GLOBAL HEALTH CENTRE | DISCUSSION PAPER | 2025

TECHNOLOGY TRANSFER IN PRACTICE: IMPLICATIONS FOR PANDEMIC AGREEMENT NEGOTIATIONS

Interviews with Ellen 't Hoen, Ravi Ganapathy, Ike James and Martin Friede
Synthesis and Conclusions by Suerie Moon

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DISCUSSION PAPER PREPARED FOR THE WORKSHOP:

"Technology Transfer in Practice: Implications for Pandemic Agreement Negotiations," 27 January 2025, Geneva Graduate Institute.

Organizer: Global Health Centre, Geneva Graduate Institute.

Co-convenors of the workshop: the Permanent Mission of the Kingdom of the Netherlands to the United Nations Office and other International Organizations in Geneva, and the Permanent Mission of Pakistan to the United Nations Office and other International Organizations in Geneva.

Acknowledgements: We are grateful to Daniela Morich, Ava Greenup and Gian Luca Burci for their inputs and comments on an earlier draft of this paper, and to Ava Greenup for its design.

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INTRODUCTION

This publication was prepared as part of the lead-up to the 27 January 2025 workshop, "*Technology Transfer in Practice: Implications for Pandemic Agreement Negotiations,*" organized by the Global Health Centre (GHC), in partnership with the Permanent Mission of the Kingdom of the Netherlands to the United Nations Office and other International Organizations in Geneva, and the Permanent Mission of Pakistan to the United Nations Office and other International Organizations in Geneva.

This workshop aims to foster a deeper understanding of how technology transfer operates in practice and to explore its potential implications for the Pandemic Agreement negotiations. To enhance the discussion and prepare for the event, GHC staff members interviewed the expert speakers invited to the workshop. Their responses have been captured in writing and are included in this document. Additionally, Suerie Moon, Co-Director of the Global Health Centre, has contributed by drafting a synthesis highlighting the implications of the workshop discussions for the negotiations of the WHO Pandemic Agreement.

SESSION 1: INTERVIEW WITH ELLEN 'T HOEN, DIRECTOR, MEDICINES LAW & POLICY

1. How has technology transfer been conceptualized and defined in international law?

When discussing technology transfer, it is essential to consider two concepts: technology transfer and technology dissemination. **Technology transfer**, refers to the structured process through which intellectual property (IP), know-how, and technology are transferred to enable the production and distribution of essential products, such as vaccines or other medical countermeasures. Technology transfer generally requires the collaboration of the technology holder. While a government or government authority can grant the right to use patented technology without the consent of the patent holder through a compulsory license, this approach is more challenging to apply to other forms of intellectual property, such as trade secrets and undisclosed know-how, especially in cross-border contexts. **Technology dissemination** refers to the broader diffusion of technology.

Various international agreements address technology transfer and dissemination. For instance, the WTO Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS) includes technology transfer and dissemination among its objectives, as stated in Article 7: "*The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations*."

Furthermore, Article 8 of the TRIPS Agreement underscores the necessity of measures to prevent the abuse of IP rights or other practices that could hinder technology transfer. Article 8 reads: "*Principles*.

1. Members may, in formulating or amending their laws and regulations, adopt measures necessary to protect public health and nutrition, and to promote the public interest in sectors of vital importance to their socio-economic and technological development, provided that such measures are consistent with the provisions of this Agreement.

2. Appropriate measures, provided that they are consistent with the provisions of this Agreement, may be needed to prevent the abuse of intellectual property rights by right holders or the resort to practices which unreasonably restrain trade or adversely affect the international transfer of technology."

TRIPS Article 66(2) imposes an obligation to high income countries (HICs) to incentivize technology transfer to least developed countries (LDCs) to help them establish robust technological bases. It reads: "*Developed country Members shall provide incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base*."

The Montreal Protocol on Substances that Deplete the Ozone Layer also includes provisions that address technology transfer. The Protocol's Multilateral Fund explicitly supports technology transfer, aiding the phasing out of ozone-depleting substances and the transition to environmentally friendly alternatives.

Similarly, the United Nations Convention on the Law of the Sea (UNCLOS) and its implementing protocols, such as the Conservation and Sustainable Use of Marine Biological Diversity of Areas beyond National Jurisdiction (BBNJ Treaty), contains technology transfer provisions under Part V: *Capacity-Building and the Transfer of Marine Technology*, aimed at maritime applications. These examples demonstrate how binding obligations and well-structured frameworks aim to facilitate effective technology transfer.

2. How successful have previous treaty provisions been in producing technology transfer?

The success of treaty provisions in producing meaningful technology transfer has been mixed. In the case of the TRIPS Agreement, while Articles 7, 8, and 66(2) establish clear objectives and obligations for technology transfer, however, their implementation has been somewhat insufficient. Specifically, the obligation for HICs to provide incentives for transferring technology to LDCs has not resulted in tangible results. Due to its narrow focus on LDCs, who often face significant technological deficits, direct technology transfer is frequently impractical without extensive capacity-building efforts to enhance their capabilities. Middle-income countries (MICs), which often have stronger technological and regulatory foundations, are better positioned to benefit from technology transfer. However, they are excluded from the scope of TRIPS Article 66(2), limiting the overall impact of the article and agreement.

