Scaling-up Vaccine Production Capacity: Legal Challenges and Recommendations

Background paper 6

by

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Commissioned by The Independent Panel for Pandemic Preparedness and Response | May 2021

The Independent Panel FOR PANDEMIC PREPAREDNESS & RESPONSE

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1. Introduction: Falling short of vaccine manufacturing capacity and distribution equity

This briefing paper aims to contribute to the evidence-based assessment of the Independent Panel for Pandemic Preparedness & Response, in particular in its work to ensure equitable access to vaccines and increased manufacturing capacity.

"The world has a normal capacity of production of 3.5 billion doses of vaccines and we now seek to manufacture 10 billion doses," said Ngozi Okonjo-Iweala, the new World Trade Organization Director General, on her first day in office. This represents an unprecedented and urgent need for scale-up, which is especially true given that most recommended vaccines require two doses, and that it is not clear how long immunity lasts. It may well be that the ramp up in vaccine production is not a one-off, but rather a new annual need.

The threat posed by a pandemic outbreak has long been appreciated; pandemic preparedness plans have been discussed and, to some extent, put into practice. One concrete step was the foundation of the Coalition for Epidemic Preparedness Innovations (CEPI) in 2017. CEPI has provided a 'running start' in responding to the Covid-19 pandemic, in particular with its rapid funding support for Covid-19 vaccine development. Another development specific for Covid-19 has been the creation of COVAX, an initiative that supports the development and manufacture, procurement and equitable distribution of Covid-19 vaccines. Further, the research and development of Covid-19 vaccines has been largely de-risked by vast amounts of public financing from governments.

But it is already clear that these initiatives, however valuable, will not be enough to ensure global vaccine production scale up. With a global population of 8 billion, 74% of whom live in low- and middle-income countries, the scale of need is too great. Precisely how many doses are needed to protect the global population is not clear. WHO offers examples of how much of the population needed to be immunised to beat other infectious diseases, including measles (95%) and polio (80%). COVAX has set a target of supplying 1.8 billion doses of vaccines to LMICs by the end of 2021; a laudable target that still falls far short of need. Gavi, which co-leads COVAX, has acknowledged there are "many uncertainties" around achieving this target, including around manufacturing capacity and funding availability.

Lopsided distribution will also be a challenge in a situation that is not over for anyone until it is over for everyone. Outside COVAX, the wealthiest countries have deals securing more than 65% total doses from existing vaccine manufacturers and even they still have faced vaccine shortages. And the longer the virus is allowed to spread unchecked in certain locations, the greater the chance new variants will arise. It is evident that the scale of the challenge posed by the Covid-19 pandemic means that a lot more needs to be done, especially in further driving the rapid scaling-up of Covid-19 vaccine manufacture to enable more equitable global access.

Several initiatives have been proposed that begin to address key challenges of scaling up vaccine production capacity, but so far in limited or piecemeal ways. What is ultimately needed is a cohesive global action plan that addresses the legal, technical and financial barriers to rapid scale-up of vaccine production. This paper addresses the key legal options and sets forth concrete recommendations for vaccine production scale-up.

1.1 Challenges to vaccine production capacity scale-up and recommendations

Capacity scale-up is a multi-dimensional issue. The most important factor is the total number of vaccine doses able to be manufactured per unit time. However, vaccine technology type should also be considered. It may, for example, be advantageous to leap-frog older technologies and move straight to newer adenoviral vector or mRNA-based vaccines. Balancing considerations of manufacturing efficiency and 'autonomy' may influence the geographical location of capacity building. Since countries (or regions) are now painfully aware that access to vaccine supplies manufactured elsewhere may be precarious and may be cut off entirely if export bans are enacted, some are aiming to achieve vaccine supply 'autonomy' such that every necessary element in the manufacturing chain is contained within their own borders. Although this is a political question, it may cause an additional 'squeeze' on supplies in the short to medium term as the necessary inputs for those manufacturing chains are repeatedly secured by multiple countries (or regions).

