existing pre-COVID	No	
Basis for and means of collaboration	Funding/Scholarships; Building or providing access to networks	Research collaboration of industry with government funding.
Streamlining of processes	Regulatory approval	A specific regulatory approval pathway was developed to expedite the approval process of products produced under the initiative.
Cooperation across disciplines	• Type: Production capacities • Disciplines: Medical device manufacturing, epidemiology, regulatory expertise	
Leveraging existing assets	Technology/Infrastructure development	Technologies to produce respirators had already been in an advanced stage of development prior to the pandemic and needed.
Role of the government (here: CONACYT/INSABI)	Provider of funding, Network builder/Negotiator	Government funding for the project was provided and the government engaged in network building by also leveraging its own networks to bring together the public and private actors needed to achieve the project's objectives.
Intermediary Role(s)	Government/public institution	CONACYT launched multiple calls for both private companies as well as research institutions to participate and actively encourage cooperation beyond the COVID-19 initiative, forming a new national policy for research, technological development, and innovation, which includes an open Innovation national ecosystem predicated on cross-sectoral collaboration.
COVID-19 exceptionality	Accelerated regulatory approval; Collaboration involved direct production and product development (integration with production process).	

Table 20.b. Partners

Name of key partner	Type of institution	Country	Contribution
National Council of Science and Technology (CONACYT)	Government agency	Mexico	• Provided USD 5 million (MXN 100 million) in grants. • Coordinated a group with experts in different fields and from different institutions. • Acted as advisors in terms of biomedical security, basic science, the quality of the technology and advanced manufacture.
Centre for Research in Engineering and Industrial Development (CIDESI)	Public research institution	Mexico	Engaged in R&D to develop ventilators and respiratory devices.
DYDETEC (software development, electrical design and mechanical design company)	Company	Mexico	Produced ventilators and respiratory devices.
INSABI (Institute of Health for Well-being)	Government agency	Mexico	Financial contribution of USD 11.4 million (MXN 227 million).

Table 20.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	1 130 respiratory devices built.
Knowledge, capabilities.	• Experience and knowledge regarding the development of respiratory devices under tight time schedule with limited access to foreign inputs. • Streamlined regulatory procedures for medical equipment.
Networks	The government actively helped set up the strategic partnership in technology development between the public and private partners.

21. Transnational – COVID-19 Moonshot

Short description

The COVID-19 Moonshot is a non-profit, open-science, global consortium of scientists that aims to develop antiviral drugs against COVID-19 and future viral pandemics that are affordable and easily manufactured. The initial phase, co-funded by participating institutions and from crowd-sourced funds, consisted of collaborative efforts to identify new molecules that could block SARS-CoV-2 (the virus causing COVID-19). Initially, three scientists at PostEra, a medical academic start-up that integrates molecular design with chemical synthesis, co-founded by academics in the University of Cambridge, started a hackathon by inviting researchers/virologists to submit molecules, donations and assays (testing) via the social media platform Twitter. This resulted in over 4 000 submissions with the engagement of more than 150 participants spanning from a range of expertise. The initiative's efforts identified key compounds showing significant antiviral activity against the main protease (enzyme speeding up the break-up proteins) of SARS-CoV-2, which are critical for the development of COVID-19 drug candidates. The project subsequently received funding of USD 10.1 million (GBP 8 million) from the Wellcome Trust for phase 2, namely for the development of preclinical candidate molecules for clinical testing in early 2023.

Key takeaways

The Moonshot project is an example of crowdsourcing within a large network of more than 150 scientists across diverse scientific fields relevant to drug development, and from the biotechnology and pharmaceuticals sectors, among others.

The project illustrates the role of intermediary institutions – played in this case mainly by PostEra and the Weizmann Institute – to provide for frequent interactions and line up collaborators, logistics, expertise, funding, institutional support and permissions that were essential for rapid response.

Co-creation dimension(s) of the initiative

Both the phases involved in co-creation across universities, public and private research institutions, the private sector, not-for-profit organisations, as well as engagement with individual researchers.

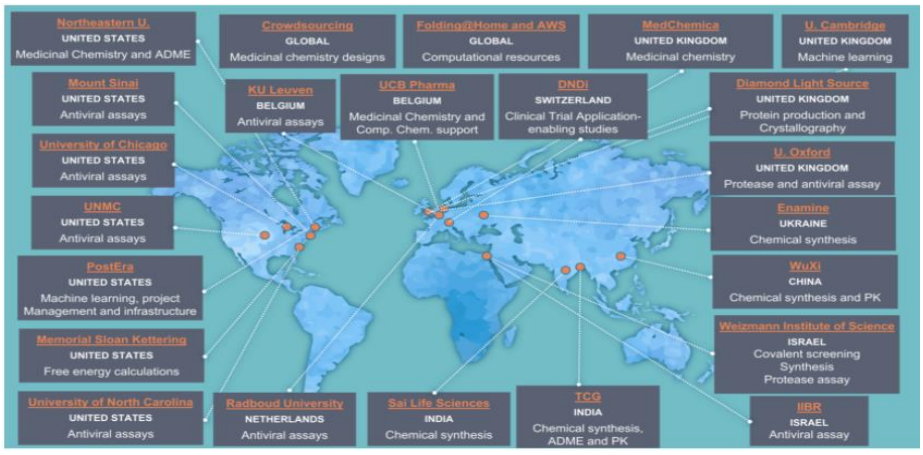
Characteristics, participating institutions and their contributions and outcomes

Phase 1 was global. Phase 2 included partner collaborations between Israel, Switzerland, the United Kingdom and the United States.

Table 21.a. Initiative characteristics

Categories	Overview	Description
Initiative size	150 researchers from a variety of institutions (see Figure 1)	
Funding sources	Academia, Non-for-profit organisation, Individuals (crowdfunding)	• Phase 1: Funding of USD 1.26 million (GBP 1 million) from the University of Oxford USD 253 000 (GBP 200 000), PostEra USD 190 000 (GBP 150 000), London Lab, Weizmann Institute of Science USD 379 000 (GBP 300 000), Chodera Lab, Memorial Sloan Kettering Cancer Center USD 379 000 (GBP 300 000) and a crowdfunding campaign USD 63 000 (GBP 50 000). • Phase 2: Grant funding of USD 10.1 million (GBP 8 million) from the Wellcome Trust in the United Kingdom.
Timeline	Phase 1: March 2020 to July 2021; Phase 2 ongoing (as of May 2022 (time of report completion))	• Phase 1: A group of scientists, academics, pharmaceutical research teams, and students began a worldwide, Twitter-fuelled collaboration to identify new molecules that could block SARS-CoV-2 infection. • Phase 2: Development of preclinical candidate molecules for clinical testing in early 2023.
Initiating organisation(s)	Individuals (academic/experts, professionals)	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating data; Organising a hackathon	Three scientists organised a hackathon inviting researchers/virologists to submit molecules, donations and assays (testing) via the social media platform Twitter. This resulted in over 4 000 submissions. Data from different projects was integrated for common analysis.
Streamlining of processes	Open access/open-source	Sourcing of inputs via the use of hackathons and social media (Twitter) and open sharing of inputs across participating institutions sped up the process.
Reason for multidisciplinarity	• Type: Expertise, technologies • Disciplines: computer modelling, simulations, online tools; chemistry; pharmacology among others	
Leveraging existing assets	Network; Infrastructure	• Network: Large ecosystem of expertise and biopharma supply chains. • Infrastructure: Long-term strategic investments in national infrastructure and research institutions.
Role of the government	No role of the government	
Intermediary Role(s)	University	The NIHR Biomedical Research Centre, Oxford (OxBRC) coordinated the activity
COVID-19 exceptionality	Use of social media and/or hackathons to use contributions from a wide range of participants rapidly; Creation of large global network to leverage all available expertise; Big and/or real-time data analytics (to accelerate drug discovery process); Bottom-up initiative.	

Figure 1. Key collaborators of Phase 1



Note: Antiviral, protease and covalent screening are processes used in drug discovery; ADME is an abbreviation for absorption, distribution, metabolism, and excretion (i.e. how a pharmaceutical is metabolised); PK is pharmacokinetics; Crystallography is a branch of science that deals with discerning the arrangement and bonding of atoms in crystalline solids; Free energy constitutes a thermodynamic quantity to understand how chemical species recognize each other, associate or react

Table 21.b. Overview of key partners of Phase 2.

