Development of Innovation Cooperation in the Time of COVID-19 Pandemic

Submitted 28/12/20, 1st revision 25/01/21, 2nd revision 01/03/21, accepted 20/03/21

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Abstract:

**Purpose:** The aim of the article is to present the development of new partnerships and R&D alliances in the time of COVID-19 pandemic.

**Design/Methodology/Approach:** The main method applied in this research was the scientific study. Descriptive, comparative, documentation and desk research methods were used. Additionally, the authors used the methods of deductive and inductive forecasting.

**Findings:** The authors present new partnerships undertaken by biopharma (biotech and pharma) companies (in and outside the industry) in order to face pandemic and to discover and deliver a new vaccine for SARS-CoV-2 to the market. In addition, the research projects in the European Union focused on the development of diagnostics, treatments, vaccines, epidemiology, preparedness and response to outbreaks, socioeconomic, production and digital technologies as well infrastructures and data resources that make it possible this research will be presented.

**Practical Implications:** It should be taken into consideration that due to the current situation caused by pandemic the cooperation of companies and all entities in the whole biopharmaceutical R&D innovation ecosystem is even more challenging than before COVID-19. Biopharma–university alliances can significantly increase the likelihood of creating better medical therapy for patients.

**Originality/value:** Results of this cooperation enable a number of innovative projects given the significant pressure on innovativeness and challenges caused by the pandemic.

**Keywords:** COVID-19 pandemic, innovation cooperation, open innovation, open innovation alliances, R&D alliances, business-academia alliances, biopharmaceutical industry, patient care, ECMO.

**JEL codes:** 031, 032, 033.

**Paper Type:** Research article.

**Acknowledgement:** This paper includes findings from the research project financed by the research grant of the National Science Centre (Poland) awarded based on the decision no. DEC-2015/19/D/HS4/00414 and project awarded funding from a POWER competitive national grant no. POWR.04.00-IP.05-00-006/18 by the Polish Ministry of Health.

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1. Introduction

Analysing the development of cooperation of biopharmaceutical (biotech and pharma) companies with universities we can observe these relations for many years, starting with individual, single projects, from small research projects to large clinical trials. Later the companies developed alliances with individual academic institutions, including a wider range of cooperation, through research programs, clinical trials, and translational research. Companies also increasingly began to apply different models of R&D alliances, from individual links in research projects to multilateral agreements involving multiple research projects, including various models for open innovation (Chesbrough, 2003). According to the latest definition by Chesbrough open innovation is “a distributed innovation process based on purposively managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with each organization’s business model” (Chesbrough, Bogers, 2014, p. 17). This concept can be realized in bilateral and multilateral alliances. Open innovation model in comparison to traditional alliances is more dynamic because partners in alliance are not identified in the conventional, purposeful way.

Cooperation is focused more on the exchange of knowledge and ideas during the period preceding the creation of the alliance. Open innovation alliances are aimed at supporting the free flow of knowledge and ideas leading to the creation of partnerships focused not only on joint innovation, but also at risk and profit sharing (Wilks and Prothmann, 2012). The results of research on open innovation have shown how firms are managing both the inflows and outflows of knowledge and how they are searching for partners and the innovations they provide (Culpan, 2014; West, 2014; Chesbrough, 2019). We can also observe how companies in specific industries (like biopharma) use the model of open innovation to establish open innovation alliances not only with firms from the same or other industry but also with universities, individuals, communities, or other organizations (Wilks and Prothmann, 2012; Deloitte, 2017).

It should be considered that the organizational fluidity of open innovation initiatives as well as multiparty relations increase the complexity in the alliance management but at the same time increase the innovation potential. The use of open innovation model can significantly speed up the production process of new drugs and vaccines, which are in demand on the market because of COVID-19 pandemic (Chesbrough, 2020a). More interdisciplinary academic teams can also accelerate and support this process (Wilks and Prothmann, 2012). Open innovation was implemented by companies in several ways, including innovations for users, crowdsourcing, creation of joint development alliances or through building innovative ecosystems (Wilks and Prothmann, 2012; Deloitte, 2017; Hanson, 2015; Puślecki, 2015; 2016; Puślecki and Staszków, 2015).

The main aim of the article is to present the development of new partnerships and R&D alliances in the time of COVID-19 pandemic. The authors will present new
partnerships undertaken by biopharma companies (in and outside the industry) to face pandemic and to discover and deliver a new vaccine for SARS-CoV-2 to the market. In addition, the research projects in the European Union focused on the development of diagnostics, treatments, vaccines, epidemiology, preparedness and response to outbreaks, socioeconomics, production, and digital technologies as well infrastructures and data resources that make it possible this research will be presented.

It should be taken into consideration that due to the current situation caused by pandemic the co-operation of companies and all entities in the whole biopharmaceutical R&D innovation ecosystem is even more challenging than before COVID-19. Biopharma–university alliances can significantly increase the likelihood of creating better medical therapy for patients. In addition to partnerships within the industry, biopharma companies develop alliances with universities or research institutes as well as more often cross-industry alliances and public-private partnerships.

Results of this cooperation enables several innovative projects and allows significant synergy effects given the significant pressures on innovativeness and challenges caused by pandemic of coronavirus SARS-CoV-2. The main method applied in this research was a method of scientific study. Descriptive, comparative, documentation and desk research methods were used. Additionally, the authors also used the methods of deductive and inductive forecasting.

2. **Boosting Innovation in the Biopharmaceutical R&D Innovation Ecosystem**

Innovation cooperation developed in biopharmaceutical R&D ecosystem enables important scientific breakthroughs in novel diagnostic technology and the definition of molecular targets for the development of personalized medicines. These advances have an impact on the current development of new drugs in the time of COVID-19 and improvement of medical care. Biopharmaceutical companies involved in cooperation can develop targeted therapies and drugs needed to treat serious diseases and unmet medical needs (Deloitte, 2017; Gomes-Casseres, 2014; Chesbrough, 2020b) and have better innovation cooperation performance (Trąpczyński, Puślecki, and Staszków, 2018). The biopharmaceutical R&D ecosystem is composed of a varied group of stakeholders (Figure 1) and makes it possible for them to achieve together that which would be difficult acting as an individual entity.

In the R&D ecosystem biopharma companies are responsible for two functions – they are contributors as well as integrators of the ecosystem. They gather diverse stakeholders offering distinct characteristics and contributions with a common goal of improving patient health outcomes. Patients are positioned as hub at the ecosystem as both key participants in driving patient-centered innovation and as the recipients of the value created as a result of cooperation in ecosystem (Deloitte, 2017).
Figure 1. Illustrative biopharmaceutical R&D innovation ecosystem

Source: Own elaboration based on (Deloitte, 2017, p. 11).