Whatever the type of vaccine technology is chosen, and where-ever the capacity is to be located, it is likely that all forms of intellectual property will need to be shared to enable equitable scale-up, including:

1. *Patents*: While the mobilisation of billions in public financing has been instrumental in the rapid vaccine development, there has been little in the way of public sharing of the rights to use the resulting technology. This means that manufacturing is controlled and limited by its patent rights holders: both their own capacity, and their willingness to let others use their technology. While there have been creative solutions - most recently a deal brokered by the US government between rival pharmaceutical companies Johnson & Johnson and Merck so the latter can help fill the J&J's manufacturing deficit on its newly-approved vaccine - they are not at the scale where they can make up the needed doses.
2. *Know-how*: While legal right to manufacture through access to patent licences would be an important step in the right direction, it would not alone be enough to ensure the needed production capacity. New technologies, including the mRNA vaccines produced by Pfizer/BioNTech and Moderna, and therapies such as monoclonal antibodies (mAb), are important in prevention and care. Countries may not have the technical know-how and capability to produce such technologies, whether or not they have the legal right to do so. Transfer of know-how will therefore be critical to enable scale-up.
3. *Materials and data*: Because many of the vaccines being developed for Covid-19 are biologic products, transfer of materials (such as cell lines) might also be needed to aid in the process of scale-up as well as the corresponding regulatory documentation and data.

2. Access to patents and other intellectual property rights

Early on in the Covid-19 pandemic outbreak in 2020, countries expressed concerns about intellectual property issues related to accessing health products needed in the response to the pandemic. These concerns were fuelled by a number of intellectual property disputes that broke out in the early months of the pandemic [see Box 1]. Concerns about IP in relation to access to Covid-19 products are of course also based on past experiences with access to patented medicines, in particular those needed to treat people with HIV/AIDS.

Generally, there are two courses of action to ensure intellectual property protection does not restrict access to potential medicines and medical technologies in limited supply. One avenue is for intellectual property owners (e.g. companies) to voluntarily license their patents and other IP, or to refrain from enforcing their intellectual property rights on their medical technology worldwide. This may also include licensing through mechanisms that facilitate IP sharing, such as the Medicines Patent Pool [see Box 2]. Although some companies have taken these steps in response to the Covid-19 pandemic, these decisions remain the exception, not the rule[1]. The second course of action is for national governments to use the flexibilities and exceptions allowed under international trade law and the legal tools in national law to access different types of intellectual property that are necessary to make, import and/or grant marketing approval to the Covid-19 medical products themselves without the consent of the patent holder. Neither of these courses of action necessarily address the need for access to knowledge and know-how, though voluntary licences can include provisions that ensure this access (for example, Medicines Patent Pool licences include data exclusivity waivers).

Last year, countries deeming that existing initiatives were insufficient, tabled proposals to address their concerns at both the World Health Organization (WHO), where Costa Rica proposed to establish a Covid-19 Technology Access Pool [discussed in section 3], and at the World Trade Organization (WTO), where South Africa and India proposed a temporary waiver to the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS).

This chapter will discuss both existing and proposed new mechanisms in the context of their usefulness in scaling up the production of Covid-19 vaccines.

Box 1: Examples of IP disputes early in the pandemic

- The original manufacturer of respirator valves threatened IP infringement legal action against a group of Italian engineers who were 3-D printing the valves when the manufacturer could not meet the demand, which caused an emergency situation.
- The refusal by Roche to share the technical specification of its lysis buffer, a solution to break open cells, used in Roche Covid-19 testing machines. When Roche was not able to meet the demand for the solution in the Netherlands, hospital pharmacists stepped in to prepare the substance but needed access to the secret recipe.
- The shortage of remdesivir when it became clear that the entire production was bought by the US. In most high-income countries, increasing production or import from others other than the patent holder, Gilead, would likely have required the use of compulsory licensing.

2.1 Existing measures for addressing intellectual property barriers

IP holders may decide to grant others the right to make use of their IP through voluntary mechanisms. Further, the WTO's Trade-Related Aspects of Intellectual Property Rights (TRIPS) Agreement, the

[1] There have been media reports of licence agreements between Russian and Chinese manufacturers, for example in Italy, in Argentina, in Malaysia, and in Indonesia.

international trade agreement that sets out enforceable rules for IP protection for WTO Members, includes provisions that safeguard the right of nations to gain access to IP when needed.

2.1.1 Voluntary licenses and non-enforcement declarations

Intellectual property holders may decide to grant others the right to make use of their technology through voluntary licences. Voluntary licences are signed at the discretion of patent holders, and may include additional clauses such as a waiver allowing the rights to use test data even if there are market exclusivities in place or an agreement to engage in technology transfer. Licences can be made directly between the IP holder and a licensee, or through a (non-exclusive) licensing body such as the Medicines Patent Pool [see Box 2].