Name of key partner	Type of institution	Country	Contribution
Wellcome Trust - COVID-19 Therapeutics Accelerator The Wellcome Trust is a charitable foundation focused on health research; The Therapeutics Accelerator is an initiative launched by the Bill & Melinda Gates Foundation, Wellcome, and MasterCard with support from public and philanthropic donors to speed up the response to the COVID-19 pandemic	Not-for-profit organisation	United Kingdom	Provided approx. USD 10.1 million (GBP 8 million) in grant funding (until the start of the clinical trials in 2023).
PostEra, a medical academic start-up that integrates molecular design with chemical synthesis, co-founded by academics in the University of Cambridge	Company	United States / United Kingdom	Launched Phase 1 and now helps lead Phase 2; Conducted research in the areas of medicinal chemistry using machine learning tools.
Diamond Light Source, a scientific facility of the UK Government through the Science and Technology Facilities Council (STFC), and funded by the Wellcome Trust	Public research institution	United Kingdom	Provided industrial and academic user communities with access to its XChem fragment screening platform, i.e. X-ray structure-accelerated, synthesis-aligned lead discovery.
Weizmann UK, on behalf of Weizmann Institute of Science, Israel, a multidisciplinary, independent, scientific research institution	Public research institution	Israel	Offered multidisciplinary expertise in the areas of biochemistry, biology, chemistry, and computer science.
Nuffield Department of Medicine at the University of Oxford and National Institute for Health Research Oxford Biomedical Research Centre	University	United Kingdom	Provided research expertise also regarding clinical skills.
Drug discovery consultant companies: MedChemica Ltd; Thames Pharma Partners; Compass Business Partners	Companies	United Kingdom & United States	Contributed expertise on drug discovery.
Memorial Sloan Kettering Cancer Center	Public Research institution	United States	Contributed expertise and research infrastructures.
Drugs for Neglected Diseases initiative	A non-profit research and development organisation	Switzerland	Coordinated the proper usage of the funding received from the Wellcome Trust, e.g. by implementing procurement procedures.

Table 21.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Discovered key compounds showing significant antiviral activity against the main protease (enzyme speeding up the break-up proteins) of SARS-CoV-2.
Knowledge, capabilities	Experience to the process of data analytics to discover molecules to the clinical trial stage. Experience in running drug discovery process in an open source global challenge format.
Networks	New connections by building a collaboration of 150 scientists globally.

E. Co-creation for data-related innovation initiatives

In the following initiatives, the focus of the co-creation projects is gathering, integrating, analysing and/or presenting data to support responses to COVID-19. The project results provide insights or digital solutions in the form of software applications or data/information-platforms. The end users included governments, research institutions, journalists, and the general public.

22. Estonia – MASC: Digital platform for managing stock and supply of personal protective equipment (PPE)

Short description

The MASC (Management of Acute Supply During Crises) project isa real-time digital inventory and demand monitoring platform with a distribution tool to manage personal protective equipment (PPE) logistics in Estonia. The initiative was created by a group of friends with backgrounds in sales, law, information technology (IT), software development, medicine and pharmacology, who came together after participating in a hackathon "The Global Hack", a global initiative that was part of the Hack the Crisis movement (an initiative that involved over 40 online hackathons organised across countries to offer solutions on how to use tech for the crisis response). In collaboration with the Estonian Government, the project aimed to monitor and manage the distribution of the limited personal protective equipment (PPE) supply in the early phase of the COVID-19 crisis. The solution went live in Estonia in April 2020, and was used by the Health Board, the Ministry of Social Affairs, the Ministry of Finance, and about 300 public sector agencies in Estonia (including the countries' hospitals). MASC is still in use by the Estonian healthcare sector and in addition to the PPE, stock and supply of COVID-19 medicine and ventilators are managed by the platform.

Key takeaways

The initiative is an illustration of pro bono engagement of entrepreneurs willing to help respond to the COVID-19 crisis of which several took place.

Co-creation dimension(s) of the initiative

Co-creation occurred between the team of entrepreneurs and the government to build a suitable platform for use by government ministries and other public sector end users. Additionally, as the system runs from the input received from multiple users and suppliers of PPE (e.g. all the public sector institutions, including hospitals, care homes, local governments, schools, and state-owned companies), co-creation occurs in terms of data integration with support from the system developed by the core MASC team.

Characteristics, participating institutions and their contributions and outcomes

Table 22.a. Initiative characteristics

Categories	Overview	Description
Initiative size	15 (10 entrepreneurs worked pro bono; 5 government officials);	Entrepreneurs engaged in this activity pro bono for several months involving 5 individuals from the Ministries of Finance and Social Affairs as well as the Health Board and the Ministry of Science, Technology, Knowledge and Innovation.
Funding sources	No data available	
Timeline	April 2020	The MASC platform solution was built and deployed in April 2020. As of May 2022, the solution continues to be used by the Estonian health care sector.
Initiating organisation(s)	Individuals (industry professionals)	
Existing pre-COVID	No	
Basis for and means of collaboration	Building or offering access to networks; Providing access to outputs to a wider community	Initiating group previously worked together in a hackathon; Wider community (particular within government) contributed in order to monitor the availability of PPE.
Streamlining of processes	Data integration	Data from different sources was integrated in order to facilitate tracking the availability and need for PPE for decision-taking around supplies.
Cooperation across disciplines	• Type: Expertise • Disciplines: Sales, law, information technology (IT), software development, medicine and pharmacology	
Leveraging existing assets	Network	Personal relationships of entrepreneurs behind the initiative with public sector officials from relevant ministries facilitated building the platform for public sector use.
Role of the government (here: Ministries of Finance, Social Affairs and the Health Board)	Legitimiser; Collaborator in innovative co-creation	• Government institutions endorsed the tool for wider use across the public sector. • Provided inputs to the MASC team on the existing solution and work methods to design and develop a system for use by the public sector.
Intermediary Role(s)	No role	
COVID-19 exceptionality	Input and contributions solicited from individuals, start-ups and/or not-for-profits); Pro-bono involvement of entrepreneurs; Bottom-up initiative.	

Table 22.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Ministry of Finance	Government ministry	Estonia	• Provided inputs to the MASC team on the existing solution and work methods to design and develop a system for use by the public sector. • Promoted the use of the tool among other potential public sector users.
Ministry of Social Affairs	Government ministry	Estonia	
The Health Board	Government agency	Estonia	
MASC (Management of Acute Supply During Crises)– Entrepreneurs providing pro-bono contributions	Individuals (professionals)	Estonia	Led the design and operations of the platform.

Table 22.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• IT solution for use by the public sector to monitor and optimise the distribution of PPE supplies. • Developed visualisations to ease the operation of the tool. • Developed real-time data collection tool for potential use beyond the crisis.
Knowledge, capabilities	Expertise in operating an internal tracking system of PPE supplies.
Networks	Network involving entrepreneurs and government ministries.

23. Chile – Base de Datos COVID-19 (Database)

Short description

The *Base de Datos COVID-19* (database) project was initiated in response to the lack of real-time COVID-19 health-related data available in Chile to inform policy decisions. The collaborators – the Ministry of Science, Technology, Knowledge and Innovation that led the initiative and research teams from eight research institutions – developed an integrated database of national COVID-19 data at regional and city level, including data on the COVID-19 incidence, the health system, on mobility and on vaccination campaigns. The data were collected by the Ministry of Health. The project team also developed a user-friendly interface for the database so that any users (policy makers, researchers, etc.) could easily access, download and use the data for analysis and interpretation. The data was made available in standardised open format which could be updated, used to inform decisions in real-time and used to estimate the number of newly infected in the country by way of a mathematical model building on the data. The use of the database was widely promoted also with the Chilean president and high-profile government representatives referring to it in public interventions.

More information is available at: COVID19 (minciencia.gob.cl)

Key takeaways

Mobile applications were used to disseminate the data and engage with the public in a user-friendly way, which proved to be beneficial in establishing trust in the use of data for policy decisions.

The initiative critically pointed to the importance of resolving data governance questions and policies on data ownership and data in Chile.

Co-creation dimension(s) of the initiative

The initiative involved a collaboration between Chile's Ministry of Science, Technology, Knowledge and Innovation with universities and research institutions to co-create a publicly available database of health-related data.