3. Growing Diversity of Partners in R&D Cooperation – COVID-19 Vaccines Projects

Analyzing examples of partnerships in biopharmaceutical industry we can observe different modes of cooperation, R&D alliances, open innovation alliances, public-private partnerships, consortia, pharma-university alliances, cross-industry alliances (especially with IT industry) as well as different entities involved in cooperation including governments, universities and research institutes, foundations, funds, banks, and organizations. As multiparty alliances these partnerships require even greater competencies and skills of alliance managers and appropriate alliance management tools.

Thanks to significant synergy effects participation in R&D Innovation Ecosystem enables the partners accessing the huge innovative potential and more market opportunities, which helps them to innovate, accelerate growth and expand into new promising markets (Fraser, 2014; Burke, 2020; De Man, 2018; De Man, Koene, and Ars, 2019; De Man, 2020; De Man and Luvinston, 2019).

Taking into consideration current challenges impacting the biopharmaceutical R&D environment - COVID-19 pandemic, development of collaborative relationships can help partners in obtaining scientific and technological advances and offer new innovations like new vaccines and drug to patients faster (Table 1). Potential vaccines, like drugs must pass through clinical trial stages. It is important when it comes to safety, even during COVID-19 pandemic. Currently scientists are testing 50 candidate vaccines in clinical trials in people. Additionally, 150 candidate vaccines are in preclinical development, including animal and laboratory testing. In China and Russia
six vaccines have been given limited or early approval (before the completion of phase 3 clinical trials), which has raised some concerns about safety (Healthline, 2020).

| Name/Partners | Description | Results |
|---------------|-------------|---------|
| **Moderna/ National Institutes of Health** | The company began testing its two-dose messenger RNA (mRNA) vaccine in March 2020 in a phase 1 clinical trial, with promising results. In late July 2020, Moderna began phase 3 clinical trials of the vaccine. | In mid-November 2020, Moderna officials reported that their vaccine had achieved an effective rate of **94 percent** in initial phase 3 trial results. Experts said more testing and more information is needed. |
| **Pfizer / BioNTech / Fosun Pharma** | Drugmaker Pfizer teamed up German biotech company BioNTech and Chinese drugmaker Fosun Pharma to develop a two-dose mRNA vaccine. On November 9, 2020, the company announced that its vaccine had been more than **90 percent** effective in clinical trial participants. A few days later, company officials announced they were applying for an emergency use authorization from the FDA for their vaccine. It was the first regulatory approval in the United States for a COVID-19 vaccine. The officials said the vaccine could be available to high-risk groups as early as mid-December 2020. | |
| **Johnson & Johnson** | Drugmaker Johnson & Johnson announced in late July 2020 that it had begun a phase 1/2 trial in people after their adenovirus vaccine had shown promising results when used in monkeys. In mid-November, Johnson & Johnson officials say they expected their vaccine to be ready for FDA approval by February 2021. | |
| **AstraZeneca/ University of Oxford** | A phase 1 clinical trial at the University of Oxford began in late April. The vaccine is based on a chimpanzee adenovirus, which shuttles coronavirus proteins into cells. In August 2020, AstraZeneca began phase 3 trials in Brazil, South Africa, and the United States. These trials were halted in September when a study volunteer developed a rare spinal inflammatory disorder called transverse myelitis. The trials were restarted a week later in Brazil and the United Kingdom. In late October, the FDA authorized the U.S. trial to resume. In mid-November 2020, company officials said their vaccine had produced a strong immune response in a clinical trial that involved people over the age of 70. | |
| **INOVIO** | When COVID-19 appeared in December 2019, drugmaker Inovio had already been working on a DNA vaccine for MERS. Company officials announced at the end of April 2020 that it had enrolled 40 healthy volunteers in its phase 1 trial. In late September 2020, the company | |
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| Company/Institute | Description | Status/Notes |
|-------------------|-------------|--------------|
| Sanofi / Translate Bio. | Drugmaker Sanofi announced in February that it would work with Translate Bio to develop an mRNA vaccine. Preclinical testing showed that the vaccine could elicit a strong immune response in mice and monkeys. | The company expects results from its phase 2 trial in early December 2020. After that, they will start a phase 3 study. |
| Sanofi / GSK / TranslateBio | Drugmaker Sanofi is pursuing two vaccines. The company is working with drugmaker GSK on a vaccine based on proteins from the coronavirus. When combined with another compound, called an adjuvant, the proteins elicit an immune response. | They expect results from a phase 2 trial in early December 2020, after which they will begin a phase 3 study. Sanofi is also working with biotech company Translate Bio to develop an mRNA vaccine. They expect to start clinical trials in December 2020. |
| CanSino Biologics | Scientists at this Chinese company are also working on a potential vaccine that uses an adenovirus known as Ad5 to carry coronavirus proteins into cells. | The Chinese military approved the vaccine in June 2020, allowing the vaccine to be given to its armed forces. In August 2020, the company began phase 3 trials in Pakistan, Saudi Arabia, and Russia. |
| Gamaleya Research Institute | This Russian institute developed a vaccine that includes two adenoviruses, Ad5 and Ad26. | In August 2020, President Vladimir Putin announced that the country’s regulatory agency had approved the vaccine, even before phase 3 trials had started. Russian officials later said the vaccine had received a “conditional registration certificate.” Results of a phase 1/2 trial found that the vaccine elicited an immune response with mild side effects. Phase 3 trials are currently under way in Russia, Belarus, United Arab Emirates, and India. |
| Novavax | This company received up to $388 million in funding this spring from the Coalition for Epidemic Preparedness Innovations (CEPI), a group that has funded COVID-19 vaccine development. The vaccine is made by attaching virus proteins to microscopic particles. | In August 2020, Novavax launched a phase 2 trial in South Africa. A month later, the company began a phase 3 trial in the United Kingdom. It plans to start another phase 3 trial in the United States by the end of November 2020. |
| University of Queensland in Australia / CSL | Researchers at the university developed a vaccine by growing viral proteins in cell cultures. They began preclinical testing stages in early April 2020. | The phase 1 trial in people began in early July 2020. A phase 2/3 trial is expected to start late in 2020. |
Chinese company Sinopharm is testing an inactivated virus vaccine developed by the Wuhan Institute of Biological Products. After a successful phase 1 trial, researchers launched phase 3 trials in the UAE in July 2020 and a month later in Peru and Morocco.

Phase 3 trials began in June 2020 in the UAE and in September 2020 in Argentina. In September 2020, the UAE approved the vaccine for use on healthcare workers even before the results of the phase 3 trials.