WTO Members can compel the sharing of know-how when appropriate circumstances present themselves, and they can do so in a TRIPS-compatible way.[1,2] This can effectively be thought of as a compulsory know-how licence. Article 39 of the TRIPS Agreement addresses the protection of undisclosed information, which includes know-how as defined under Art. 39.2 of the Agreement. However, this protection is limited to forbidding dishonest or unfair commercial use. It is therefore justifiable for WTO Members to require the sharing of undisclosed information in circumstances which do not represent dishonest or unfair commercial use. For example, if a compulsory patent licence were granted during a pandemic to enable urgent production of a pharmaceutical product at large scale, it would be permissible for the patent holder to also be required to share any additional know-how necessary to enable the successful production of that product.

By contrast, the Montreal Protocol demonstrates how effective international agreements can facilitate technology transfer. The protocol succeeded in phasing out ozone-depleting substances partly due to the establishment of a multilateral fund which provided the financial resources to facilitate technology transfer. This fund enabled the dissemination of technologies to produce environmentally friendly alternatives, bridging gaps between developed and developing countries. The protocol's success was driven by the international community's recognition that global cooperation was essential to achieve the best outcomes for the planet.[3]

To quote Stephen Andersen and colleagues[4]: "*It [the technology transfer] is an extraordinary deviation from the situation reported in other case studies of technology transfer, and many readers may find the truth too good to believe. It is possible that the Montreal Protocol experience is the only occasion so far when public and private stakeholders considered technology cooperation a matter of human survival, stepped out of their narrow self-interests and promoted actions that allowed humanity to survive on Earth.*"

1 Gurgula, O. and Hull, J., 2021. Compulsory licensing of trade secrets: ensuring access to COVID-19 vaccines via involuntary technology transfer. Journal Of Intellectual Property Law and Practice, 16(11), pp.1242-1261.

2 Levine, D.S. and Sarnoff, J.D., 2023. Compelling Trade Secret Sharing. Hastings LJ, 74, p.987.

3 For details see: https://medicineslawandpolicy.org/2021/10/lessons-for-a-pandemic-preparedness-treaty-from-previous-successes-and-failures-with-treaty-based-technology-transfer/

4 Andersen, S.O., Sarma, K.M. and Taddonio, K.N., 2012. Technology transfer for the ozone layer: Lessons for climate change. Routledge.

3. What legal language or other factors have made such transfer more or less likely, in your view?

The language used in legal agreements can significantly affect the likelihood of successful technology transfer. Clear, binding commitments increase the chances of success, while vague or non-committal language allows for the avoidance of meaningful action. However, the adoption of relevant legal language alone is not sufficient. For instance, while TRIPS includes provisions on technology transfer, the lack of enforceable mechanisms undermines its impact. An important barrier is the fact that technology is often in the hands of private parties and not governments.

Other factors that can also influence the likelihood of technology transfer include funding mechanisms, such as the multilateral fund established under the Montreal Protocol, which provides the financial resources to facilitate technology sharing. International collaboration and a shared sense of urgency, as seen with the Montreal Protocol's focus on the global threat of ozone depletion, also play crucial roles. Additionally, a country's capacity to utilize the technology affects the success of transfers. Without adequate infrastructure, regulatory systems, and skilled personnel, even the best-designed technology transfer initiatives can fail.

The framing of technology transfer as voluntary or compulsory also impacts its feasibility. Voluntary technology transfer can be hugely beneficial. But it does not always happen even when there are urgent needs for it, as we have seen during the Covid-19 crisis. Therefore, governments must be able to retain the ability to compel technology transfer during crises, even if voluntary mechanisms are preferred. This balance ensures that countries can respond effectively to crises without being overly reliant on the goodwill of technology holders.

4. What legal or policy-related language would make timely, successful technology transfer more likely? What legal or policy language would pose barriers that hinder it, particularly during pandemic emergencies?

Timely and successful technology transfer depends on legal and policy language that creates clear, actionable obligations. International agreements should include clear obligations on technology holders and their home countries, financial resources to buy out or compensate technology holders, support for technology sharing mechanisms such as Pools and clearing houses. It should also include compulsory measures in case technology holders refuse to collaborate in voluntary mechanisms.

Mechanisms to address non-voluntary scenarios are equally important. Clear provisions for compulsory measures, such as fines or government intervention, can ensure that technology transfer is not hindered by reluctance or non-compliance. These measures provide a fallback option, ensuring that essential technologies are accessible when voluntary mechanisms fail. The European Union's draft regulation for EU-wide compulsory licensing during crises is an example of legal language that could be adapted for global use (see amendment 42, Article 13a). This regulation allows for penalties against companies that refuse to share information or collaborate in emergency scenarios, strengthening provisions on compulsory access to know-how and trade secrets.