IP holders may also decide not to enforce their market exclusivity in certain conditions. Notably, Moderna has declared it will not enforce patent rights related to its mRNA vaccine during the pandemic.

Voluntary patent licensing of the Covid-19 vaccines may offer a solution to potential patent barriers, but to enable production also other forms of IP and materials need to be transferred [see Section 3].

2.1.2 Compulsory licenses, TRIPS Articles 31 & 31bis

In the absence of voluntary licences, compulsory licensing can be used. Compulsory licensing is a measure a government (or government authority) can take to allow the use of the subject matter of a patent without the consent of the patent holder when voluntary measures (licensing or non-enforcement of patents) are absent or insufficient, normally against the payment of a remuneration. A government can also use compulsory licences (CLs) for its own purposes, in which case this is called Government use (GU) or Crown use. CL and GU licenses have been used effectively to overcome patent barriers to production and supply of generic HIV medicines and some other medicines, such as cancer medicines. Article 31bis was amended to the TRIPS Agreement in 2017 and regulates a special type of compulsory licence for the production for export (this type of CL is necessary in some cases where a country needs to import a medical product which is produced under a CL in the exporting country).

It is therefore understandable that the deployment of CLs has been proposed to help increase production capacity of Covid-19 vaccines. But compulsory patent licences are granted product-by-product, and country-by-country and are time-limited. The CL decision is subject to judicial review which may suspend the execution of the CL. It is not possible to grant blanket CLs for an entire field of technology or for an overarching purpose such as 'combating a pandemic'. Thus, this route is likely to be time consuming, necessitating repeated CL processes for each promising vaccine or treatment. An additional complexity is the opt out of TRIPS Article 31bis as importers by a number of high income countries.

2.1.2 Least Developed Country Exemptions

Least developed countries (LDCs) of the WTO are exempted from the obligation to implement the substantive provisions for protection and enforcement of intellectual property rights contained in TRIPS during an agreed transition period, which is currently set to end on 1 July 2021. This transition period is subject to further extension (TRIPS Article 66.1) for which the LDC group has submitted a still-pending request in October 2020. Furthermore, LDCs benefit from an extended transition period for the granting and enforcing of pharmaceutical patents and data protection, until at least 2033. There are 35 LDC Members of the WTO. The LDC transition is of limited usefulness in countries that do not have the capacity to make their own medical technologies and if IP is still in force in (exporting) countries of manufacture.

2.1.3 Security exceptions TRIPS Article 73

Invoking 'Security Exceptions' (TRIPS Article 73) is a legal strategy for WTO Members to efficiently override the IP that states must otherwise make available under the TRIPS Agreement. One benefit of the 'Security Exceptions' system is that it may be used to overcome a variety of IP protections that are not addressed by compulsory licensing/government use (TRIPS Art. 31, 31bis; see section 2.1.1) alone. For example, security exceptions under Art. 73 may be claimed by those high-income countries that have opted out of the Art. 31bis system. Security exceptions also allow Members to suspend prior data protection (granted under TRIPS Art. 39.3) and to address a broader range of IP protections (for example, trademark, copyright, design rights, undisclosed data, and trade secrets) that could impair the production or distribution of Covid-19 medical products. Security exceptions may be used in tandem with compulsory licensing/government use.

Professor Frederick Abbott has concluded that Member States may invoke 'Security Exceptions' in order to override IP related to medicines, vaccines, and medical products in order to respond to the Covid-19 pandemic. These actions are justified, he argued, because the Covid-19 pandemic is an *emergency in international relations* and measures to override the IP of medicines, vaccines, and medical products are relevant to protect Members' *essential security interests*. WTO Members have substantial discretion to determine the actions they consider necessary to protect their interests provided they are *plausibly related* to the emergency.

It is common for governments that adopt measures that are inconsistent with the WTO trade rules to invoke these security exceptions; however, they have not yet been used in relation to pandemics.

2.2 The TRIPS Waiver

Current voluntary licensing for Covid-19 vaccines falls short of the needs. Although some pharmaceutical firms have engaged in 'exclusive' licensing with chosen manufacturing partners, they have been reluctant to offer more open ('non-exclusive') licences that could rapidly scale-up production. Further, TRIPS measures such as CLs and transition periods have limitations when the goal is global scale up of production of Covid-19 vaccines and global access to such vaccines. Further, TRIPS measures such as CLs and transition periods have limitations when the goal is global scale up of production of Covid-19 vaccines and global access to such vaccines.