In August 2020, the Chinese government issued emergency approval for the vaccine for use on high-risk groups.

Indian company Bharat announced in late October 2020 that it was beginning a phase 3 trial of its inactivated virus vaccine.

Source: Own elaboration (state as of 8th December 2020).

### 4. Growing Diversification of Partners - COVID-19 Research Projects in the European Union

Due to the challenges caused by COVID-19 pandemic we can also observe the development of new research Horizon 2020 projects (the EU’s research and innovation programme) in the European Union on coronavirus diagnostics and treatments taking into account following categories: clinical management and treatment, vaccines, preparedness and crisis management, health system resilience, basic science, including biology of SARS-Cov-2 virus, diagnosis, as well as public health measures (161 projects) (Table 2) and other non-specific COVID-19 Horizon 2020 projects reoriented to fight the COVID-19 emergency (842 projects) (Table 3).

### Table 2. Covid-19 Horizon 2020 projects according to major needs by EU financial contribution.

| Category                                          | Number of projects | Funding (million euro) |
|---------------------------------------------------|--------------------|------------------------|
| Clinical management and treatment                 | 45                 | EUR 118.9              |
| Vaccines                                          | 4                  | EUR 108.2              |
| Preparedness and crisis management                | 25                 | EUR 78.2               |
| Health system resilience                          | 27                 | EUR 48.5               |
| Basic science, including biology of SARS-Cov-2 virus | 24                 | EUR 38.2               |
| Diagnosis                                         | 25                 | EUR 36.3               |
| Public health measures                            | 11                 | EUR 12.3               |

Source: Own elaboration.
Table 3. Distribution of other non-specific COVID-19 Horizon 2020 projects reoriented to fight the COVID-19 emergency according to major needs (number of projects per category).

| Category                                                      | Number of projects |
|---------------------------------------------------------------|--------------------|
| Preparedness and crisis management                            | 234                |
| Clinical management and treatment                             | 231                |
| Basic science, including biology of SARS-Cov-2 virus           | 225                |
| Health system resilience                                      | 47                 |
| Public health measures                                        | 42                 |
| Diagnosis                                                     | 36                 |
| Vaccines                                                      | 27                 |

Source: Own elaboration.

Dedicated calls for proposals for COVID-19 funding in 2020 have so far attracted nearly 700 partners in EU-funded projects from the Member States and beyond. Most of the participants are in Germany, Italy, France, Spain, Great Britain, the Netherlands and Belgium (433 participants). Scientists from the countries associated with the Horizon 2020 program are located in Albania, Bosnia and Herzegovina, Israel, Norway, Serbia, Switzerland and Turkey. In terms of cooperation partners, higher or secondary education (mainly universities) together with research organizations (Table 4) accounted for the majority of the participations of EU-funded COVID-19 projects, followed by private entities, 67% of which were SMEs (Table 5) (European Commission, 2020a).

Table 4. Top 10 participants in COVID-19 Horizon 2020 Projects – by EU financial contribution (million euro).

| Participants in COVID-19 Horizon 2020 Projects                  | EU financial contribution |
|---------------------------------------------------------------|---------------------------|
| 1 Insem                                                       | EUR 22.9                  |
| 2 UNINOVA – Instituto de Desenvolvimento de Novas Tecnologicas-Associacao | EUR 5.0                   |
| 3 Universidad Politecnica de Madrid                           | EUR 4.9                   |
| 4 Academisch Ziekenhuis Leiden                               | EUR 4.6                   |
| 5 Karolinska Institutet                                       | EUR 4.4                   |
| 6 Centre hospitalier universitaire vaudois                    | EUR 3.8                   |
| 7 AVA AG                                                      | EUR 3.8                   |
| 8 Universiteit Utrecht                                       | EUR 3.6                   |
| 9 Laboratorio Iberico Internacional de Nanotecnologia         | EUR 3.5                   |
| 10 Goethe-Universitat Frankfurt am Main                       | EUR 3.3                   |

Source: Own elaboration.

Table 5. Top 10 SMEs in COVID-19 Horizon 2020 Projects

| SMEs in COVID-19 Horizon 2020 Projects | EU financial contribution |
|----------------------------------------|---------------------------|
| 1 AVA AG (Switzerland)                 | EUR 3.8                   |
| 2 Remedy Biologics Limited (Ireland)   | EUR 2.5                   |
| 3 Onera BV (Netherlands)               | EUR 2.5                   |
| 4 SwissDeCode SA (Switzerland)         | EUR 2.5                   |
| 5 Resistell AG (Switzerland)           | EUR 2.5                   |
| 6 NanoScent Ltd (Israel)               | EUR 2.5                   |
Below you can find description of 8 research projects financed by the Innovative Medicines Initiative (IMI) (EU’s partnership with the pharma industry) with the total amount of EUR 72 million (IMI, 2020) selected for funding from its fast-track call for proposals on coronavirus and diagnostics treatments in May 2020 (Table 6) as well as 41 projects financed by the European Commission (European Commission, 2020b, 2020c) in Horizon 2020 in March 2020 (Table 7) and August 2020 (Table 8). Up till September 2020, the EU has already invested EUR 458.9 million from in 103 Horizon 2020 research projects specifically targeting the COVID-19 pandemic (not including loans from the Horizon 2020 InnovFin Infectious Diseases Finance Facility or the EUR 5.9 million top-up to projects funded from non-COVID-19 calls). These research projects are focused on the development of diagnostics, treatments, vaccines, epidemiology, preparedness and response to outbreaks, socioeconomics, production and digital technologies as well as the infrastructures and data resources that enable this research (IMI, 2020; European Commission, 2020a; 2020b; 2020c).

### Table 6. Innovative Medicines Initiative Projects (8 projects selected for funding from its fast-track call for proposals on coronavirus diagnostics and treatments).