The draft pandemic agreement text circulated on October 30, 2023 included the following language under article 11(3.c): "*[...] encourage manufacturers within its jurisdiction to share undisclosed information, in accordance with paragraph 2 of Article 39 of the TRIPS Agreement, with qualified third-party manufacturers when the withholding of such information prevents or hinders urgent manufacture by qualified third parties of a pharmaceutical product that is necessary to respond to the pandemic.*" This language was important to encourage access to trade secrets when needed in an emergency situation. This language, however, has since been removed from the text despite the fact that it was still based on voluntary actions by the rights holders.

A significant barrier to timely technology transfer is the perception that robust technology transfer provisions conflict with IP rights. The TRIPS Agreement allows for flexibility in adopting measures to facilitate technology sharing during emergencies. Misunderstanding or misrepresenting these flexibilities can create unnecessary roadblocks, particularly during pandemics, when rapid access to technology is critical.

5. Are there successful precedents for a mix of voluntary and compulsory technology transfer models? How could such approaches inform the Pandemic Agreement?

Medicines Patent Pool (MPP) is one example of a successful mixed model. While MPP operates as a voluntary licensing mechanism, its success was partly driven by widespread use of compulsory licensing during the HIV/AIDS crisis. Technology holders were driven to MPP due to concerns of increased compulsory license use and other non-voluntary measures. This encouraged collaboration while ensuring that governments retained tools to address non-cooperation.

The WHO's mRNA hub in South Africa is another relevant example. While primarily focused on voluntary technology sharing of the mRNA technology the hub developed, the hub may require compulsory measures to address IP barriers when transferring technology to other countries. This mix of voluntary and compulsory approaches provides a flexible framework that can adapt to different contexts.

For the pandemic agreement, the importance of avoiding a binary framing of voluntary versus compulsory transfer should be emphasized. Recognizing the complementarity of these approaches could help resolve negotiation deadlocks and ensure the agreement includes tools to address both routine and emergency needs.

SESSION 2: INTERVIEW WITH RAVI GANAPATHY, DIRECTOR, CMC R&D, HILLEMAN LABORATORIES SINGAPORE PTE. LTD

1. What lessons can be drawn from your experience in facilitating technology transfer for vaccine production in low- and middle-income countries?

Facilitating technology transfer for vaccine production in low- and middle-income countries presents numerous challenges and learning opportunities. It is important to emphasize the need to have clearly defined goals that align with the capabilities of the transferring and receiving parties. Without this alignment, the process is likely to fail, as seen in instances where the recipient lacked the capacity to implement the transferred technology effectively. Successful transfers depend on thorough capacity assessments, ensuring the recipient has the necessary technical expertise, human resources and facilities in place. Furthermore, the transferring party may need to ensure that the regulatory ecosystem where the recipient is located is equipped to assess and bring the product to market in an efficient and timely manner.

Equally important is establishing trust and fostering collaboration between the transferring and receiving entities. This involves open communication, a shared understanding of goals, with a clear aim to protect intellectual property (IP), and a commitment to a robust governance structure to oversee operations on both sides. A clear definition of roles, coupled with well-defined project objectives, ensures that all stakeholders are aligned. Successful transfers often require significant capacity building, local and technical expertise, and manufacturing capabilities that are context-specific to ensure sustainable and impactful results. Without these elements, even the best-intentioned efforts may not yield the desired outcomes. Depending on the context, these transfers can take anywhere between 9 months and 2 years to complete.

2. What makes holders of pandemic-related technology more willing or likely to transfer it to others? Less likely?

Several factors can make holders of pandemic-related technology more or less willing to transfer their technology. Financial incentives such as licensing fees, royalties, and government funding can play a significant role in encouraging companies to engage in technology transfer. Governments can further incentivize technology transfer by offering tax breaks or by providing direct funding to support such initiatives. Political pressure might have a role, and it can be exercised by governments, civil society or the public or by applying political pressure through specific mandates. In addition, companies may see reputational benefits in partaking in technology transfer that helps increase local production of pandemic related products, contributing to global health equity. Collaborative frameworks, such as those established by WHO or global access agreements, can also facilitate technology transfer by creating formal mechanisms for sharing knowledge and technology. Lastly, arrangements between pharmaceutical companies can be made, particularly when one company may lack the bandwidth or capability to finalize a product, or the access to a certain market.

Conversely, several barriers reduce the likelihood of technology transfer, including the fear that technology could be used by the competition to develop competing products. These concerns about losing market share or unauthorized use of IP are common, highlighting the critical role of trust. As a result of this, companies may hesitate to transfer technology to recipients they perceive as incapable of protecting IP or effectively using the technology. A recipient's lack of readiness,

including inadequate infrastructure, regulatory frameworks, or skilled personnel, adds further uncertainty. The reputational risks associated with failed transfers or poorly executed production is another discouraging factor.

3. What makes it more likely that such transfer will succeed in health products reaching those who need them in a timely manner?