This is one of the reasons why, South Africa and India submitted on 2 October 2020 a draft decision text to the WTO TRIPS Council on a waiver from certain provisions of the TRIPS Agreement for the prevention, containment and treatment of COVID-19 ("TRIPS waiver").

Referring to "exceptional circumstances" they requested that "the Council for TRIPS recommends, as early as possible, to the General Council a waiver from the implementation, application and enforcement of Sections 1 (copyright and related rights), 4 (industrial designs), 5 (patents), and 7 (protection of undisclosed information) of Part II of the TRIPS Agreement in relation to prevention, containment or treatment of COVID-19." The TRIPS-waiver proposal states that, "This decision is without prejudice to the right of least developed country Members under paragraph 1 of Article 66 of the TRIPS Agreement." [see section 2.1.2 above].

The proponents of the TRIPS waiver propose that the measure "should continue until widespread vaccination is in place globally, and the majority of the world's population has developed immunity hence we propose an initial duration of [x] years from the date of the adoption of the waiver." The

TRIPS-waiver proposal is therefore limited in time (for the duration of the pandemic) and limited in scope (for the purpose of combating Covid-19).

If agreed, WTO Members could invoke the waiver to disregard certain forms of intellectual property when needed to ensure timely access to affordable medical products including vaccines and medicines or to scaling-up of research, development, manufacturing and supply of medical products essential to combat Covid-19.

The waiver is not a complete solution, insofar as it would not adequately address the critical issue of access to know-how and confidential data discussed in the next section. It is much easier for a government to waive the enforcement of an intellectual property right that it has granted, for example, a patent, than to try to force a pharmaceutical firm to hand over its manufacturing know-how, particularly if the firm is located in another country.

However, discussions on compulsory TRIPS measures such as the waiver have important political and strategic value since they might encourage pharmaceutical firms to engage in voluntary licensing programmes and collaborative transfer of know-how.

3. Access to know-how and technology

In the case of vaccines and other more complex technologies, a patent licence, a declaration to not enforce patents, or a CL, are likely to be insufficient to enable others to make or use the invention. The production of vaccines and complex medical technology requires access to know-how, cell lines, and regulatory data *as well* as patent licences where applicable. In other words, direct technology transfer from the entity that holds the knowledge and rights. Such technology transfer cannot be forced with a compulsory licence, and would not be guaranteed by an IP waiver.

If a collaborative approach were pursued instead, it would likely speed up the technology transfer and ensure continued interaction to solve problems in the production process, accelerate regulatory approvals and contribute to capacity enhancement.

This section looks at mechanisms to facilitate know-how, data, and technology sharing, including new mechanisms proposed to meet the particular needs of the Covid-19 pandemic, and discusses where they need to be strengthened to reach their potential.

3.1 The WHO Covid-19 Technology Access Pool (CTAP) / Medicines Patent Pool (MPP)

On 23 March 2020, the President of Costa Rica proposed that the WHO Director General "undertake an effort to pool rights to technologies that are useful for the detection, prevention, control and treatment of the COVID-19 pandemic." The proposed pool would collect voluntary licences or assignments, of rights in patented inventions and designs, as well as rights in regulatory test data, know-how, cell lines, copyrights and blueprints for manufacturing diagnostic tests, devices, drugs, or vaccines. And it would provide for access or licensing on reasonable and affordable terms, in every member country.

Following the proposal, WHO announced the establishment of the Covid-19 Technology Access Pool (C-TAP) on 29 May 2020 with the publication of a Solidarity Call to Action to realize equitable global access to COVID-19 health technologies through pooling of knowledge, intellectual property and data. The

Solidarity Call to Action is supported by 41 high-, middle- and low-income countries. The implementing partners of C-TAP are the Medicines Patent Pool [see Box 2], The Open COVID Pledge (a public commitment to making COVID-related IP freely available), and the Technology Access Partnership (a UN initiative to connect potential manufacturers with technical expertise and resources). C-TAP is supported by UNITAID, including with some financial support. C-TAP's aim is to facilitate the actual transfer of IP – including know-how, data, material and technology – needed to scale up production of essential Covid-19 health products.