| Acronym/Title | Description | Project coordinator | Partners |
|---------------|-------------|---------------------|----------|
| **COVID-RED** - COVID-19 infections - remote early detection | Could digital technologies help to detect COVID-19 cases? The COVID-RED project thinks so – it will combine expertise in clinical epidemiology with digital devices (such as wearables and mobile apps) to rapidly and reliably detect cases so that they can be prioritised for testing. | Universitair Medisch Centrum Utrecht, the Netherlands | 9 partners from Denmark, Lithuania, the Netherlands, Switzerland, United Kingdom |
| **DECISION** - A miniturized disposable molecular diagnostics platform for combating coronavirus infections | The DECISION project hopes you won’t have to wait more than 15 minutes. They’re working on a low-cost, miniaturised, disposable molecular diagnostic system that will make it possible to test patients with laboratory quality performance pretty much anywhere and give them their results in a matter of minutes. | 4 partners from Germany, Italy, Spain | 4 partners from Germany, Italy, Spain |
| **DRAGON** - Rapid and secure AI imaging-based diagnosis. | If you’ve been tested for COVID-19, you want to get your results fast. The DRAGON project will apply artificial intelligence and machine learning to deliver a decision | Oncoradiomics, Belgium | 21 partners from Belgium, China, Italy, the Netherlands, |
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| stratification, follow-up, and preparedness for coronavirus pandemics | support system for improved and more rapid diagnosis and prognosis. Citizens and patients will be involved in the development of the system. | Switzerland, United Kingdom |
|---|---|---|
| **KRONO** - Evaluation of a production ready portable, point-of-need platform (instrument and reagents), direct from nasal swab test for the molecular diagnostic detection of COVID-19 infection. | The KRONO project aims to change that by delivering a simple test that can be used at a doctor’s office or a patient’s home (for example) and would deliver results in just 40 minutes. While the focus of the project is on the SARS-CoV-2 virus, the team also plans to demonstrate a pipeline for rapidly deploying new tests in response to future outbreaks. | BG Research Ltd, United Kingdom | 5 partners from France, Italy, United Kingdom |
| **RAPID-COVID** - Robust automation and point of care identification of COVID-19 | While the world focuses on COVID-19, other infectious diseases with similar symptoms continue to circulate. The RAPID-COVID project aims to develop a diagnostic test that can simultaneously detect SARS-CoV-2 as well as 30 other common respiratory bacteria and viruses. This will ensure COVID-19 patients are quickly isolated and all patients receive the right treatment. It will also avoid the unnecessary use of antibiotics. | GeneFirst Limited, United Kingdom | 5 partners from France, Slovenia, Spain, United Kingdom |
| **TREATMENT** | The goal of the CARE project is to deliver treatments for the current COVID outbreak as well as future coronavirus outbreaks. To do this, they will identify candidates among existing drugs that could be effective as treatments for the COVID-19 pandemic (drug repurposing), and develop new drugs specially designed to tackle the SARS-CoV-2 virus. After extensive testing in the laboratory, the project will advance the most promising drug candidates to clinical trials in humans. | Institut National de la Santé et de la Recherche Médicale (INSERM), France | 36 partners from Belgium, China, Denmark, France, Germany, the Netherlands, Poland, Spain, Switzerland, United Kingdom, United States |
| **Impentri** – Development of Impentri, an intravenous imatinib | Many people with severe COVID-19 infection experience a build-up of fluid in the lungs, making it hard to breathe and, in the worst cases, contributing to the death of the | Exvastat (Ireland) Limited, Ireland | 5 partners from Canada, France, Ireland, the Netherlands |
formulation for COVID-19 acute respiratory distress syndrome (ARDS) patient. The body’s own immune response is partly responsible for this build-up of fluid. There are signs that the generic drug imatinib could address the problem, and now the Impentri project plans to run a randomised, double-blind clinical trial to properly test the efficacy and safety of the drug as a treatment for COVID-19 patients with lung inflammation.

MAD-CoV 2 - Modern approaches for developing antivirals against SARS-CoV 2

The aim of the MAD-CoV 2 project is to dive into the molecular details of the SARS-CoV-2 virus and use this knowledge to develop new COVID-19 treatments. Achieving this will entail engineering human tissue to test new treatments in the lab; studying how to exploit the role of the ACE2 receptor (which the virus latches onto to break into cells), and mapping factors that are critical for virus replication.

Source: Own elaboration based on (IMI, 2020).

Table 7. 18 Horizon 2020 research projects on coronavirus short-listed for funding in March 2020.

| Acronym/Title | Description | Project coordinator | Partners |
|---------------|-------------|----------------------|----------|
| **PREPAREDNESS AND RESPONSE – Total EU funding: € 19.1 million** |
| **I-MOVE-COVID-19**
Multidisciplinary European network for research, prevention and control of the COVID-19 Pandemic | To obtain epidemiological, clinical and virological information on coronavirus and infected patients through the I-MOVE surveillance network spanning 11 countries. | Epiconcept (France) | 25 partners: Albania, Germany, Spain (5), France (5), Ireland, Lithuania, the Netherlands (2), Portugal (2), Romania, Sweden, United Kingdom (5) |
| **RECOVER**
Rapid European COVID-19 Emergency research Response | To gather comprehensive data from clinical and epidemiological studies to strengthen Europe’s clinical research preparedness for future emerging infectious diseases. | Universiteit Antwerpen (Belgium) | 11 partners: Belgium (2), China, Denmark, France (2), Italy, the Netherlands (3), United Kingdom |
### HERoS
Health Emergency Response in Interconnected Systems

**Goals:** To improve the effectiveness and efficiency of the response to coronavirus outbreak by providing guidelines for improved crisis governance.

**Partners:** 11 partners: France, Finland (2), Italy, the Netherlands (2), Poland (3), United Kingdom, United States

### EpiPose
Epidemic intelligence to minimize 2019-nCoV’s public health, economic and social impact in Europe

**Goals:** To understand epidemiological characteristics COVID-19, social dynamics of the outbreak, public health preparedness and response, and assess economic impact.

**Partners:** 6 partners: Belgium (2), Switzerland, Italy, the Netherlands, United Kingdom

### CORESMA
COVID-19-Outbreak Response combining E-health, Serolomics, Modelling, Artificial Intelligence and Implementation Research

**Goals:** To help devise evidence-based response strategies by combining clinical, epidemiologic and immunological data from field studies and implementation research.

**Partners:** 7 partners: Switzerland, Ivory Coast, China, Germany (2), Nepal, the Netherlands, Germany

### EXSCALATE4CoV
EXaSCale smart platform against pathogens for Corona Virus

**Goals:** To exploit powerful computing resources to identify molecules capable of targeting coronavirus and develop an effective tool to counter future pandemics.

**Partners:** 18 partners: Belgium, Switzerland, Italy, Spain, Italy (10), Poland, Sweden

### DIAGNOSTICS – Total EU funding: € 6.4 million

#### CoNVat
Combating 2019-nCoV: Advanced Nanobiosensing platforms for POC global diagnostics and surveillance

**Goals:** To develop a point-of-care device using optical biosensor technology for rapid diagnosis and monitoring, and also monitor the evolution of viruses in animals and help prevent future outbreaks.

**Partners:** 5 partners: Spain (3), France, Italy

#### CoronaDX
Three Rapid Diagnostic tests (Point-of-Care) for COVID-19 Coronavirus, improving epidemic preparedness, public health and socioeconomic benefits

**Goals:** To deliver three complementary diagnostic tools, including one point-of-care diagnostic that can be used with minimal training.