Technology transfer is extremely complex, requiring adaptation and customization on a case-by-case basis. Successful and timely delivery of health products through technology transfer depends on addressing a broad range of factors. One important factor includes thorough capacity assessments to ensure the recipient is ready to use and implement the technology. Clear and achievable goals, supported by sufficient funding and resources, are equally essential for success. This includes aligning timelines, budgets, and specific project milestones to create a structured path toward implementation.

A shared understanding of objectives among stakeholders is vital to maintaining focus and collaboration throughout the process. Building trust and encouraging knowledge sharing through the establishment of secure communication platforms ensures transparency, and the ability to protect Intellectual Property Rights. Furthermore, investments in the broader ecosystem—such as supply chains, regulatory frameworks, and local expertise— enhance the likelihood of success. Governments and international organizations play a key role in creating these conditions through sustained funding, training programs, and regulatory support.

Furthermore, capacity building must be prioritized. Without the proper infrastructure, human resources and consideration of cultural factors, technology transfer is unlikely to result in timely health product delivery. These foundational elements should be addressed through phased development and collaborative efforts which will be crucial for ensuring that health products reach those in need when they are most needed.

4. How can the Pandemic Agreement ensure that technology transfer initiatives strengthen local manufacturing capabilities in a sustainable manner?

The pandemic agreement represents a unique opportunity to embed sustainable practices into technology transfer initiatives and strengthen local manufacturing capabilities. It is important to emphasize the need to tie obligations for technology transfer to commitments for capacity building. Obligations should be context-specific, recognizing the diverse needs and challenges of recipient countries. For instance, in regions with limited regulatory capacity or weak production and manufacturing facilities, a phased approach is essential. Starting with simpler tasks, such as fill-and-finish operations (transfer, packaging and distribution), and gradually progressing to more complex manufacturing and production processes allows for incremental development, increasing the likelihood of sustainable technology transfer. This will take years to develop, highlighting the need to build up these ancillary processes and associated supply-chain mechanisms within the county or region (which could be key drivers of Cost-of-Goods) in peacetime rather than waiting until the next pandemic emergency.

Mandatory technology transfer could be considered under specific contexts, such as during pandemic emergencies, to ensure equitable access to critical health products. However, for this approach to be effective, it is vital that the receiving country has the capacity and technical expertise to use the technology efficiently to produce the final product at the required quality and scale. Without these foundational elements in place, mandatory technology transfer risks being ineffective and counterproductive, again emphasizing the need to improve capacity during peacetime. Equally, this underscores the need for continued support from the transferring party to ensure a seamless transfer and successful use of the technology, ultimately benefiting both the parties.

Increased investment in infrastructure is equally critical. Successful local manufacturing requires not only production facilities but also robust supply chains, skilled personnel, and equipped regulatory systems. For example, vaccine production requires a reliable supply of raw materials, biological inputs, and packaging materials, underscoring the need to improve local infrastructure to ensure sustained, long-term manufacturing.

The role of regional hubs, particularly in underserved regions, are also important. Harmonizing regulatory systems within and between regions and establishing regional reputable technology transfer hubs can enable countries to collaborate more effectively and reduce duplication of effort. These initiatives, supported by international funding and long-term training programs, are key to creating resilient manufacturing networks.

To ensure sustainability, it is important that long-term commitments from all parties are secured. The pandemic agreement should prioritize capacity building, regulatory harmonization, and ecosystem development in the context of technology transfer. By embedding these principles into the agreement, countries can lay the foundation for a more equitable and effective global health system, ready to respond to future pandemics.

SESSION 3: INTERVIEW WITH IKE JAMES, TECHNOLOGY TRANSFER DIRECTOR, MEDICINES PATENT POOL

1. What are key factors that enable successful technology transfer in the current mRNA hub program? What factors impede or limit its success?

Successful technology transfer in the current mRNA hub program relies on a combination of factors that ensure smooth collaboration, efficient adaptation, and rapid deployment of critical health technologies. A primary enabler is strong political will and commitment from governments and global health organizations to prioritize pandemic preparedness and health equity. This commitment helps align resources, policies, and infrastructure development with the needs of recipient countries. Equally important is the presence of robust infrastructure, including state-of-the-art manufacturing facilities, skilled personnel, and well-functioning regulatory systems, which enable recipient countries to effectively adopt and utilize transferred technologies.

Collaborative partnerships also play a key role. When technology holders, governments, and local manufacturers work together transparently and equitably, trust is built, and knowledge-sharing accelerates. Clear agreements on intellectual property (IP) rights and access further support this process, ensuring that all parties have a shared understanding of expectations and obligations. Financial and logistical support, such as grants for capacity-building, supply chain development, and workforce training, are critical in bridging gaps and sustaining momentum. Additionally, mechanisms that allow for the sharing of scientific data and training materials can drastically reduce barriers to entry and speed up local production.