Box 2: The Medicines Patent Pool

The Medicines Patent Pool is a UN-backed organisation dedicated to increasing access to affordable medicines through voluntary patent licensing. It was created in 2010 with the initial mandate of expanding access to treatment to combat the HIV pandemic; it now has licences for all WHO-recommended HIV treatments. Its mandate has since been expanded several times, and now includes all patented medicines on the WHO's Essential Medicines List, as well as new technologies to combat Covid-19. The MPP works by negotiating non-exclusive, transparent licences to use patents on key medical technology in low- and middle-income countries. Importantly, MPP licences also include provisions to waive any exclusivity around test data, further facilitating generic production. MPP's expertise in patent licensing to maximise medicines access will make it an important implementer of C-TAP implementation.

The original idea behind Costa Rica's request was that the WHO would seek to secure rights in Covid-19 technologies funded by the public sector and other relevant actors at an early stage by reaching out to these funders. This, however, has not happened. While C-TAP has reached out to several manufacturers, it has not secured any licenses or technology transfer agreements. For details see the WHO concept paper on operationalising the Covid-19 Technology Access Pool.

3.2 The WHO vaccine technology transfer hub

WHO being involved in technology transfer for vaccines is not new. In May 2006, a broad range of actors including policy makers, national immunization programmes, regulatory authorities, vaccine manufacturers and the research community approved the global pandemic influenza action plan to increase vaccine supply (GAP).

The expansion of manufacturing capacity in particular in developing countries was a central feature of the GAP. At that time the global production capacity for seasonal influenza vaccine was estimated at 350 million doses while 13.4 billion doses would be needed in a pandemic. 90% of the vaccine production capacity was situated in Europe and North America. In May 2007 the World Health Assembly (WHA60.28) asked the WHO to seek ways to ensure the equitable sharing of benefits of influenza vaccine R&D, including the development of capacity for influenza vaccine production in developing countries. In 2008 the Global Strategy and Plan of Action on public health, innovation and intellectual property (GSPA-PHI) further prioritised increasing vaccine production capacity through technology transfer to developing countries.

In 2008 the WHO established an influenza vaccine technology transfer hub to provide vaccine producers in developing countries with the necessary know-how and technical assistance and financing. The WHO obtained royalty free know-how licences and regulatory documentation from originator companies where companies were amenable to enter into such agreements. The 'hub' provided multiple manufacturers 'turnkey' technology transfer instead of case-by-case bilateral agreements. The hub was established in collaboration with the Netherlands Vaccine Institute (NVI), which was a governmental vaccine manufacturer. The technology transfer hubs have been successful in expanding production capacity of influenza vaccines in 11 countries in all WHO regions. (Beneficiary countries were Brazil, Egypt, India, Indonesia, Iran, Mexico, Republic of Korea, Romania, Serbia, Thailand and Vietnam.) Beneficiaries of the WHO technology transfer hub initiative had to commit to selling at an affordable price 10% of their pandemic vaccine production to UN agencies for distribution in countries without production capacity.

An assessment of the initiative acknowledged that technology transfer hubs are effective mechanisms to increase vaccine production capacity, but not readily feasible where multiple intellectual property barriers exist or where know-how is not easily available. This is why replicating such hubs for Covid-19 will need to address IP, know-how and regulatory data transfer issues.

The WHO is currently reinitiating the vaccine technology transfer hub for Covid-19 vaccines. The success of this initiative will depend on access to all forms of IP. Therefore, the co-existence of an effective licensing mechanism such as the C-TAP/MPP and a WHO Covid-19 vaccine technology transfer hub that would provide the necessary technical, financial and regulatory support would be an ideal set up to increase and create production capacity in regions where this is currently insufficient.

4. IP challenges: Conclusion

Various compulsory TRIPS measures and potentially the TRIPS waiver can be invoked to override Covid-19 related IP and gain access to products. But, as they do not necessarily address the access to know-how problem, they are less suitable to expand or build vaccine production capacity required to combat the Covid-19 pandemic and to ensure continued vaccine production capacity for the future.

A more effective solution will therefore be the implementation of an initiative such as C-TAP that, in a predictable manner, assures access to all relevant IP: patents, know-how, data, technology and materials. WHO or another suitable agency should lead such an initiative in securing rights to technologies funded by the public sector and other actors. The MPP's expertise in licensing IP to maximise access together with a Covid-19 vaccine technology transfer hub engaging manufacturers and potential manufacturers should be an integral part of this initiative.