**Partners:** 8 partners: Austria, China (2), Denmark (2), Italy (2), Sweden
| Project | Description | Lead Institution | Partners | Funding |
|---------|-------------|-----------------|----------|---------|
| HG nCoV19test | Development and validation of rapid molecular diagnostic test for nCoV19 | Hibergene Diagnostics (Ireland) | 4 partners: China, Ireland, Italy, United Kingdom | |
| TREATMENT – Total EU funding: € 17.0 million |
| Fight-nCoV | Fighting-off Coronavirus with broad-spectrum antivirals: establishing animal challenge mode | Stockholms Universitet (Sweden) | 6 partners: Germany (2), Denmark, France, Sweden (2) | |
| SCORE | Swift COronavirus therapeutics Response | Academisch Ziekenhuis Leiden (the Netherlands) | 10 partners: Belgium (3), Switzerland, Germany (2), France (2), the Netherlands (2) | |
| Solnatide | Exploration of safety, tolerability and clinical efficacy of Solnatide IMP in patients infected with the 2019 new coronavirus | RTDS Association (Austria) | 6 partners: Austria, Germany (2), Spain, Italy, the Netherlands | |
| ATAC | Antibody therapy against coronavirus (COVID-2019) | Karolinska Institutet (Sweden) | 5 partners: Belgium, Switzerland, Germany, Italy, Sweden | |
| MANCO | Monoclonal Antibodies against 2019- New Coronavirus | Erasmus Universitair Medisch Centrum Rotterdam (the Netherlands) | 8 partners: Germany, Spain, France (2), the Netherlands (4) | |
| CoroNAb | Nanobodies and antibodies against 2019-nCoV | Karolinska Institutet (Sweden) | 4 partners: Switzerland, Denmark, Sweden, United Kingdom | |
| RiPCoN | Rapid interaction profiling of 2019-nCoV for network-based deep drug-repurpose learning (DDRL) | Helmholtz Zentrum München (Germany) | 3 partners: Germany, Spain, France | |
| VACCINES – Total EU funding: € 5.7 million |
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| Acronym/Title | Description | Project coordinator | Partners |
|---------------|-------------|---------------------|----------|
| **OPENCORONA** Rapid therapy development through Open Coronavirus Vaccine Platform | To develop a vaccine that can also be used as a therapy against the coronavirus using a DNA vaccine platform. | Karolinska Institutet (Sweden) | 7 partners: Germany, Italy, Sweden (5) |
| **Prevent-nCoV** Prevention of 2019 nCoV infection through development and clinical testing of a novel Virus Like Particle (VLP) vaccine | To develop and evaluate a potential vaccine that uses virus-like particles to expose coronavirus proteins to the immune system. | Københavns Universitet (Denmark) | 6 partners: Germany, Denmark (3), the Netherlands (2) |

Source: Own elaboration based on (European Commission, 2020b).

Table 8. 23 Horizon 2020 research projects on coronavirus short-listed for funding in August 2020.

| Acronym/Title | Description | Project coordinator | Partners |
|---------------|-------------|---------------------|----------|
| **RAPID REPURPOSING OF MANUFACTURING FOR VITAL MEDICAL SUPPLIES AND EQUIPMENT** – Total EU funding: € 22.1 million | Injection Moulding Repurposing for Medical Supplies enabled by Additive Manufacturing (PPE, ventilator accessories, etc.) | National Technical University of Athens (Greece) | 19 partners: Belgium, Greece (4), Spain (2), France, Italy (6), Norway, Slovenia, United Kingdom (3) |
| **CO-VERSATILE** Adaptive and resilient production and supply chain methods and solutions for urgents need of vital medical suppliers and equipment | SZTAKI – Institute for Computer Science and Control (Hungary) | 21 partners: Austria, Switzerland, Germany (4), Spain (3), Hungary (2), Israel, Italy (5), the Netherlands, United Kingdom (3) |
| **RESERVISTA** Repurposing manufacturing lines for providing medical and other products and services in case of spiking dem and times | Centre Scientifique & Technique de l’Industrie Textile Belge (Belgium) | 17 partners: Belgium (5), Greece, Spain (4), Finland (3), France, Italy (2), the Netherlands |
| **Eur3ka** European Vital Medical Supplies and Equipment Resilient and Reliable Repurposing Manufacturing as a Service NetworK for Fast Pandemic Reaction | Engineering Ingeneria Informatica Spa (Italy) | 24 partners: Switzerland, Denmark (2), Germany (4), Spain (3), Finland, Israel, Italy (6), Luxembourg, the Netherlands, Norway, Portugal, Romania |
| **MEDICAL TECHNOLOGIES, DIGITAL TOOLS AND ARTIFICIAL INTELLIGENCE ANALYTICS TO IMPROVE SURVEILLANCE AND CARE AT HIGH TECHNOLOGY READINESS LEVELS** | **Total EU funding:** € 55.2 million |
|-------------------------|----------------------------------|
| **ESSENCE** Empathic platform to personaly monitor, Stimulate, enrich, and aSsist Elders And Children in their Environment | Politecnico di Milano (Italy) | 9 partners: Cyprus, Spain, France, Israel, Italy (4), Slovenia |
| **PyXY.AI** Telehealth-ready AI-powered multi-parametric system for surveillance of COVID-19 and cardio-pulmonary chronic patients | Bat-Call Ltd (Israel) | 7 partners: Germany (3), Israel (2), Norway (2) |
| **Icovid** AI-based chest CT analysis enabling rapid COVID diagnosis and prognosis | Incometrix NV (Belgium) | 9 partners: Belgium (5), Germany, the Netherlands, United Kingdom (2) |
| **VASCOViD** Portable platform for the assessment of microvascular health in COVID-19 patients at the intensive care | Fundacio Institut de Cienes Fotoniques (Spain) | 7 partners: Spain (4), Ireland, Italy, the Netherlands |
| **PORSAV** Controlling Vidal aerosols in COVID-19 and Beyond | Pintail Ltd (Ireland) | 5 partners: France, Ireland (3), Poland |
| **CleanAir** Lab to Fab development of air decontamination system for protecting health practitioners against COVID-19 | Villinger GmbH (Austria) | 7 partners: Austria (4), Germany, Ireland, Italy |
| **ICU4Covid** Cyber-Physical Intensive Care Medical System for Covid-19 | UNINOVA – Instituto de Desenvolvimento de Novas Tecnologias (Portugal) | 19 partners: Austria (3), Germany (7), Greece (2), Luxembourg, the Netherlands, Portugal (5) |
| **ENVISON** Intelligent plug-and-play digital tool for real-time surveillance of COVID-19 patients and smart decision making in Intensive Care Units | Johann Wolfgang Goethe Universitaet Frankfurt am Main (Germany) | 19 partners: Belgium, Germany (4), Switzerland, Spain, Finland, Hungary (2), Italy (2), Lithuania, the Netherlands, Portugal, Romania, Slovenia (2), UK |
## Development of Innovation Cooperation in the Time of COVID-19 Pandemic