Characteristics, participating institutions and their contributions and outcomes

Table 23.a. Initiative characteristics

Categories	Overview	Description
Initiative size	Five organisations (2 government department, 2 universities, 1 research institution) overseen by a government advisory board (16 members)	The project was overseen by the 16 members of the government advisory board in Chile (COVID-19 Data sub-table) and implemented by a team convened by the Ministry of Science, Technology, Knowledge and Innovation to facilitate access to data information for academic and research purposes on COVID-19.
Funding sources	No data available	
Timeline	March 2020 – ongoing as of May 2022 (time of report completion)	• March 2020: The project was assigned to the Ministry of Science, Technology, Knowledge and Innovation by the government advisory board. • April 2020: The first version of the database was produced. With 10 000 downloads within the first week of operation. • July-December 2020: The team expanded the availability of data.
Initiating organisation(s)	Government ministry	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating data; Integrating resources (digital and/or material)	Distributed computing resources and data were integrated to create a common output.
Streamlining of processes	Not applicable	
Cooperation across disciplines	Not applicable	
Leveraging existing assets	Capabilities	Built on existing expertise on data management, and making these open access in another area (astronomy).
Role of the government (here: Ministry of Science, Technology, Knowledge and Innovation)	Network builder/Negotiator; Collaborator in innovative co-creation	The government set up the project and co-ordinated the sourcing of inputs, developed the platform in collaboration with research institutions listed below and engaged in awareness-raising campaigns on the availability and use of data.
Intermediary Role(s)	Not applicable	
COVID exceptionality	Big and/or real-time data analytics (to inform policy); Government as active collaborator.	

Table 23.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Ministry of Science, Technology, Knowledge and Innovation	Government ministry	Chile	Developed the platform in collaboration with research institutions listed below and engaged in awareness-raising campaigns on the availability and use of data.
Ministry of Health	Government ministry	Chile	Collected and generated data used by the stakeholders in the creation of the data platform.
Department of Science of the Computation of the School of Engineering UC, UC Institute of Mathematical and Computational Engineering, School of Public Health of the University of Chile, Center for Mathematical Modelling (CMM), Institute of Complex Engineering Systems (ISCI), Interdisciplinary Neuroscience Center of Valparaíso (CINV)	Universities	Chile	Contributed to the creation of the data platform.
Institute Millennium Foundations of the Data (IMFD)	Research institution	Chile	Provided data to the data platform.
Science & Life Foundation	Not-for-profit organisation	Chile	Contributed to the creation of the data platform.

Table 23.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Development of a COVID-19 database with a model that manages to estimate the number of newly infected in the country to 98% accuracy. • Data technologies developed to convert data to a digital format, perform data standardisation, data extraction, etc., which could be used for both future pandemic and non-pandemic times (i.e. the use of climate change data).
Knowledge, capabilities.	Experience in making real-time data available on an open platform.
Networks	Networks established within the research community and with different government ministries and end users.

24. Latvia – Apturi COVID-19

Short description

This co-creation initiative, started by a small group of tech professionals and developers, created a mobile contact tracing application (aimed at identifying persons who may have come into contact with an infected person) to manage the population's exposure to COVID-19. Key participants in the initiative were the Latvian Government Ministries and other public sector institutions (Office of the President of Latvia, Health Ministry, the Information Technology Security, Incident Response Institution, and State Data Inspectorate), members of civil society (software developers), the University of Latvia and companies, including multinational companies Google and Apple, as well as legal services consultancies and telecommunications companies. The code developed for the contact tracing app has been made available open-source in order to support the faster launch of similar contact tracing apps elsewhere.

More information is available at: Apturi Covid

Key takeaways

The endorsement and participation of the Office of the President of Latvia and various Latvian Government Ministries, as well as the transparent communication about data security and privacy helped build trust in the use of the data among the public, facilitating uptake by 329 000 people (17% of Latvia's population) by June 2021.

The initiative illustrates the benefits of building networks of expertise in the STI ecosystem. In this case, the co-creation project was facilitated by the Latvian Government's pre-pandemic efforts in building an ecosystem of ICT (information and communication technology) experts.

Co-creation dimension(s) of the initiative

Co-creation occurred in the development of a contact tracing app which involved the government, universities, the private sector (including large multinational companies and SMEs), individuals and software developers.

Characteristics, participating institutions and their contributions and outcomes

Table 24.a. Initiative characteristics

Categories	Overview	Description
Initiative size	70 people	70 researchers and experts contributed from public and private sector organisations to developing the app and to its management.
Funding sources	Not disclosed	Financial contributions to cover various expenses were made by several partners, but it was agreed that they will not be noted.
Timeline	April to May 2020 (project development and launch in Latvia) – June to November 2020 (marketing campaign to promote uptake and project extension for cross-country uptake)	• April 2020: Team comprised of local tech company individuals initiated the project, government and large multinational companies got involved • May 2020: App made available on Google Play store, then maintenance and version fixes. • Last update as of May 2022: October 2020.
Initiating organisation(s)	Individuals (professionals)	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Building or offering access to networks	Existing group of partners, incl. government contacts to provide software solution.
Streamlining of processes	Data integration; Open access/open source	Databases and coding of private individuals were shared with participating institutions via an open-source interface in order to facilitate adaptation and further development.
Cooperation across disciplines	• Type: Expertise, • Disciplines: Epidemiologists (to understand the dynamic of the pandemic; software developers, data privacy lawyers, marketing experts to promote public use	
Leveraging existing assets	Networks	Ecosystem of ICT experts built-up by the government prior to the pandemic.
Role of the government (here: Office of the President of Latvia)	Legitimiser, Network builder/Negotiator; Collaborator in innovative co-creation	• Adopted as a collaboration project by the Latvian Government to promote public uptake of the tool. • Government officials took part in the project discussion and facilitated networking and connections.
Intermediary Role(s)	Private sector	Co-coordinated by telecommunications company Latvijas Mobilais Telefons.
COVID exceptionality	Pro-bono involvement of entrepreneurs; Included extensive public engagement (to facilitate output adoption and/or solution development); Bottom-up initiative.	

Table 24.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Local tech companies from the Riga Tech Hub	Companies	Latvia	• Initiated the project (Riga Tech Hub co-founders) and participated in the project steering group. • Participated in marketing campaigns the advantages of the app. • Organised and coordinated app development.
Latvijas Mobilais Telefons (telecommunication company)	Company	Latvia	• Created project structure and provided administrative and technical projected management, legal framework, communication plan, virtual teamwork environment. • Contributed to the development of the app. • Developed the app's privacy policy. • Engaged with other stakeholders on dissemination of project results.
Software/app development companies (MAK IT, Autentica, TestDevLab, Zippy Vision)	Companies	Latvia	• In charge of developing the app with inputs from contributors. • Collaboration with Google and Apple technical developers on building the framework for the app.
Researchers from the University of Latvia	Individuals (academics/experts)	Latvia	Contributed to the development of the app.
DDB, Truesix, Deep White, Grizzly Riga, Mobilly (marketing companies)	Companies	Latvia	• Developed marketing strategy including logo, name, app design. • Conducted national and international media communication strategy.
Advisers from the Office of the President of Latvia	Government	Latvia	• Took part in the project discussion, helping to address various issues and overseeing the progress. • Made public commitment to take up the project • Coordinated the cooperation with Apple and Google • Monitored project progress
Google and Apple (Multinational high-technology and communication companies)	Companies	United States	Advised and supported the implementation of the contact tracing framework and app development on the basis of their respective technology.

Table 24.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Contact-tracing app for COVID-19, with potential use for influenza or other virus outbreaks. • Web page developed to promote the mobile app's use by the general public.
Knowledge, capabilities	• Experience in the technology use of contact-tracing apps. • Experience in marketing the technology and managing legal aspects of data privacy compliance related to using sensitive user data. • Experience in remotely collaborating across private and public sectors.
Networks	• Partnership networks established for the development of the application and for its diffusion. • International exchanges for global contact tracing efforts.

25. Spain – Rapid-App

Short description

The Rapid App is an employee movement-tracing app to identify potential exposures to COVID-19 and manage risks of in-person work environments. It was developed in a collaboration of three Spanish research institutions (Ikerlan, Vicomtech and Tecnalia) and received support of the Basque Government. The Rapid-App was developed as part of the Rapid initiative, which originated from a specific call for projects by the SPRI Group, the entity of the Economic Development, Sustainability and Environment Department of the Basque Government for promoting the Basque industry. The call to which the Rapid-App responded had asked for solutions that would help maintain in-person production in the Basque countries' industrial sector during the COVID-19 pandemic. Data collected by the Rapid-App made it possible to reconstruct employees' contact patterns within their organisations (Ikerlan, Vicomtech and Tecnalia). The inferences made from the data were used to support taking measures in the event of a positive case of COVID-19. Next to the app, an additional artificial intelligence tool which allows for risk estimation by sector or geographic area was developed. The Rapid-App technology solution includes:

- A contact tracing mobile application for use by individual organisations (research institutions/companies), with two complementary technologies, Bluetooth tracing and QR codes.
- Advanced simulation capabilities (including scenario planning of which teams / persons should get back to in-person activity on the basis of COVID-19 infections registered).
- Advanced visual analytics panels for easy use of the tool by human resource management professionals.