However, there are notable challenges that can impede successful technology transfer. The challenges are the direct opposite of the enablers—some are internal to the recipient organization, and some pertain to the ecosystem. A lack of supportive policy environment, infrastructure, skilled manpower, absorptive capacity etc. can impede tech transfer. IP, for instance, can create barriers to accessing critical technologies. In the mRNA technology transfer programme, freedom to operate (FTO) was evaluated at a country level and as mitigation the programme developed work around strategies to ensure FTO. Similarly, limited infrastructure and expertise in some recipient countries may delay or prevent the effective use of transferred technology. Political alignment and a lack of funding also create obstacles, while inconsistent or inefficient regulatory processes can add further delays. And in general, mismatched priorities between technology holders and recipients, such as when profit-driven motives clash with health equity goals, can lead to friction and slow progress.

2. From your experience, what makes holders of pandemic-related technologies more willing or likely to transfer it to others? What makes it less likely?

The willingness of technology holders to transfer pandemic-related technologies depends on a variety of factors, including reputational, operational and financial considerations.

Companies and institutions are more likely to share their innovations when they see global health incentives and recognize their corporate social responsibility to address inequities. Public funding, subsidies, or tax incentives tied to technology sharing can also encourage participation. Additionally, public pressure, advocacy campaigns, and international agreements requiring technology sharing during pandemics can create compelling reasons for collaboration. For

technology holder, collaborating in a technology transfer initiative could indicate a commitment to equitable access, enhancing the company's reputation among investors and the public, ultimately creating business value. However, reluctance may arise if technology holders fear losing market exclusivity, face risks of intellectual property misappropriation, or encounter inconsistent policy frameworks. Geopolitical misalignment and a lack of trust in recipients further deter willingness.

3. What makes it more likely that such transfer will succeed in health products reaching those who need them in a timely manner?

For technology transfer to translate into timely and effective health products, several conditions must be met. A shared commitment to equitable access and affordability among all stakeholders is critical. Technology transfer cannot occur in a vacuum. Pre-established manufacturing capacity, capability, networks and partnerships allow for rapid mobilization, while decentralized production models reduce dependency on global supply chains and ensure that products are available locally. Sustained financing and the market potential of the product are also important. Strong distribution infrastructure and community engagement ensure that vaccines and other health products reach those who need them without unnecessary delays.

4. How can the Pandemic Agreement ensure more timely, successful technology transfer in future potential pandemics?

Looking forward, the proposed Pandemic Agreement presents an opportunity to initiate mechanisms that ensure timely and successful technology transfer in future pandemics. It is good to see that relevant provisions in Articles 9 and 13, relating to leveraging public funding of R&D and procurement respectively to facilitate global access to pandemic-related health products as well as article 10 are green in the latest draft of the pandemic agreement. It would help if agreement can be reached on Article 11 (facilitating the transfer of technology and know-how for the production of pandemic -related health products) and other relevant articles as well. By supporting technology sharing during global health emergencies, backed by organizations like WHO, the agreement can set a precedent for equitable access. A centralized global platform for sharing key technologies, patents, and data could facilitate rapid dissemination of knowledge. Financial mechanisms, such as subsidies and grants, can support technology transfer and local capacity-building, while flexible IP and licensing models strike a balance between commercial interests and public health needs.

The agreement could also focus on capacity-building by investing in training, infrastructure, and regulatory systems in low- and middle-income countries, enabling them to participate effectively in the global health response. Accountability frameworks and regular monitoring would ensure that commitments are upheld. Additionally, advance purchase agreements can provide predictable funding and demand for products, incentivizing technology holders to engage in the transfer process. Encouraging public-private partnerships will further pool resources and expertise, fostering innovation and collaboration.

By addressing these factors, the Pandemic Agreement can lay the foundation for a more equitable and effective global health response, ensuring that life-saving technologies reach those who need them most in a timely manner.

5. What has MPP's experience in fostering access to technology and know-how been?

In the 2000s, one of the most pressing global public health challenges was the lack of access to affordable, life-saving drugs for HIV treatment in LMICs. Newer, more effective, and better-tolerated antiretrovirals were often patented and prohibitively expensive, leaving millions without adequate treatment.

To address this, Unitaid established the Medicines Patent Pool (MPP) in 2010. MPP works by persuading and negotiating with patent holders to grant licenses, which it then sublicenses to multiple generic manufacturers. These manufacturers competitively produce and sell affordable versions of the medicines in LMICs. Through this model, over 43 billion doses of affordable treatments have been supplied in 148 countries, delivering significant public health and economic benefits.

The mRNA Technology Transfer Programme was established by the WHO and MPP during the COVID-19 pandemic as a multilateral mechanism to develop mRNA manufacturing capacity in LMICs.

SESSION 4: INTERVIEW WITH MARTIN FRIEDE, COORDINATOR, INITIATIVE FOR VACCINE RESEARCH, WORLD HEALTH ORGANIZATION

1. What are examples of technology transfer initiatives carried out by WHO, during as well as before Covid-19? What were the key factors that contributed to their success? What barriers impeded or limited their success?