5. Regulatory issues

Vaccines need to be effective and safe to use. The latter is even more important for vaccines than for products used to treat illness because vaccines, in general, are used in healthy populations. In order for a vaccine to become available, the product needs to have regulatory approval. Not all countries have regulatory capacity to assess new vaccines. To illustrate this point, the WHO maintains a list of vaccine producing countries with functional national regulatory agencies (NRAs). Currently, this list contains 24 countries.

WHO performs prequalification (PQ) of vaccines for UNICEF and other UN agencies, including COVAX, for purchase by those agencies. WHO Member States also use the WHO prequalification information in procurement decisions as do donors of medicines procurement and NGOs.

In addition to PQ, the WHO has also developed the Emergency Use Listing (EUL) process to expedite the availability of unlicensed medical products needed in public health emergency situations. Also, the EUL assists UN procurement agencies, Member States and others in determining the acceptability of specific products in the context of a public health emergency, based on an essential set of quality, safety, and efficacy/immunogenicity data. The EUL allows for investigative products to be made available. This special procedure is particularly relevant for Covid-19 vaccines which are developed and brought to market in unprecedented short timelines. The WHO can only evaluate products for which the manufacturer has submitted an application and provided all required documentation including all clinical trial data. Where a stringent regulatory authority (SRA) has assessed a product, the WHO will not duplicate the work but largely rely on the findings of the SRA.

Currently the prequalification of Covid-19 vaccines is funded by COVAX and the Gates Foundation.

On 1 October 2020, the WHO sent out the first invitation to manufacturers of Covid-19 vaccines to submit an expression of interest. This chart by the WHO shows the progress of prequalification of Covid-19 vaccines and is regularly updated.

One problem in assuring timely marketing authorisation of Covid-19 vaccines is the lack of mutual recognition arrangements among regulatory agencies globally. To remedy this somewhat, COVAX has established a Regulatory Advisory Group (RAG)[2] led by WHO and CEPI to encourage coordinated responses from regulatory authorities to filings by vaccine developers. RAG members encouraged developers to simultaneously approach several agencies in parallel, e.g. four, including at least one SRA, in different geographic regions with the same data package and give permission to allow the agencies to exchange information and discuss coordinated feedback.

Box 3: Vaccine Taskforces

The United Kingdom launched its 'Vaccine Taskforce' in May 2020 in order to secure domestic access to Covid-19 vaccines. Its membership included pharmaceutical industry and military experts as well as civil servants in so that it "has access to the deep, specialist expertise in vaccine preclinical and clinical development, regulatory issues, manufacturing and project management necessary to deliver its objectives." Underlining its hybrid nature, the British Prime Minister asked a well-known venture capitalist in the life-sciences field to be its Chair. As of November 2020, it had just under 200 staff. It has already been remarkably successful, enabling the surprising speed and scale of the UK Covid-19 vaccination program. In addition to a British government vaccine

[2] RAG is made up of Regulatory Agencies from Argentina, Australia, Brazil, Canada, Europe (EMA & EDQM), Ghana, Japan, Singapore and USA.

budget which reached some £12 billion by the end of 2020, a significant element in its success has been the close support offered by the British government in building supply chains for pharmaceutical firms, for example, 'effectively commandeering' one manufacturing facility and securing exclusive access to another for at least eighteen months.

The United States launched 'Operation Warp Speed' in May 2020 in order to drive the development, manufacture and domestic deployment of Covid-19 vaccines at an unprecedented rate. The initiative brings together government agencies such as the National Institutes of Health (NIH) and the Biomedical Advanced Research and Development Authority (BARDA) as well as eight pharmaceutical companies developing Covid-19 vaccines. In October 2020, its budget so far has been estimated to be as much as $18 billion. Having supported the successful development, manufacture and deployment of several Covid-19 vaccines in record time, the initiative has now been described as a "triumph" (2nd March 2021, Wall Street Journal).

India launched its 'Vaccine Taskforce' in August 2020 and has devoted a budget of $3.5 billion to Covid-19 vaccines. The country is already home to the Serum Institute of India (SII), the largest vaccine manufacturer in the world.