More information is available at: RAPID, a project for the safe return to full, industrial and economic activity (vicomtech.org)

Key takeaways

A major challenge in this initiative was privacy associated with the sensitive data collected on employee movement. This was overcome by implementing secure data protection measures so that the use of the data did not infringe on and on the data that was provided to the human resource department. In addition, the Basque Government provided oversight regarding data protection matters.

The project illustrates the potential of digital innovations which may be useful beyond the pandemic. For example, it was acknowledged that the key technology could be used for logistic related operations (e.g. tracking the movement of objects).

Co-creation dimension(s) of the initiative

Co-creation occurred in this initiative as a consortium comprised of three research institutions located in the Basque region (Ikerlan, Vicomtech and Tecnalia) working together to develop the contact tracing app. Co-creation also occurred with the involvement of the Basque Government as it provided support to address the privacy concerns of employees on the use of sensitive mobility data, in addition to providing funding for the project.

Characteristics, participating institutions and their contributions and outcomes

Table 25.a. Initiative characteristics

Categories	Overview	Description
Initiative size	17 researchers across 4 organisations (research institutions and government departments)	17 staff/researchers involved across 4 organisations:2 from the Basque Government, Department of Economic Development and Infrastructures; and 5 each from Ikerlan, Vicomtech and Tecnalia research institutions.
Funding sources	Public	Public funding of USD 550 000 (EUR 480 000) from the Basque government
Timeline	May 2020 – February 2021 (subsequent expansion of uptake)	• May 2020: Call for proposal initiated by the Basque Government, Department of Economic Development and Infrastructures. • June 2020: Government approval of the project proposal and development of the app begins. • October 2020: First internal versions of the app developed. • November 2020: Partial deployment of app in Vicomtech as a test environment to check the effectiveness of the app. • February 2021: Full deployment of the app in Vicomtech, and app made available to R&D institutes and companies in the Basque region. • July 2021: Use of the app across all three institutions with in-person working and presence rate of 64%.
Initiating organisation(s)	Research institutions	
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating data; integrating resources (digital and/or material); Issuing a call for participation	Resources from the three participating research institutions were pooled to create the app; data from across participants was necessary to draw meaningful insights.
Streamlining of processes	Data integration; Project evaluation and approval process; Open access/open source	• Co-creating institutions shared data from the app usage to speed up and improve further development. • The code of the app was shared in an open source license to facilitate uptake. • The project approval/funding procedures were expedited and funding institutions were involved throughout the project.
Cooperation across disciplines	Not applicable (application developed internally)	
Leveraging existing assets	Technologies; Networks	• Technologies existing within the companies, incl. software/coding. • Network – Basque Research and Technology Alliance - to promote the adoption of the technology/app).
Role of the government (here: Basque Government)	Provider of funding	Specific call of projects launched by the entity of the Economic Development, Sustainability and Environment Department of the Basque Government for promoting the Basque industry (SPRI Group) led to the app development.
Intermediary Role(s)	Research alliance	• Three collaborating research centres started collaboration through the facilitation by the Basque Research and Technology Alliance (BRTA). • BRTA offered Rapid-App to other members.
COVID exceptionality	Used open-source inputs or open IP outputs to facilitate rapid response (open-source license shared for wider uptake).	

Table 25.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Basque Country Government–Department of Economic Development and Infrastructures	Government ministry	Spain	• Provided funding for the app development. • Provided support to request permission from Google to publish the app (with the goal of wider engagement).
VICOMTECH	Private, not-for-profit research institution	Spain	Conducted research for the Rapid-App and developed the tracing and simulation tool.
Ikerlan	Private (co-operative business) research institution	Spain	Contributed to the development of the app.
Tecnalia	Private foundation	Spain	Contributed to the development of the app and associated software by providing inputs on the development of statistics on risks, based on sector and geography.
Basque Research and Technology Alliance (BRTA) - alliance of 16 research centres	Scientific-technological consortium	Spain	Contributed to promoting the use of the app beyond the three institutions that developed it.

Table 25.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Rapid-App: Advanced contact tracing and artificial intelligence tool which allows for risk estimation by sector or geographic area and which can be adapted for use during other crises or for other purposes.
Knowledge, capabilities	Experience in fast development of secure and private mobile application solutions.
Networks	Strengthening of the collaboration between participation public research institutions, the BRTA Alliance and the Basque government.

26. Switzerland – GRAPH Network

Short description

The Global Research and Analyses for Public Health (GRAPH) Network initiative developed a data platform that provides real-time evidence on the evolving situation of the COVID-19 pandemic for countries in Sub-Saharan Africa. The initiative involves data management, visualisations (via a dedicated data platform, which was developed for this purpose) and analyses of country-specific pandemic developments.

The World Health Organisation's Regional Office for Africa (WHO AFRO) funded the initiative via the Health Emergency Information and Risk Assessment programme of the World Health Organization Africa (HIM WHO). Association Actions en Santé Publique a Swiss not-for-profit organisation, which oversaw the administration of the network. African governments engaged with the core team of researchers in providing access to data by establishing trust with data providers. The analytical team from different departments of the University of Geneva and wider research network is made up of 63 researchers and postgraduate students from 32 countries (of which 17 African).

A total of 45 in-depth country-specific epidemiological reports and data quality reports were prepared for 28 countries. The other key tasks of the analytical team included searching and integrating different sources of data (e.g. country level data of, published literature on measures used for evaluation, data published on the websites of Health Ministries, and information on C available from health surveys). The project also involved developing visualisations of the data and reporting tools to make accessible and timely inferences for policymakers. The deliverables included, for example, an open-source web-based epidemiological data platform called EpiGraphHub, a secure data-storage, data analysis and visualisation platform, a contact-tracing app, country-specific databases, and a training platform for data analysis in R (a programming language for statistical computing). The network closely with health professionals and public health officials in respective countries. The network also expanded its initial scope and is now working on disease surveillance more generally.

More information is available at: The GRAPH Network - Global Research and Analyses for Public Health

Key takeaways

This initiative is an example of a cross-country collaborative project where researchers allocated to work on specific tasks are managed by a central coordinator.

The initiative highlights how skills and resources internationally can be leveraged to develop advanced data integration infrastructure to provide policy-relevant information on a global health crisis.

Co-creation dimension(s) of the initiative

Co-creation occurred in this initiative between the intergovernmental WHO, the University of Geneva and the not-for-profit organisation "Actions en Santé Publique". The operative team was made up of multidisciplinary community of researchers, health professionals and students from over 30 countries working in the fields of epidemiology, data analysis, software development and education, coming from different departments of the University of Geneva, as well as independent researchers from across the globe, but especially Africa. Governments from across Africa engaged with the core team of researchers in providing access to data by establishing trust with data providers.

Characteristics, participating institutions and their contributions and outcomes

Table 26.a. Initiative characteristics

Categories	Overview	Description
Initiative size	63 researchers	63 researchers from 32 nations (of which 17 were African countries).
Funding sources	Public (intergovernmental organisation)	USD 200 000 from WHO Regional Office for Africa.
Timeline	June 2020 - December 2020 (development), Jan 2021-ongoing as of May 2022 (time of report completion) (operation of the database)	Data infrastructures for the project were completed in December 2020 and from that point onwards was being operated with new data being introduced.
Initiating organisation(s)	University	University of Geneva
Existing pre-COVID	No	
Basis for and means of collaboration	Building or offering access to networks; Funding/scholarships; Integrating data; Interacting via a digital platform	The networks of the various institutions were used to broaden the analysis; different data sources were pooled together for analytical purposes; researchers in different teams collaborated via the digital platform; funding from the WHO made the initiative possible.
Streamlining of processes	Temporary, task-oriented team creation	Simplified recruitment processes at the University of Geneva due flexibility during the pandemic allowed building the project team quickly.
Cooperation across disciplines	• Type: Expertise • Disciplines: public health, socio-economic, geographic, demographic, policy (needed to provide a comprehensive picture of the developments in Africa during the pandemic, incl. academic understanding of different fields of knowledge to be made accessible through the platform); software development (to establish the platform)	
Leveraging existing assets	Networks	• Country network of the WHO to provide access to data. • Cross-disciplinary network within the University of Geneva and with independent researchers in Africa.
Role of the government (here: WHO Regional Office for Africa)	Provider of funding; Network builder/Negotiator	WHO steered efforts from a content perspective and connected researchers with governments in the region.
Intermediary Role(s)	Not-for-profit association	• Association Actions en Santé Publique administered the network (administrative issues regarding volunteering of staff's time, etc.).
COVID exceptionality	Creation of large global network to leverage all available expertise; Big and/or real-time data analytics (to inform policy).	