| Project | Description | Partners | Country Details |
|---------|-------------|---------|-----------------|
| **COVID-X**<br>Covid eXpontial Programme | 10 partners: Cyprus, Spain (4), Ireland, Italy, Luxembourg, Lithuania, Sweden | F6S Network Ltd (Ireland) |
| **INNO4COV-V-19**<br>Boosting Innovation for COVID-19 Diagnostic, Prevention and Surveillance | 11 partners: Austria, Belgium (2), Germany, Ireland, Spain (3), Italy, Portugal (2) | Laboratorio Iberico Internacional de Nanotecnologia (Portugal) |
| **IRIS-COV**<br>Market Release of a Portable Device for COVID-19 at the Point-of-Care; a Global Diagnostics Approach | 8 partners: Belgium, Swizerland, Greece (3), France, United Kingdom, South Africa | Idryma Technologias Kai Erevnas (Greece) |
| **COVIRNA**<br>A diagnostics test to improve surveillance and care of COVID-19 patients | 15 partners: Belgium, Germany (2), Spain, France, Hungary, Italy, Luxembourg (2), the Netherlands, Portugal, Slovenia, Bosnia and Herzegovina, United Kingdom (2) | Luxembourg Institute of Health (Luxembourg) |
| **CorDial-S**<br>Portable and fast surface plasmon resonance point-of-care test for COVID-19 | 7 partners: Belgium, France (4), Israel | Universite de Lille (France) |

### BEHAVIOURAL, SOCIAL AND ECONOMIC IMPACTS OF THE OUTBREAK RESPONSES – Total EU funding: € 28 million

| Project | Description | Partners | Country Details |
|---------|-------------|---------|-----------------|
| **COVINFORM**<br>COronavirus Vulnerabilities and INFOrmation dynamics Research and Modelling | 16 partners: Austria (2), Belgium, Germany, Greece, Spain (2), Israel, Italy (2), Portugal, Romania, Sweden, United Kingdom (3) | Synyo GmbH (Austria) |
| **PERISCOP**<br>Pan-European Response to the ImpactS of COVID-19 and future Pandemics and Epidemics | 32 partners: Austria, Belgium (7), Switzerland, Czechia, Germany (2), Spain (2), France (3), Italy (7), the Netherlands, Poland, Portugal, Romania, Serbia, Sweden (2), United Kingdom | Universita di Pavia (Italy) |
| **SHARE-COVID**<br>Non-intended health, economic and social effects of the COVID-19 epidemic control decisions: Lessons from SHARE | 15 partners: Czechia, Germany (3), Denmark, Greece, Spain, France, HR, Israel, Italy (2), the Netherlands, Poland, Sweden | Max-Planck-Gesellschaft zur Foerderung der Wissenschaften (Germany) |
| **RESPOND**<br>Improving the Preparedness of Health Systems to Reduce Mental Health and Psychosocial Concerns resulting from the COVID-19 pandemic | 14 partners: Australia, Belgium, Germany (2), Spain (2), France, Italy (3), the Netherlands (2), Sweden, United Kingdom | Stichting VU (the Netherlands) |

### PAN-EUROPEAN COVID-19 COHORTS – Total EU funding: € 19.9 million
By the end of 2020, the EU will invest EUR 1 billion into research and innovation to face COVID-19 and its consequences. In addition, 547 projects (funded by Horizon 2020 and its predecessor, the Seventh Framework Programme) could contribute scientific knowledge or technologies including new disinfectant coatings for protective clothing, safe transport of patients, waste water treatment or digital applications. The European Commission, EU Member States, industry, healthcare and research organisations, non-profit organisations and global partners rapidly prepared a coordinated research response to this public health crisis. In April 2020 Commission services and national administrations developed the first ERAvsCorona action plan, taking into account 10 priority short-term actions in research and innovation to deal with coronavirus.

Over the coming months and years, the Commission will deliver on its commitment to invest even more in coronavirus-related research and innovation, notably in the new research and innovation program, Horizon Europe, to be launched in 2021. Strong involvement of regulatory, financial authorities institutions, civil society and industry will ensure the rapid availability of research results - from new vaccines and tests to health and social care. The enormous funds for clinical management and treatment, vaccine development and diagnostics reflect the European Union's strong global commitment to fighting the pandemic. The engineering and re-purpose of production systems for emergency medical services and new digital telemedicine are expected to strengthen the resilience of the healthcare system. Evidence-based public health measures will focus in particular on vulnerable populations. They will provide solutions or inform decision makers to manage crisis and be better prepared for future pandemics. This is backed by fundamental research to improve our understanding of the SARS-CoV-2 virus, funding for data science, and flexible, adaptable clinical infrastructures. The budget of the Access to Risk Finance for InnovFin Infectious Diseases Finance Facility, funded under Horizon 2020 and implemented by the European Investment Bank (EIB) received an additional EUR 400 million to invest in key innovative players developing promising vaccines candidates, drugs, medical and
diagnostic devices or cutting-edge critical research and innovation infrastructures (including manufacturing facilities) (European Commission, 2020a).

5. Global Cooperation Initiatives in Research and Innovation Projects

The European Union has taken a leading role as a global actor and major contributor of international aid (including a commitment of more than EUR 1 billion for research and innovation). Funding from Horizon 2020 has leveraged the work of existing multilateral research platforms (European Commission, 2020a):

- The Coalition for Epidemic Preparedness Innovations (CEPI) is to receive EUR 100 million from Horizon 2020, in addition to funding from EU member states.
- The Global Research Collaboration for Infectious Disease Preparedness (GLOPID-R) has received €2.9 million.
- Access to COVID-19 Tools (ACT) Accelerator (the EU is a founding member) which aims to accelerate the development, production and fair access to COVID-19 testing, treatments and vaccines. To speed up and scale-up the development and production of the global supply of vaccines for citizens around the world, in poor and rich countries, the Commission will provide EUR 400 million in guarantees to support COVAX (co-led of GAVI (The Global Alliance for Vaccines), CEPI and WHO) in Coronavirus Global Response context.