The European Commission announced its proposal for a European Health Emergency Preparedness and Response Authority (HERA) Incubator in February 2021. It foresees that: "In order to boost production capacity in Europe, we need a much closer, more integrated and more strategic public-private partnership with industry." The European Commission has likewise set up a 'Task Force for Industrial Scale-up of COVID-19 vaccines', in order to help pharmaceutical firms with "…queries and operational support" regarding issues such as addressing bottlenecks in production and supply of raw materials for vaccine production and the re-purposing of suitable pharmaceutical capacity toward vaccine production.

Box 4: Penicillin and sharing of know-how

Given the importance of manufacturing 'know-how' to the scaling-up of Covid-19 vaccine production, it is helpful to consider the example of the successful scaling-up of penicillin production in the United States during World War II, when the American government ensured a relatively open sharing of manufacturing 'know-how' between American pharmaceutical firms.

Penicillin is an antibiotic, naturally produced by some species of the *Penicillium* genus of fungi (moulds). Although its antibiotic properties were discovered in 1928 by Sir Alexander Fleming at St Mary's hospital, in London, it was a team including Sir Howard Florey, Ernst Chain and Norman Heatley at Oxford University, working between 1936 and 1940, which first isolated penicillin and established its 'miraculous' clinical effectiveness. Given the obvious potential importance of penicillin in treating wounded soldiers if much larger quantities could be produced, Florey and Heatley tried to interest both the British and American governments in massively scaling up its

production. To that end, they travelled to the United States in 1941 with the intention of sharing their *Penicillium* moulds and their associated scientific and technical knowledge. Their mission was a tremendous success and penicillin production was indeed massively scaled-up in the United States during the war. By D-Day, in June 1944, American pharmaceutical firms were producing some 100 billion units of penicillin per month. Just a year later, in June 1945, had increased this to some 650 billion units per month.

As, for example, Neushul (1993) explains, the key to the organisation of the scaling-up was a remarkable collaboration between the American government and American pharmaceutical firms. It drew on scientific and technological R&D undertaken by, for example, the Northern Regional Research Laboratory (Department of Agriculture) to improve the yield of penicillin produced by *Penicillium* moulds in fermentation units, and by the Office of Production Research and Development to solve particular 'bottlenecks' in production. The War Production Board (WPB) organised a collaborative manufacturing effort among around twenty American pharmaceutical firms. A key feature of this effort was that the WPB not only passed on the fruits of the government R&D to all its partners but also asked those partners to share the equivalent fruits of their own work with each other. The penicillin project 'czar', Albert Elder, said that: "…attaining maximum production today depends upon the efficient harnessing of the 'know-how' recently developed." He further indicated that: "…it is entirely possible that some one producer may make such a drastic improvement in the process that total needs for penicillin could be met very quickly by applying this information to all of the production facilities." Although the larger pharmaceutical firms such as Merck, Pfizer and Squibb were reportedly reluctant to share everything, since the stakes were so high "…the techniques and productive Penicillium strains were made available to all corporations…", making a huge contribution to "…ensuring an industry-wide adoption of the most valuable wartime developments in penicillin production."

6. Recommendations

Different governments have responded to the challenge of Covid-19 in different ways, but there are common features to those that appear to have managed the task of scaling-up Covid-19 vaccine production most successfully. In particular, several countries have established well-funded 'vaccine taskforces' [see Box 3].

Given that a successful scaling-up of Covid-19 vaccine production is in everyone's interest, it is essential that sufficiently enhanced, co-operation, support and international funding for similar mechanisms at the global level be achieved.

In order to effectively and equitably combat the Covid-19 pandemic and to be prepared for any future outbreaks the world needs a 'Global Vaccine Taskforce'. Although it will be challenging, if global scaling-up of Covid-19 vaccine production is to be effectively tackled, a suitably empowered Global Vaccine Taskforce equivalent of national or regional initiatives such as the American Operation Warp Speed or the Vaccine Taskforces of, for example, the United Kingdom, India or the European Union should be implemented [see Box 3]. The UN Secretary-General recently supported the establishment of an

"emergency Taskforce" via the G20 to implement and finance: "…a global vaccination plan to bring together all those with the required power, scientific expertise and production and financial capacities", but speed and effectiveness are vital.

A robust global framework should now also be established to permit a more rapid and effective response to future pandemics. Perhaps the most obvious possibility is the negotiation of a comprehensive framework pandemic treaty, which should also provide for rules for the treatment of intellectual property.