Table 26.b. Partners

Name of the Partner	Type of institution	Country	Contribution
WHO Regional Office for Africa	Intergovernmental organisation	Republic of the Congo	• Contributed USD 200 000. • Provided country data in collaboration with participating African country governments. • Offering access to internal reports of WHO for data. • Used the data platform created to provide member states advice on dealing with the COVID-19 pandemic.
Association Actions en Santé Publique	Not-for-profit organisation	Switzerland	Administered the network which manages the funding and human resources of the GRAPH Network.
University of Geneva (Divisions of Infectious Diseases and Mathematical Modelling)	University	Switzerland	Contribution to data selection and analysis by experts, such as epidemiologists, social scientists, data analysts, computer scientists, global health professionals and postgraduate students.

Table 26.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Developed open-source web application, EpiGraphHub, to display core COVID-19 health data with useful technical additions such as automatic generation of reports using advanced data analyses features (e.g. mathematical models, geospatial analyses) for decision-makers to request real-time data for policy information purposes.
Knowledge, capabilities	• Knowledge developed on the COVID-19 health crisis across 28 African WHO AFRO member countries. • New capabilities in developing training modules to mentor new members, such as researchers, but also health professional and public health officials using the platform for information purposes.
Networks	Established the Global Research and Analyses for Public Health (GRAPH) Network, bringing together an international research group.

27. United States – CORD-19

Short description

The COVID-19 Open Research Dataset (CORD-19) initiative created an openly accessible collection of research articles on COVID-19 and other coronaviruses through a collaboration of universities (Georgetown University), government (White House Office of Science and Technology Policy, National Institutes of Health's National Library of Medicine), and the private sector (including Allen Institute for Artificial Intelligence, Microsoft Research), as well as academic publishers and philanthropic organisations. The collaboration brought together expertise and capabilities in information management, natural language processing (NLP), and artificial intelligence (AI) to allow researchers, public health officials, and the public to access the latest research on COVID-19 to accelerate progress on COVID-19 and develop improved search and retrieval technologies.

The initiative created an openly accessible set of machine-readable scientific text from scholarly articles. It built a resource of over 1 million scholarly articles, including nearly 370 000 with full text about COVID-19 and related coronaviruses, with the final update release planned for 2 June 2022. NLP and other AI techniques were applied to analyse the textual data in these articles to improve the search quality of the database. The project was initially launched under a 'call to action' from the White House Office of Science and Technology Policy to introduce a system that improves accessibility and the use of scientific literature to inform the COVID-19 response. The Georgetown University Center for Security and Emerging Technology, Semantic Scholar team at the Allen Institute for Artificial Intelligence, and National Library of Medicine teamed to lead the project.

The CORD-19 initiative benefited from contributions from the wider innovation ecosystem as AI inputs and expertise to develop CORD-19 were sought under a challenge that was posted on Google's Kaggle AI, which is an online machine-learning platform where innovation competitions are posted, and teams can win prizes for developing and submitting innovative solutions.

More information is available at: https://arxiv.org/abs/2004.10706v2 and GitHub - allenai/cord19: Get started with CORD-19

Key takeaways

The involvement of the government in this initiative was key to the development of the database and particularly in providing convening powers and negotiating for open-access resources with the publishing community of scientific literature.

Co-creation dimension(s) of the initiative

Co-creation occurred in this initiative with the development of the CORD-19 open access database through the collaboration between company partners, universities, government, and philanthropic organisations.

Co-creation also occurred through Google's AI Kaggle Challenge, inviting AI experts to develop text and data mining tools that could help the medical community to develop answers to high-priority scientific questions. The CORD-19 call for inputs was a very popular Kaggle AI challenges in terms of participation and engagements and generated 17 tasks, 1 645 codes and 374 discussions.

Characteristics, participating institutions and their contributions and outcomes

Table 27.a. Initiative characteristics

Categories	Overview	Description
Initiative size	25 staff	10 individuals from the semantic scholar team at the Allen Institute for AI and 15 from key partner organisations worked on the project.
Funding sources	Private	• The Semantic Scholar team at the Allen Institute for Artificial Intelligence, a non-profit institute, contributed staff time and technical resources. • The National Library of Medicine (NLM), an element of the National Institutes of Health, Department of Health and Human Services devoted staff time and leveraged its existing PubMed Central archive of biomedical literature. • Google's Kaggle AI platform sponsored prize for the winner of the challenge.
Timeline	March 2020 – June 2022	• March 2020: CORD-19 team was created following a White House call to action; created initial dataset of relevant research papers; released dataset and launched Kaggle AI competition; harmonising of the data from the challenge into a database. • April 2020 – June 2022: Timely updates of the database incorporating new research • June 2022: Final updated version released. NLM will continue to collect, organize and disseminate its collection of full-text journal articles related to COVID-19 and the broader family of coronaviruses.
Initiating organisation(s)	Government ministry	White House Office of Science and Technology Policy
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating resources (digital and/or material); Integrating data; Organising a hackathon; Building or offering access to networks	• Collaboration: Cross-institutional access to computing infrastructures and data sharing between cross-institutional teams. • 'Codeathon': The Kaggle Platform, a digital platform posting challenges for solutions within the ecosystem, enabled developing information retrieval techniques (e.g. text and data mining tools) faster. The Kaggle challenge model was useful to source different AI, NLP and search engine tools. • Building networks: partnerships with publishers to get access to data.
Streamlining of processes	Data integration; Open access/open source	• The use of open source tools and leveraging state-of-the-art tools by leading companies on questions of search, NLP and machine learning helped developing more quickly some of the functionalities. • NLM modified its procedures and technical systems to accommodate contributions of journal articles from a growing number of publishers and scholarly societies. • The use of the hackathon model to call for contributions from the community of programmers also helped identify solutions more quickly.
Cooperation across disciplines	• Type: Expertise, technologies • Disciplines: medical, AI, machine learning, and data retrieval technologies	
Leveraging existing assets	Infrastructures (Publications repositories)	Previously existing infrastructures and capacities within project participants were leveraged.
Role of the government (here: White House)	Network builder/Negotiator	White House Office of Science and Technology Policy launched the project and brought together partners for collaboration; the National Library of Medicine contributed staff time, expertise and its existing technical platform.
Intermediary Role(s)	Government/public institution; Research institution	White House Office of Science and Technology Policy brought together partners for collaboration.
COVID exceptionality	Used open-source inputs or provided open access to outputs to facilitate rapid response (open access provided to COVID-19-related publications); Use of social media and/or hackathons to use contributions from a wide range of participants rapidly; Creation of large global network to leverage all available expertise.	