EU funding is accelerating efforts to develop effective treatments, vaccines, therapies and diagnostics, and to ensure universal availability at an affordable price. Horizon 2020 projects attracted research teams from 14 countries that are not EU members or associated with the programme: Argentina, Australia, Brazil, Canada, China, Colombia, Congo, Cote d’Ivoire, Gabon, India, Korea, Nepal, South Africa and the United States. Moreover, Horizon 2020 co-funds the European & Developing Countries Clinical Trials Partnership (EDCTP), which is focused on infectious diseases research in sub-Saharan Africa. This public-public partnership funded 24 projects for a total of EUR 11.45 million aimed at preventing or managing the spread of the epidemic. In addition, EDCTP and its partners are investing EUR 23 million in building research capacity, strengthening regional research networks and establishing an African epidemiologist and biostatist cohort through training in institutions in Europe and Sub-Saharan Africa (European Commission, 2020a).

6. Promising First Results of Horizon 2020 Projects Focused on COVID-19 Pandemic

Taking into account the urgency of this health threat, considerable effort has gone into developing new vaccines, drugs, medical devices, and other technologies and tools that will help people return to their daily activities safely. The promising first results of the Horizon 2020 projects are presented in Table 9.
**Table 9. Promising first results of Horizon 2020 projects**

| Area of innovation cooperation | Project title           | Promising first results                                                                                                                                 |
|--------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------|
| **DIAGNOSIS**                 | HG nCoV19 test project  | Researchers involved in the EU-funded project developed a new portable diagnostic system to detect viral infection that gives accurate and reliable results in 30 minutes. |
|                               | RealNano                | It is an example of a project that successfully reoriented its activities to focus on the manufacturing of low cost and printable biosensors to detect the coronavirus. |
| **VACCINE**                   | Prevent-nCoV            | Researchers from the University of Copenhagen working on the EU-funded project have announced that their vaccine candidate shows results that will enable them to progress into testing on humans already this year. |
|                               | OSIRIX project          | A French SME behind the OSIRIX project funded under the European Innovation Council, is using its unique technology platform to develop a universal vaccine against all existing and emerging coronavirus infections. |
|                               | BioNTech                | On 11 June 2020, the EIB concluded a EUR 100 million debt financing agreement with BioNTech to support the development of BNT162, the company’s COVID-19 vaccine programme. BioNTech became the first EU company to begin clinical testing. On November 9, 2020 the company announced that its vaccine had been more than 90 percent effective in clinical trial participants. A few days later, company officials announced they were applying for an emergency use authorization from the FDA (the United States Food and Drug Administration) for their vaccine. It was the first regulatory approval in the United States for a COVID-19 vaccine. The Pfizer & BioNTech & Fosun Pharma vaccine is available to high-risk groups in the United Kingdom (accepted by MHRA – the Medicines and Healthcare products Regulatory Agency) on 2.12.2020, first vaccination in the world was done 8.12.2020) and in the United States (accepted by FDA on 13.12.2020, first vaccination was done on 14.12.2020). It is also available in the European Union after EMA (European Medicines Agency) approval on 21.12.2020. |
|                               | CureVac                 | On 23 April 2020, the EIB Board approved a EUR 75 million debt financing agreement with CureVac, a highly innovative European vaccine developer, to scale up development and production of a vaccine against the coronavirus, which should be available in 2021. |

**TREATMENT**
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| **Exscalate4CoV** | The project announced on 18 June 2020, that an already registered generic drug used to treat osteoporosis, Raloxifene, could be an effective treatment for COVID-19 positive patients with mild or asymptomatic infection. The project is funded under Horizon 2020 and uses an EU-backed supercomputing platform, one of the world’s most powerful, to check the potential impact of known molecules against the genomic structure of coronavirus |
| **ATAC** | Researchers in the ATAC project have already shared highly appreciated new scientific knowledge about antibody therapy against COVID-19 in three articles published in peer reviewed journals. |

**ENABLING NEW DIAGNOSTICS, THERAPEUTICS AND VACCINES**

| **RECOVER, EU-RESPONSE and SUPPORT-E** | The cluster of 3 Horizon 2020 projects will contribute to the clinical studies of different therapeutic approaches for COVID-19, and contribute to the coordination of European clinical development efforts. |
| **The European Health Data & Evidence Network (EHDEN)** | The Network run under the Innovative Medicines Initiative (IMI) (EU’s partnership with the pharma industry), aims to make large-scale analysis of health data in Europe a reality. It is now working with 28 data partners (such as hospitals, primary care providers or databases) in 11 countries to harmonise clinical data across therapeutic areas including COVID-19 – including 150 million anonymised patient records. |

**PUBLIC HEALTH MEASURES**

| **EpiShuttle** | Developed by Norwegian company EpiGuard, is a reusable, single-patient isolation and transport system designed to provide maximum patient safety and comfort while allowing critical care and treatment to be performed. It is currently in daily and successful use in many European countries, including Norway, Denmark, and Germany. |

**PREPAREDNESS**

| **Go Green Routes** | The project will evaluate the impact of reduced air pollution during the lockdown and its aftermath, as well as the impact on the mental health of urban citizens and their views on re-greening their cities. |

**BASIC SCIENCE**

| **European Open Science Cloud (EOSC)** | The COVID-19 Data Platform, run under the European Open Science Cloud (EOSC), is a free-to-use, open digital space for researchers to share and upload data sets. Since its launch on 20 April 2020, it has seen more than 78 000 users and 2.7 million requests from over 170 countries. The platform already offers access to a comprehensive set of preprints and publications (>100 000), viral sequences (>17 000), sequences from patients, and other microbiological data (>400 protein structures). |

*Source: Own elaboration based on (European Commission, 2020a).*

The involvement of many different international partners in innovation cooperation (in different projects funded by IMI, Horizon 2020 or vaccine projects) including biopharmaceutical companies, universities and research organizations, SMEs can
contribute to faster overcoming challenges related to the COVID-19 pandemic and better preparation for future pandemics (Healthline, 2020; IMI, 2020; European Commission, 2020a; 2020b; 2020c).

7. Findings

Stopping growing pandemic COVID-19 requires speed, agility and cooperation. Opening up mobilizes knowledge from many different places, making science progress and accelerating our progress in the fight against the disease. Openness unleashes a volunteer army of scientists working in their own facilities, in different time zones and in different countries. Openness uses human capital available in the world to fight disease, as well as access to already existing physical capital (such as factory and equipment) to begin rapid testing of possible solutions. Open innovation can speed up action. More than 50 vaccine candidates under consideration are already approved drugs for other medical uses (being repurposed). This means that baseline safe dosage levels for any candidate in humans have already been established. This allows testing to begin in the middle of the normal drug development process, with Phase 1 of clinical trials safety protocols already completed. Making all relevant medical research available at the same time in a machine-readable form allows for rapid learning by anyone who wants to look at it, end enabling scientists around the world to contribute to the fight against pandemic (Chesborough, 2020a; 2020b).