Thus, the chief recommendation of this paper is immediate action to establish and implement a Global Vaccine Taskforce, or similar coordinating body, whose primary activities are outlined in the recommendations below.

The following short- and medium- term actions are recommended to begin the mobilisation necessary to meet the immediate need for greater Covid-19 vaccine production. These recommendations can be seen as the critical activities of the Global Vaccine Taskforce:

1. Define the problem.

Global Covid-19 vaccine production capacity and potential capacity should be rapidly mapped [NGOs such as Knowledge Ecology International and the Third World Network have made an effort to do this]. The capacity gap between what is available and what will realistically be needed in the short, medium and long terms must be determined. Capacity should not only be mapped in terms of number of vaccine doses but also vaccine technology type.

2. Ready C-TAP mechanism.

The WHO C-TAP mechanism (or an equivalent mechanism) (section 3.1) should be readied for use so that, wherever necessary, it can enable rapid and large-scale technology transfer. In order to permit owners of Covid-19 vaccine (or other) related intellectual property to begin to plan for collaboration, this should include making available an outline of its proposed IP licensing policy. Practically, this means using the Global Vaccine Taskforce or a similar framework through which the WHO technology transfer hub and the Medicines Patent Pool can collaborate and be financed.

3. Support voluntary efforts to scale-up.

Governments and international agencies, should support the efforts of pharmaceutical companies to expand manufacturing capacity for Covid-19 vaccines *via* voluntary licensing, including in terms of direct funding, assisting with the supply of necessary materials and overcoming production 'bottlenecks. Drawing on the model of penicillin scaling-up in World War II [see Box 4], however, the supported pharmaceutical companies should be encouraged or required to share improvements in know-how with other pharmaceutical companies, including government production facilities, governments and international agencies (including the technology transfer hub mentioned below) who could benefit from them. It is in everyone's interest that the manufacture of Covid-19 vaccines is as effective as possible everywhere. These efforts could make use of the MPP and C-TAP (or an equivalent mechanism), and should share technology and know-how through the WHO technology transfer hub. The supported

companies should be required to meet stipulated access requirements for their Covid-19 vaccines.

4. In parallel, governments should prepare for the use of compulsory measures, in case they become necessary.

If, for example, a pharmaceutical company with critical know-how neither sufficiently scales-up production of the corresponding vaccine nor shares that know-how with others who could, then governments will likely need to take action to force the sharing of that know-how *via* compulsory measures (including potentially the TRIPS waiver). Governments should therefore urgently audit their domestic IP legislation, if they have not done so already, to ensure that they are able to effectively invoke compulsory powers if it becomes necessary. Co-ordinated action between several governments (and the Global Vaccine Taskforce) may be necessary. The know-how may subsequently be shared *via*, for example, C-TAP (or an equivalent mechanism) and / or the WHO technology transfer hub.

5. Consideration of post-Covid-19 manufacturing needs.

Whilst ensuring that the Covid-19 manufacturing capacity gap is addressed as quickly as possible, consideration should also be given to the optimal use of that capacity after the pandemic is over, whether in terms of ('active use') conversion to manufacture other vaccines or biologicals or ('passive use') being kept at minimum readiness for future use.

6. Efficient regulatory approvals and support to manufacturers

Greater international regulatory collaboration is needed and in particular processes for mutual recognition of regulatory decisions to avoid duplication of work and unnecessary delays. In order to avoid any additional delays in making vaccines available, countries should rely on the recommendations by the WHO PQ/EUL or SRAs (see section 5) in authorising the use of vaccines. There is little to be gained from replicating the regulatory assessment in terms of health benefits, and it will inevitably lead to a delay in making vaccines available.

WHO PQ needs to include regulatory assistance for Covid-19 vaccine producers or candidate producers as a continued core function. The WHO PQ/EUL needs to be fully funded on an ongoing basis from the regular WHO budget.

7. Seize the opportunity to better prepare for the next pandemic outbreak.

Building on the immediate necessity for the establishment of a Global Vaccine Taskforce, a robust global framework should now also be established to permit a more rapid and effective response to future pandemics and other bio-security threats in the medium and long term, whether caused by natural or engineered pathogens. Perhaps the most obvious possibility is the negotiation of a framework pandemic treaty, which should provide for rules for the treatment of intellectual property in such circumstances, and the establishment of permanent surveillance, vaccine, therapy and diagnostic R&D and manufacturing capacity resources, whether public / private or wholly public in nature.