WHO has engaged in several technology transfer initiatives both before and during the COVID-19 pandemic, achieving varying levels of success. One prominent pre-COVID example of a framework that addresses technology transfer is the Global Action Plan on Pandemic Influenza Vaccines (GAP), adopted in 2006 in response to the H5N1 outbreak in the mid 2000s. At the time of the outbreak, several countries demanded fair access to vaccine technology, pointing out the injustice faced by those who provided the virus samples but were later excluded from the benefits of the vaccines. As a result, the WHO, in collaboration with member states, helped build vaccine production facilities in several countries to enhance their pandemic preparedness. By the time H1N1 emerged in 2009, several of these national facilities were able to produce vaccines for their populations, demonstrating the value of preemptive capacity building during 'peacetime'.

However, the successes of this initiative were limited. For instance, no African country was able to manufacture influenza vaccines. This was due to limited production capabilities and incomplete alignment between the donors and recipients of the technology transfer, underscoring the significant gaps in regional coverage.

Economic sustainability is another recurring barrier. We have observed instances where, despite the construction of a facility capable of producing 20 million doses annually, the facility was eventually shut down. This occurred after it became clear that the government only procured a limited number of doses, such as 100,000 annually. This highlights the economic infeasibility of maintaining a large-scale facility without a consistent and substantial demand. Similarly, another facility was unable to produce the final product due to incomplete technology transfer, as a small but critical piece of knowledge was not transferred, whether intentionally or due to oversight. Misalignment of objectives between donors and recipients, along with a lack of sustained government commitment to support local production, are critical factors that must be considered for the long-term viability of such facilities.

During COVID-19, WHO managed several initiatives, including the mRNA technology hub in South Africa. This project is seeking to build local production capacity for mRNA vaccines in underserved regions, harnessing the versatility of mRNA technology for various vaccines. This created a foundation not only for COVID-19 vaccines but also for other vaccines and treatments for diseases such as Tuberculosis (TB) or cancer, in principle enabling the creation of sustained demand and hence sustainability of the manufacturing facility. While this plan is based on more sustainable foundations than the influenza vaccine plans, the programme is facing challenges in terms of the long time to develop and approve novel applications of the mRNA technology before revenues can be generated.

Key factors that can contribute to the success of technology transfer include strong international collaboration, early capacity building, and alignment of donor and recipient goals. Conversely, barriers include economic sustainability issues, non-competitive production costs at small

manufacturers compared to large multinationals, insufficient government support in terms of supporting capital investment but also sustained procurement of the locally manufactured product, gaps in infrastructure and supply chains, and incomplete information sharing during technology transfer (either due to insufficient workforce capacity from donor or recipient, insufficient time allocated, misaligned objectives etc).

2. What makes holders of pandemic-related technologies more willing or likely to transfer it to others? Less likely?

Holders of pandemic-related technologies are more willing to transfer their technology when there is a clear mutual benefit, where both the donor and the recipient stand to gain from the transfer. Financial incentives can play a significant role in facilitating technology transfers. For instance, commitments from recipient governments to procure products from the local manufacturer can make the transfer more attractive to the recipients. Technology holders are also more inclined to transfer when the recipient country already has existing capabilities and infrastructure, as this reduces the time and cost of the transfer process. Trust and collaborative partnerships further increase the likelihood of successful technology transfer. These factors highlight once more the need to increase capacity in underserved regions during 'peacetime.'

On the other hand, several factors make technology holders less willing to share. A major concern is the lack of economic or strategic benefit for the donor. If the donor perceives no clear advantage—whether financial, reputational, or strategic—they are unlikely to engage. Incomplete trust between donors and recipients further exacerbates this reluctance, particularly if there is skepticism about the recipient's ability to maintain quality standards or protect sensitive information, and concern that the donor will be creating a competitor for non-pandemic products and losing control of their proprietary technology.

Forced technology transfer has never happened in the vaccine field, and even compulsory licenses have much lower potential impact than in the small molecule field since the resulting vaccine would still need years of product development. Even in cases where legal frameworks could exist to support and enforce such measures, the lack of alignment or goodwill could ultimately undermine the transfer process, leading to failure. Technology holders might go through the motions without genuine commitment, significantly reducing the effectiveness of the transfer (even when there is genuine commitment we have seen failures resulting from minor misalignments).

3. What makes it more likely that such transfer will succeed in health products reaching those who need them in a timely manner?

Timely and successful technology transfer requires several preconditions to be met. First, the recipient country must have the capacity and readiness. Facilities must already exist, and their staff members must have the technical skills to apply the transferred technology. Without this baseline, the transfer process can take years and/ or completely fail. Sometimes even advanced facilities with a high degree of technical expertise can require significant time—potentially up to five years—to complete the transfer, underscoring the importance of pre-existing infrastructure.

Government commitment is critical to success. This includes financial support for local manufacturers, ensuring the sustainability of facilities during non-pandemic periods, and creating policies that encourage and favour local production. There are instances where governments have undermined local production by instead procuring cheaper vaccines from international suppliers, severely impacting the long term sustainability of local facilities.