Table 27.b. Partners

Name of the Partner	Type of institution	Country	Contribution
Semantic Scholar team at the Allen Institute for Artificial Intelligence	Private, not-for-profit research institution	United States	• Built the CORD-19 data platform by transforming article texts into machine-readable formats for fine-grained analysis within articles, developing the search engine to optimise search and developing the website to host the database. • Provided funding to build the CORD-19 data platform, including resources for staff involved in the project development. • Co-organised a TREC-COVID shared task (informational retrieval shared task).
White House Office of Science and Technology Policy	Government agency	United States	Issued a call to technology companies and research groups to identify how AI tools could be used to optimise search on Kaggle together with research institutions and NIH.
Chan Zuckerberg Initiative	Not-for-profit organisation	United States	• Funded Cold Spring Harbor Laboratory's BioRxiv server (open access pre-print repository that provides the backbone to much content on the CORD-19 platform). • Tracked new research on a dedicated page on Meta (research search engine). • Provided access to articles posted on pre-print servers but not yet peer-reviewed.
Microsoft Research	Company	United States	Indexed and mapping global scientific literature, including provision of metadata.
National Institutes of Health's (NIH) National Library of Medicine	Government agency	United States	• Adapted procedures for depositing articles to their PubMed Central digital archive to provide greater flexibility and ensure relevant research is available in machine-readable formats. • Negotiated with publishers to offer open access to published materials. • Co-organised a TREC-COVID shared task (informational retrieval shared task).
Georgetown's University Centre for Security and Emerging Technology	University	United States	Coordinated the project acting as point of contact with the White House.
Cold Spring Harbor Laboratory	Not-for-profit organisation	United States	• Provided access to fully indexed relevant research from the BioRxiv and its open access preprint repository which hosts pre-prints of scientific literature for biology.
Kaggle AI platform (an online machine-learning platform where innovation competitions are posted, owned by Google)	Company	United States	• Setup the Kaggle competition for CORD-19 under COVID-19 data challenges (the COVID-19 Open Research Dataset Challenge). • Sponsored USD 1 000 for the winner of each task within the challenge.
Publishers of academic research	Company	Global	More than 50 scholarly publishers and scientific societies contributed its publications of relevance to COVID-19 research.
Amazon Web Services (AWS)	Company	United States	Provided machine learning enabled search capabilities for the data.
IBM Research AI	Company	United States	Applied tools in document conversion to update the CORD-19 dataset.

Table 27.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Developed platform of over 1 million machine-readable full text openly accessible research articles available for big data analysis. • Developed systems to facilitate PDF parsing and allows for automated database updating of useful application beyond the database.
Knowledge, capabilities	• Experience in engaging in virtual collaborations with several partners and wider ecosystem. • Model for accelerating access to research articles related to national priorities.
Networks	Network involving government, research institutions, philanthropic organisations and companies.

28. Australia – Wastewater Surveillance for COVID-19

Short description

Researchers at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) partnered with the University of Queensland and regional public health authorities, Queensland Health, to investigate whether and how wastewater surveillance could detect COVID-19 prevalence in a community. The project provided such information from wastewater (untreated sewage) testing. The partnership resulted in a wastewater surveillance system across Queensland that involved wastewater catchments covering ~80% of the population. The results were consequently used to inform Queensland Health's policy in dealing with the COVID-19 pandemic.

More information is available at: Monitoring wastewater for COVID-19 - CSIRO

Key takeaways

International engagement with researchers globally contributed to quicker progress in developing methodological accuracy.

Co-creation dimension(s) of the initiative

The co-creation initiative involved collaborative innovation by Australia's national science agency, CSIRO, and the University of Queensland and was sponsored in partnership with Queensland Health. In the early stages of methods development, the team engaged with a global network of scientists pioneering Wastewater-Based Epidemiology (WBE) for SARS-CoV-2 surveillance such as at the University of Notre Dame in the United States, Hokkaido University in Japan, and the COVID-19 WBE Collaborative.

Characteristics, participating institutions and their contributions and outcomes

Table 28.a. Initiative characteristics

Categories	Overview	Description
Initiative size	17 researchers	6 researchers from CSIRO, 12 from University of Queensland.
Funding sources	Public	USD 215 000 (AUD 300 000) in monthly funding from Queensland Health, the public health service of the state of Queensland.
Timeline	March 2020 – ongoing as of May 2022 (time of report completion)	• March 2020: Identification of relevant international research and knowledge by researchers at CSIRO; Building a project team involving CSIRO and researchers from University of Queensland. • March – July 2020: Research and exchange with international researchers on the matter; interest by national public institutions in Australia, but ultimately no funding available. • July 2020: Programme with Queensland Health as sponsor officially started. • As of May 2022: Weekly analysis continues, number of testing sites are adapted depending on overall COVID-19 dynamic in the country; project was used in Queensland, Victoria, and New South Wales. Improvements in the methodology have been undertaken to improve accuracy.
Initiating organisation(s)	Government agency	Initiated by researchers at the Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australia's national science agency.
Existing pre-COVID	No	
Basis for and means of collaboration	Integrating data; Integrating resources (digital and/or material)	Access to wastewater treatment facilities and technology for wastewater-based analysis by the University of Queensland combined with expertise in environmental microbiology and genomics by CSIRO; data-sharing with Queensland Health made it possible for results to inform COVID-19 public health intervention strategies.

Streamlining of processes	Data integration	The initiative helped inform SARS-CoV-2 surveillance in wastewater in NSW, Victoria, and SA and integrated data from wastewater-based epidemiology (WBE) with data from testing, informing public health department responses.
Cooperation across disciplines	• Type: Expertise, technologies (for testing the water) • Disciplines: waste-water surveillance, data management and integration as well as microbiology, chemistry, genomics and epidemiology	
Leveraging existing assets	Network; Knowledge	Existing knowledge and network related to wastewater surveillance from researchers in various countries were used to develop the method for this initiative.
Role of the government (here: Queensland Health, CSIRO)	Provider of funding; Collaborator in innovative co-creation; Network builder/Negotiator; Legitimiser	• Queensland Health provided funding for the project, facilitated access to the wastewater treatment facilities (negotiator) and used the data to inform its public health interventions (legitimising role). • Researchers from CSIRO, a public agency, were the main actors in adapting the concept of wastewater analysis to COVID-19 (collaborator)
Intermediary Role(s)	Government/public institution	Commonwealth Scientific and Industrial Research Organisation (CSIRO), a public agency, and the University of Queensland jointly organised the programme.
COVID exceptionality	Big and/or real-time data analytics (to inform policy); Creation of global network to leverage all available expertise.	

Table 28.b. Partners

Name of key partner	Type of institution	Country	Contribution
Queensland Health	Government agency	Australia	• Provided funding of approx. USD 215 000 (AUD 300 000) per month for programme development and operation • Integrated wastewater-based epidemiology data on SARS-CoV-2 into evidence for public health interventions. • Facilitated access to wastewater treatment facilities.
University of Queensland	University	Australia	• Sampled and processed wastewater. • Made access to wastewater treatment facilities possible (through contract with Australian Criminal Intelligence Commission and Queensland Health). • Conducted analysis to adapt wastewater-based epidemiology (WBE), previously in place for chemicals and illicit drugs, to testing for SARS-CoV-2.
The Commonwealth Scientific and Industrial Research Organisation (CSIRO)	Government agency	Australia	Conducted research to develop and refine wastewater analysis methods to optimise the detection of the SARS-CoV-2 virus in wastewater.

Table 28.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	• Developed Droplet Digital PCR (ddPCR), a comprehensive, cost-effective, highly sensitive way to detect specific variants of the SARS-CoV-2 coronavirus in wastewater. • Methods developed applicable to detecting other relevant information for surveillance of health risks and pollution.
Knowledge, capabilities	• Published peer-review papers on the knowledge acquired. • Protocols developed to train staff in Queensland Health in applying the method.
Networks	New connections between researchers and public sector officials.

29. Netherlands – Dutch ICU Data Warehouse

Short description

The Dutch ICU Data Warehouse (DDW) is an electronic health record (EHR) database integrating full-admission data from critically ill COVID-19 patients from multiple hospitals in the Netherlands. The initiative gathered and analysed pseudonymised data from 25 large hospitals in Netherlands. Initiated by a hospital in Amsterdam, the Society for Intensive Care Medicine decided to extend the project to analysis on critically ill patients to improve quality of care.

Data included patient demographics, clinical observations, administered medication, laboratory determinations, and data from vital sign monitors and life support devices. Data sharing agreements were signed with participating hospitals before any data transfers took place. Data were extracted from the local EHRs with pre-specified queries and combined into a staging dataset through an extract-transform-load (ETL) pipeline. In the consecutive processing pipeline, data were mapped to a common concept vocabulary and enriched with derived concepts. All participating hospitals have access to the DDW. Within legal and ethical boundaries, data were made available to clinicians and researchers.

More information is available at: icudata.nl - the Dutch ICU Data Warehouse

Key takeaways

Offering to access to data for all the participating partner, for their own research, is a strong motivation to agree to data sharing.

The experience demonstrated that this activity had significant application beyond COVID and could support in multitudes of health applications.

Co-creation dimension(s) of the initiative

The DDW was an initiative that involved individuals from major hospitals in the Netherlands. In Phase 2, the collaboration was expanded to include an industry association, a software development company and a not-for-profit organisation.