Biopharmaceutical companies involved in innovation cooperation in R&D Innovation with academic institutions, especially in the model of open innovation alliances, can significantly reduce the risk and cost of research, use the resources, competencies, technology, and knowledge from partners, and thus easier respond to changes in the dynamic environment and most of all, quickly launch new biotechnology or pharmaceutical products (new vaccines and drugs) as well as offer better diagnostics and treatment of patients which are now desired because of COVID-19 pandemic. Development of different research projects funded by IMI, Horizon 2020 or vaccine projects can contribute to defeat the COVID-19 pandemic and prepare us better for potential pandemics in the future. In addition we need to focus on projects related to diagnostics, treatments, vaccines, epidemiology, preparedness and response to outbreaks, socioeconomics, production and digital technologies as well as the infrastructures and data resources that enable this research, including variety of stakeholders (public/non-profit and private) on different levels (local, regional, national) from different industries (cross-industry alliances) and countries (multinational alliances). But finding a vaccine is not enough – we need to think about logistic issues regarding transport of vaccines (mRNA vaccine) in a proper temperature as well as about distribution and delivery of vaccines to millions of people.

Mass vaccination is a giant logistic operation. Some airlines (Air France-KLM) prepared COVID-19 vaccines airlift, in order to deliver the vaccines in the right way, using dry ice. Openness could help here as well – we can learn from each other and
use good practices, which could be further applied by other airlines in the vaccines delivery and improve the mass vaccination in different part of the world. Mass vaccination of the population will be one of the biggest challenges in 2021 for many countries in addition to the already existing problems related to the fight against the coronavirus pandemic.

In these difficult times companies need to be more open to cooperation (Chesbrough, 2020a; 2020b), change their business models (Chesbrough, 2020b; Puślecki, 2020), and use local potential and local partners to develop better therapies for patients. An example of such cooperation was proposed in “ECMO for Greater Poland” program with main purpose of wide use of extracorporeal support in critical patient states. The lack of effective antiviral treatment and vaccine concepts development induced that only prevention and supportive therapies are available. Invasive mechanical ventilation is necessary for a significant number of COVID 19-cases, in both hospitalized and critically ill (2.3-33.1% and 29.1-89.9%, respectively) (Puslecki et al., 2020). About 3-5% of all cases progress into critical states. The World Health Organization (WHO) recommends extracorporeal support - ECMO in cases with refractory hypoxemia unresponsive to lung-protective ventilation emphasizing access to expertise in extracorporeal membrane oxygenation (WHO, 2020). The number of application of ECMO to support patients with COVID-19 growth substantially in last months (Czekajlo et al., 2020; Smereka et al., 2020).

It is worth considering whether the pandemic brings a decrease or an increase in cooperation between companies. The answer is not clear cut. It seems that in the long run, the consequence of the pandemic on the part of companies will be the increased interest in the development of cooperative behavior. The challenges of COVID-19 pandemic may become a development opportunity and have a positive impact on R&D and pro-innovation activities. The crisis caused by pandemic shows that companies have real opportunities to contribute to social welfare, and by acting so, they can obtain the economic benefits of doing so (Gorynia and Jankowska, 2020).

Openness to cooperation will allow companies to develop new business strategies faster during and after the COVID-19 pandemic. Taking into account Horizon 2020 projects we can also observe the development of new partnerships between universities and research organizations as well as business-academia alliances which results will be helpful both for the world of science (new publications, scientific projects, scientific discoveries) and for the main beneficiaries - patients (new therapies, procedures in patient care, new drugs, vaccines, the use of existing drugs for new therapeutic purposes, faster products and drugs delivery to market – thanks to IP release). For now, one of the biggest limitations in this article is that we are still in the fight against the coronavirus, and we do not have all the results of ongoing research projects (only promising first results of some research projects and those devoted to vaccines). We will have to wait for some of them until 2021 or even later (another 2-3 years). The effects of a pandemic will be visible for many years after the pandemic. Only then, having the results, it will be possible to carry out a broader analysis of the
effects of the measures taken during COVID-19 pandemic, to develop conclusions and recommendations in the event of the future pandemics.

Certainly, the COVID-19 pandemic contributed to the development of new strategic partnerships in the biopharmaceutical industry, also in the open model (open innovation alliances). Additionally, we can observe the involvement of many companies from Biopharma in cooperation with IT companies in order to develop diagnostic tools using the latest technologies - IOT, AI, VR, Machine Learning, Blockchain along with the progressive digitalization of health care (telemedicine, medHealth, digitalHealth). Since the end of the 1980s, the world has seen more and more non-equity R&D alliances in the biopharmaceutical industry (Puślecki, 2012), which provide greater flexibility in the selection and possible change of partners and enable a faster change of technology than traditional equity alliances.

This trend can also be seen in the region of the Central and Eastern Europe (CEE). The results of one of the first in the world quantitative research focused on innovation cooperation in the biopharmaceutical industry in the CEE, conducted within research grant entitled “Analysis of Open Innovation Alliances and Strategic Partnerships in the Biopharmaceutical Industry in Poland and CEE countries” showed that over 80% of companies from the biopharmaceutical industry from 18 CEE countries carried out mainly R&D non-equity alliances in the development of innovation cooperation in years 2015-2017. The most important objectives in the formation of these R&D alliances given by the CEE companies were access to knowledge and experience of partners. Thanks to more flexible and open cooperation it will be possible to defeat the coronavirus pandemic faster as well as current and future virus mutations.

We should know that the world after the COVID-19 pandemic will be different, we will be different, richer in knowledge and experience from the current coronavirus, which will allow us to prepare for further epidemics (better care for our health, faster diagnosis, and better treatment) and pandemics in the future. Having vaccines for current coronavirus (for now 2 mRNA vaccines available from Pfizer and Moderna) will make it easier to work on possible new drugs and vaccines in the event of future pandemics as part of expanded R&D innovation ecosystems and involvement of many partners in the cooperation.

Using the latest IT technologies will make it be possible to even better monitor, diagnose (digital Health) and take care of the patients with focus on Patient-Center Approach. “Good ideas can come from anywhere, making openness is an imperative in these times of crisis. Global public health simply works better – and faster – when we open up” (Chesbrough, 2020a, p. 413). Through our involvement in cooperation, knowledge and experience sharing through different innovation cooperation platforms, the evolution of our pandemic-induced behavior, with the patient center care and innovation approach we can further contribute to the building of the common good and improvement of the global public health.
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