Economic sustainability is another vital factor. Technology transfer initiatives are more likely to succeed when facilities have a number of diverse production lines beyond the immediate pandemic response. For example, as previously mentioned, mRNA technology can be used for the treatment of other diseases. This diversity can ensure that facilities remain operational and staff remain skilled, increasing long term sustainability of the factory and maintaining its readiness for when the next pandemic strikes.

Trust and collaboration between the donor and recipient are equally important. Successful transfers depend on the full alignment of goals and the willingness of both parties to share knowledge openly. Even minor gaps in information sharing can result in a failed final product, particularly when critical know-how or techniques are not explicitly explained, demonstrated and communicated.

Finally, a distributed supply chain can enhance the effectiveness of technology transfer. An interdependent regional approach, where neighboring countries collaborate and share different components of the supply chain, such as glass vials and rubber stoppers could be an option for consideration, emphasizing a collective response. This can reduce the likelihood of supply chain disruptions, fostering win-win situations and regional cooperation. By addressing these factors holistically, technology transfer initiatives can ensure that health products reach those in need in a timely manner.

SYNTHESIS AND CONCLUSIONS: SECURING TECHNOLOGY TRANSFER IN THE PANDEMIC AGREEMENT

By Suerie Moon

Introduction

Technology transfer has been one of the more politically and technically difficult issues on which to forge consensus in the Pandemic Agreement negotiations. In the wake of the Covid-19 pandemic—which was characterized by shortages of health products, widespread trade barriers and highly-unequal and inequitable access to pandemic products—there is widespread agreement on the importance of diversifying production capacity by strengthening it in low and middle-income countries (LMICs). All countries stand to benefit if the world can produce sufficient volumes of products to get a pandemic emergency under control as quickly as possible, by reducing the risk of ongoing spread and ending the emergency faster.

The "greening" (indicating consensus in ongoing Pandemic Agreement negotiations) of *Article 10 Sustainable and geographically diversified local production*, reflects strong support for this objective, which is also reflected in many new local production initiatives launched worldwide over the past several years.[1] Achieving this objective will require the **transfer of technology** from actors in one country to another. However, there remains significant disagreement on how to do so, particularly on what is the appropriate mix of voluntary and compulsory measures. Countries that have historically been technology-holders tend to prefer that such transfer only take place on "voluntary and mutually-agreed terms (VMAT)", whereas those that want access to technology tend to favor also adopting compulsory measures. The question remains, what is needed to ensure effective technology transfer for strengthening local production capacity?

The Geneva Graduate Institute's Global Health Centre organized a workshop on technology transfer in January 2025 to solicit experts' views on this complex topic and to facilitate understanding of real world challenges from experienced practitioners with backgrounds in industry, intergovernmental organizations and non-governmental organizations. The main ideas from each speaker are summarized in interviews earlier in this report. This synthesis article draws out implications of the workshop discussions for the draft Pandemic Agreement. They reflect the views of the author, and do not necessarily represent the views of the Global Health Centre or Geneva Graduate Institute.

For which products is technology transfer most needed?

Expert speakers largely focused on biologics – particularly vaccines – as the technology for which transfer is most essential. For small molecule drugs, compulsory licensing may be a sufficient measure including in emergencies, as many companies can manufacture these without requiring technology transfer. Diagnostics tend to be relatively low-cost to develop and manufacture, with multiple platform technologies available, and therefore also rely less heavily on technology transfer. In contrast, manufacturing of biologics such as vaccines or monoclonal antibodies (mAbs) requires both access to specific starting materials, such as cell lines, and to specialized know-how on complex, multi-step production processes. Therefore, most of the challenges discussed relate specifically to more complex pharmaceuticals such as new vaccines.

1 See, for example, the 2021 World Health Assembly resolution on local production (https://www.who.int/publications/i/item/WHA74.6-Strengthening-local-production-of-medicines-and-other-health-technologies-to-improve-access), the annual World Local Production Forum (https://www.who.int/initiatives/world-local-production-forum), and the African Union-Africa CDC Partnerships for African Vaccine Manufacturing (https://africacdc.org/download/partnerships-for-african-vaccine-manufacturing-pavm-framework-for-action), among other initiatives.

Clashing interests between technology-holders and -recipients

Workshop speakers made clear that successful technology transfer for the production in LMICs of complex biologics such as vaccines requires many different pieces of the puzzle to be in place: e.g. infrastructure, trained human resources, regulatory capacity, sufficient international supply chains, long-term investment, public purchase commitments, a sustainable business model, and years of intensive collaboration, among others. All this requires long-term political and financial commitment from home governments. They also noted that technology transfer for vaccines in normal times usually takes several years to arrive at a successful product that can receive regulatory approval and reach people. That said, timelines can be accelerated considerably when pre-existing production capacity is in place, as demonstrated during the Covid-19 crisis when technology transfer for contract manufacturing of vaccines took place within months.[2] Nevertheless, capacity to manufacture must be built during interpandemic times to ensure production facilities are ready and available when emergencies strike – a so-called "warm base." Sustaining the warm base requires a business model that makes products for sale every day, not only during crises. The implication is that technology transfer is required **as early as possible**, and that technology recipients should be able to use platform technologies (e.g. mRNA or protein sub-unit for vaccines) to produce **other products** outside of emergency periods.