Characteristics, participating institutions and their contributions and outcomes

Table 29.a. Initiative characteristics

Categories	Overview	Description
Initiative size	25 hospitals (in Phase 1)	The initial phase of the Dutch ICU Data Warehouse started as a collaboration across 25 hospitals. The initiative was then scaled up also with resources made available from health insurance providers.
Funding sources	Public-private (in Phase 2)	Funding of USD 2.15 million (EUR 2 million) by health insurance providers (Zorgverzekeraars Nederland, uniting all major health insurance companies, semi-public and semi-private).
Timeline	March 2020 – March 2021 (data warehouse development), April 2021 – ongoing as of May 2022 (time of report completion) (further project development beyond COVID-19 and use for research projects)	A nation-wide data sharing collaboration was launched at the beginning of the pandemic in March 2020. During a period of one year the data warehouse was developed and the data used for research activities. This then led to the second phase of the project to extend the initiative beyond COVID-19.
Initiating organisation(s)	Individuals (industry professionals)	Medical doctors

Existing pre-COVID	No	
Basis for and means of collaboration	Integrating data	The initiative created a database integrating full-admission data from critically ill COVID-19 patients from multiple hospitals
Streamlining of processes	Data integration	Standardised data recording templates were set up to facilitate data integration across hospitals.
Cooperation across disciplines	• Type: Expertise • Disciplines: computing/digital platform development; medical expertise	
Leveraging existing assets	Knowledge; Technologies	Existing knowledge and technologies on data extraction and integration.
Role of the government	No role of the government	
Intermediary Role(s)	Private sector	Phase 1: One ICU hospital in the Netherlands. Phase 2: Laboratory for Critical Care Computational Intelligence at Amsterdam UMC coordinated the wider development of the initiative.
COVID exceptionality	Big and/or real-time data analytics (for integration of health data); Bottom-up initiative.	

Table 29.b. Partners

Name of key partner	Type of institution	Country	Contribution
Doctors and other experts (Phase 1)	Individuals (professionals)	Netherlands	• Intensivists, medical students, junior doctors, policy officers, legal advisors, privacy officers, data scientists, statisticians, and clinicians contributed their respective expertise. • IT experts from the participating hospitals adjusted the structured queries to local system configurations and performed the data extraction and pseudonymisation.
Dutch Society for Intensive Care (NVIC) (Phase 2)	Industry association	Netherlands	Engaging in large scale data sharing on critically ill patients to improved quality of care and patient outcomes.
Laboratory for Critical Care Computational Intelligence at Amsterdam University Medical Center (Phase 2)	Hospital / research laboratory	Netherlands	Coordinates the new collaboration in Phase 2 to engage in large scale data sharing on critically ill patients to improved quality of care and patient outcomes.
National Intensive Care Evaluation (NICE) foundation (Phase 2)	Not-for-profit organisation	Netherlands	Contribute expertise in analysing data for ICU benchmarking.
Pacmed, software development company (Phase 2)	Company	Netherlands	Contribute expertise on machine learning to analyse data.

Table 29.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	Database: Data from 3 464 COVID-19 patients with more than 200 million data points are included in the data warehouse.
Knowledge, Capabilities	Expertise in on data governance, standardisation, and mapping were developed to possibly enable wider experimentation.
Networks	Network of participating hospitals and other actors relevant to data governance and platform management.

30. Germany – Corona-Warn-App

Short description

Corona-Warn-App was developed by SAP and Deutsche Telekom subsidiary T-Systems, following a request by the Federal Ministry of Health and with expert advice provided by the Robert Koch Institute (RKI). The app enables users to trace proximity to other users with confirmed COVID-19 infections, to manage SARS-CoV-2 PCR and rapid antigen tests, and to store COVID-19 test and vaccine certificates. Anyone who tests positive for SARS-CoV-2 can share this information voluntarily with the app. Other app users are then notified about epidemiologically relevant contacts with the infected person within a 14-day period, including the date of the last such contact. Smartphones also exchange encrypted random IDs with other devices using Bluetooth Low Energy (BLE) when enabled.

More information is available at: Corona-Warn-App Open Source Project

Key takeaways

The project illustrated that data privacy concerns are an important potential impediment to consumer uptake of this effective tool to trace COVID-19 exposures. To encourage uptake, the project engaged in extensive level of communication and publicity through private companies.

The project relied on leading technology companies to quickly develop a user-friendly app, leveraging the capacities of the private sector in app development. This type of collaboration is highly relevant for the development of app tools given the lead capacities in the private sector in this area.

Co-creation dimension(s) of the initiative

The government recruited two large technological companies to provide IT infrastructure for data management and to actually develop the app, combining this with the epidemiological and public health expertise provided by the government agency. They also engaged with the open-source community / civil society organisations and individual IT experts for feedback and further development of the app.

Characteristics, participating institutions and their contributions and outcomes

Table 30.a. Initiative characteristics

Categories	Overview	Description
Initiative size	More than 100 members of staff across several institutions (see partner information below)	• The Federal Ministry of Health provided the annual funding to support the initiative and steered the project. • Funding provided for the lab infrastructure, the communication campaign and open-source engagement.
Funding sources	Public	Funding provided by the government (EUR 50 million/year) for the initial development of the app, maintenance, the lab infrastructure and the communication campaign.
Timeline	April 2020 – June 2020 (initial app development), July 2020 – May 2022 (time of report completion) (further development)	In mid-June 2020 the first version of the App was launched. Then the subsequent services such as vaccine certificate management, issuing,etc. were added with constant development over two years.
Initiating organisation(s)	Government ministry	Federal Ministry of Health
Existing pre-COVID	No	

Basis for and means of collaboration	Funding/scholarships; Integrating resources (digital and/or material)	• The Ministry provided funding and oversight of the project overall. • SAP and TIS collaborated digitally, leveraging their respective computing resources. • The Robert-Koch-Institute (RKI) provided expertise on epidemiological dynamics and public health to enable the technology suppliers to co-create the application.
Streamlining of processes	Not applicable	
Cooperation across disciplines	• Type: Expertise; technologies • Disciplines: Software development; data science, epidemiology/medical sciences	
Leveraging existing assets	Infrastructure; Expertise	IT system infrastructure and expertise of SAP and Deutsche Telekom (TSI) were used.
Role of the government (here: Ministry of Health, RKI)	Provider of funding; Legitimiser; Collaborator in innovative co-creation	• The government funded the initiative and was actively involved in promoting the adoption with the aim of building trust. • The Robert-Koch-Institute (RKI), a public agency, was actively involved by providing expertise on epidemiology for the development of the application.
Intermediary Role(s)	Government/public institution	The Ministry of Health brought together private companies and the Robert Koch institute to develop the app.
COVID exceptionality	Included extensive public engagement (to facilitate output adoption and/or solution development); Input and contributions solicited from individuals, start-ups and/or not-for-profits (here: open-source community).	

Table 30.b. Partners

Name of key partner	Type of institution	Country	Contribution
Federal Ministry of Health	Government ministry	Germany	• Funded EUR 50 million/year. • Led the steering committee and overall project.
Robert Koch Institute - German federal government agency and research institution responsible for disease control and prevention.	Government agency	Germany	Provided expertise with regards to COVID-19 and on this basis relevant requirements for the scientifically sound development of the app.
SAP (German multinational software development company)	Company	Germany	Developed the app.
Deutsche Telekom (TSI)	Company	Germany	Provided key infrastructure required for data transmission (e.g. connecting the labs and test centres via servers and data transmission between the apps and the backend) for the app development.
Fraunhofer Institute for Integrated Circuits IIS	Public research institution	Germany	Conducted proximity measurements and calibrated devices for contact-tracing.

Table 30.c. Outcomes

Co-creation outcome categories	Direct outcomes to address COVID-19 / Outcomes beyond COVID-19
Technologies, innovations	The development of the Corona-Warn-App provided a key pillar in the country's response to COVID-19.
Knowledge, capabilities.	Experience in development of open-source-based and data-privacy-conscious mobile application.
Networks	Connection between the open-source community and software developers from large companies.

Annex A: Case study template

_____	_____
Initiative name	Date
_____	_____
Interviewee	Interviewer

1. This study gathers cases on successful co-creation experiences in the context of the Covid-19 pandemic. The empirical evidence will inform the current project of the OECD TIP (Innovation and Technology Policy) Working Party entitled '**Co-creation for inclusive, resilient and sustainable futures**'. By learning from co-creation during the Covid-19 pandemic, it aims to offer Science, Technology and Innovation policy recommendations as to the role of regional, national and cross-national policy for inclusive, resilient and sustainable futures.
2. Definition of co-creation adopted in the TIP project 'Knowledge co-creation is the process of joint knowledge production between industry, research and other stakeholders, such as civil society.'

1. GENERAL INFORMATION

Short description of the initiative (Interviewer, please try to complete this prior to the interview using secondary data).

3. Timeline of key milestones (Interviewer, please try to complete this prior to the interview using secondary data and you may share this with the interviewee prior to the interview and get it validated during the interview)
4. What was the broad aim of the initiative? (i.e. what the initiative hopes to achieve/statement of intent and concrete sub-objectives).
5. Why was it decided to engage in co-creation during the Covid-19 pandemic (e.g. urgency of response, scope of the challenge, need to explore new opportunities)?

2. OBJECTIVES AND CONTRIBUTIONS OF ACTORS

6. Objectives and contribution of each party and source of funding (Interviewer, please try to complete this prior to the interview using secondary data and you may share this with the interviewee prior to the interview and get it validated and completed during the interview)

Table A.1. Partner contributions

Name of the Partner	Country	Financial Contribution to the initiative by each partner' – Please state the amount	Non-financial contribution to the co-creation by each partner (e.g. human capital, IT, networks, patents, know-how, and capabilities etc.)	Number of individuals from each partner involved in the initiative (if applicable)	The key role of the partner	The main objective of the partner to engage in the initiative

If no policy partner or civil society partner is mentioned in the response to 2.1. please ask following questions (if mentioned, please move to Section 3):

- Was there an institution by the government (agency, ministry) that the co-creation Covid-19 initiative could reach out to in case it needed help? If there was one, please provide the name of the institution and how useful it was (e.g. if you were able to have a direct contacted point)? (Please explore this in more detail in the Section 5 below)
- Has the co-creation initiative engaged with the civil society or other stakeholders in its broader environment? If so how and was the engagement useful?

3. CO-CREATION OUTCOMES

7. What were the outcomes of co-creation (Interviewer, please try to complete this prior to the interview using secondary data and you may share this with the interviewee prior to the interview and get it validated and completed during the interview).

Table A.2. Co-creation outcomes

Co-creation outcome categories	3.1.1 Please state Specific/Direct outcomes	3.1.2. Please state larger impacts associated with each type of impact/impacts in general (e.g. job creation, treating patients etc.)	3.1.3. Scope (i.e. if outcomes/impacts are likely to be applicable/useful/adaptable for non-COVID-19 circumstances and how)
1. Technologies – e.g. Products, Equipment, Software, and Materials			
2. Knowledge – e.g. Data bases, and Knowledge required for decision making			
3. Capabilities – e.g. Entrepreneurial, Innovation, Scientific, Managerial, and Relational, capabilities			
4. Knowhow – e.g. Recipes, Protocols, and Scientific process			
5. Networks			
Other			

4. SUCCESS CRITERIA

8. How did you evaluate the success of co-creation initiative? (List the factors, activities or elements that are required to ensure successful completion of the project. If measurable, include KPIs)
9. Building on the uniqueness of co-creation in the Covid-19 context to better articulate the success criteria for future initiatives (Interviewer, you may share this with the interviewee prior to the interview, so that, he/she will be better prepared to respond)

Table A.3. Success criteria

Questions to identify specific success criteria/successful practices	4.2.1. What are the success criteria/ successful practices in relation to each of the category in Column 1 and why?	4.2.2. Did you change your general practices to especially engage in co-creation during Covid-19? If yes, how and where these changes useful? (e.g. new practices/change in existing practices)	4.2.3. Which changes in practices would you like to keep beyond the Covid-19 pandemic? (YES/NO)	4.2.4. How will you make use of your learning of success criteria/ successful practices, for future crisis environment and why? for future non-crisis/ normal environment and why?
1. How did you select partners?				
2. How did you manage the relationship with partners?				
3. How did you manage the engagement with broader environment/ecosystem				
4. What are the mechanisms adopted for success (e.g. new approach/es adopted as part of the project and that built for its success)?				
5. How did you make use of intellectual property rights?				
6. How did you make use of digital infrastructure?				
7. How did you offer incentives for co-creation?				
Other success criteria				

5. ROLE OF GOVERNMENT/POLICY LANDSCAPE

10. What was unique about the role of government/policy during the covid-19 pandemic and their impacts?
11. Policy instrument(s) – Please state details of policy measures which gave rise to and/or supported the initiative as well as the impact of the wider policy context. Please pay special attention to the role of specific funding, role of regional, national and cross-national policy support, underlying public funding used to support the activity, etc.
12. (Interviewer, you may share this with the interviewee prior to the interview, so that, he/she will be better prepared to respond)

Table A.4. Policy measures for co-creation

Name regional, national and cross-national policy measures for co-creation during Covid-19	What were the roles of regional, national and cross-national policy for co-creation during Covid-19? (e.g. funding, being co-creators, leading co-creation initiatives, tangible and intangible resources support, new framework conditions, partner introductions and other incentives etc.)

13. Other feedback on the role of government/policy in this Co-creation covid-19 initiative?

6. LESSONS FOR FUTURE INITIATIVES

14. What were lessons learnt from your engagement in the initiative that could be applied to future (co-creation) initiatives during (non-) crisis time and why? [Please focus on what worked well and should be continued; what did not work well and needs to be improved, or what you will not do again] [You may exclude those that have been discussed in Q 4.2]

Table A.5. Lessons learned

Levels that lessons were learnt	6.1.1. Applicable for Crisis time	6.1.2. Applicable for Non-crisis time
1. Individual		
2. Institutional		
3. National		
4. International		

Annex B: Template and definitions of initiative characteristics

Categories	Definition	Descriptor options (where applicable)
Initiative size	Number of projects or involved staff, where available	
Funding sources	Typology of institutions from which financial support to the initiative came	• Private • Public
Timeline		
Initiating organisation	The type of organisation, which started the project in its initial phase.	• Cross-government collaborative body • Government ministry • Government agency • Individuals (professionals; academic/experts) • Research institution • University
Initiating organisation(s)		
Existing pre-COVID		
Basis for and means of collaboration	What enabled the collaboration and how the initiative operated	• Building or offering access to networks • Funding / scholarships • Matching partners (and/or end users) • Organising a hackathon • Issuing a call for participation • Integrating data • Integrating resources (digital or material) • Interacting via a digital platform • Providing access to outputs to a wider community
Streamlining of processes	Factors which contributed to the efficiency of the project – either through ways in which the project was set up / structured, the main mode of cooperation, or the easing of external constraints	Streamlined process • Project evaluation and approval • Regulatory approval Streamlining tool • Data integration • Licensing contracts of intellectual property • Open access/open source • Temporary, task oriented team creation
Cooperation across disciplines	Cases in which it was necessary to use expertise/technology/capacities from different disciplines to create the output	• Type: Expertise / Technology / Capacities • Disciplines: Medical, automotive, etc.
Leveraging existing assets	Use of already existing assets for the initiative	• Technologies/Infrastructure - • Networks • Policy programme/structures
Role of the government	Ways in which governmental institutions were involved in the initiative	• Provider of funding – offered funding for the co-creation initiative (e.g. directly to the specific project or through a call for proposals) • Network builder/negotiator – used its contacts to easily connect co-creation partners to other institutions (and their services) • Legitimiser – provided legitimacy to the activities of the initiative in so far as needed to be accepted by the public • Collaborator in innovative co-creation – direct involvement in the initiative, contributing to the set-up, planning, decision-making and/or implementation

Intermediary Role(s)	Cases in which one institution increased the initiative's network and brought in new (potential) partners	• Government/public institution • Association • University • Intermediary organisations (e.g. PRIs) • Private sector • Not-for-profit organisation • Research institutions
COVID exceptionality	Ways in which this initiative differed from previous co-creation initiatives due to the specific circumstances of the COVID-19 pandemic	• Refocused existing co-creation programmes/initiatives to COVID-19 • Accelerated project evaluation • Accelerated regulatory approval • Refocused existing infrastructure to COVID-19 • Input and contributions solicited from individuals, start-ups and/or not-for-profits • Creation of large global network to leverage all available expertise • Big and/or real time data analytics or use of super-computing capacities • Government as active collaborator • Used open-source inputs or provided open access to outputs to facilitate rapid response • Included extensive public engagement (to facilitate output adoption and/or solution development) • Pro-bono involvement of entrepreneurs • Bottom-up initiative • Collaboration involved direct production and product development • Use of social media and/or hackathons to use contributions from a wide range of participants rapidly

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