Unfortunately, commercial technology-holders face incentives to do the opposite – that is, not to transfer technology outside the firm during inter-pandemic times, and if they do so, to restrict as tightly as possible the potential use of platform technologies for other products, as both measures would enable market competitors. When transfer does occur, it can vary in depth from enabling only production of the last stages (e.g. fill-and-finish), which limits autonomy of the recipient, to a full end-to-end transfer.

During the Covid-19 emergency, technology transfer practices varied widely, but overall was not sufficient to enable rapid supply to LMICs.[3] Businesses had little incentive to enable competitors to meet demand, which would have reduced the high revenues they were earning. Training others also requires significant human resources, and diverting production personnel away from manufacturing would have been commercially costly at a time when scaling up production to meet ballooning global demand was the business priority.

While companies came under political pressure to transfer technology during the crisis, that pressure is considerably lighter in inter-pandemic times. Companies that control valuable platform technologies are already developing potentially lucrative products for other diseases that can be sold day-to-day, not only during emergencies (e.g. Moderna's candidate vaccines for cancers or respiratory syncytial virus (RSV).[4] Enabling competitors to manufacture competing products both for pandemic emergencies and in interpandemic times runs directly counter to business logic.

It therefore seems **highly unlikely** that a purely voluntary approach to technology-holders will result in the technology transfer that is needed in inter-pandemic times. Even if such transfer can be induced, it is likely to be narrowly restricted to pandemic products, which is not enough to sustain the warm base through day-to-day sales. It may also be restricted to late-stage fill-and-finish, which allows the technology holder to retain considerable control since the recipient must still rely on them to supply critical inputs.

One answer to this conundrum in the past has been r**elying on non-commercial technology transfer** projects. Following the 2009 H1N1 influenza pandemic, WHO worked with the Netherlands

2 O'Sullivan C, Rutten P, Schatz C. 2020. Why tech transfer may be critical to beating Covid-19. McKinsey and Company. Available: https://www.mckinsey.com/~/media/McKinsey/Industries/Pharmaceuticals%20and%20Medical%20Products/Our%20Insights/Why%20tech%20transfer%20may%20be%20critical%20to%20beating%20COVID%2019/Why-tech-transfer-may-be-critical-to-beating-COVID-19-vF.pdf

3 Alonso Ruiz, A., Bezruki, A., Shinabargar, E. et al. Which roads lead to access? A global landscape of six COVID-19 vaccine innovation models. Global Health 20, 25 (2024). https://doi.org/10.1186/s12992-024-01017-z

4 Reuters. 2024. Moderna jumps as vaccine shows benefit in head and neck cancer in early study. April 9. https://www.reuters.com/markets/us/moderna-jumps-personalized-cancer-vaccine-shows-benefit-early-study-2024-04-09/

Vaccine Institute and International Vaccine Institute to transfer technology to potential influenza vaccine producers in LMICs. This was possible because the relevant technology was well-established, with non-commercial actors holding sufficient knowledge to train others. Similarly, two non-commercial entities – the WHO and Medicines Patent Pool – are coordinating the mRNA technology transfer hub, which is largely financed with public and philanthropic funds. Therefore, one path to facilitate technology transfer in the future is to invest public funds in R&D for pandemic products (as called for in Article 9.2(a)[5]) and to ensure the resulting technologies can be controlled and transferred by non-commercial actors.

However, relying on non-commercially-controlled technology is unlikely to be sufficient – **commercial actors hold valuable technologies** likely to be needed to address pandemics. So the question remains, how can commercial actors be induced to transfer technology when it seems to go directly against their business interests?

Compulsory and voluntary approaches to disembodied vs embodied aspects of technology

The low likelihood of commercial actors transferring technology voluntarily is a key rationale for compulsory measures. For '**disembodied**' aspects of technology—such as technical documents, patents, data, regulatory filings, starting materials—governments could require private firms to share these for pandemic-related purposes. In other words, a compulsory approach is possible. However, practitioners emphasized that successful technology transfer in inter-pandemic times requires cooperation sustained over several years, with parties that are **not only able but also willing to share 'embodied'** aspects of technology, such as know-how. 'Embodied' here refers to the knowledge of skilled, experienced practitioners that is not always written down or captured on paper in disembodied form. It is difficult to imagine how one could compel one team of practitioners, against their will, to effectively and efficiently teach another a complex manufacturing process. Practitioners emphasized that trust and goodwill facilitate effective cooperation. In recognizing the disembodied and embodied aspects of technology, it becomes apparent that technology transfer may encompass **both compulsory and voluntary elements.** Might both be needed to ensure effective technology transfer for pandemic products?

Inducing technology transfer from commercial actors

In the face of countervailing incentives, how could commercial actors be made more willing to transfer valuable technology?

One possible approach is to make the **benefits of transfer outweigh the costs of not transferring technology, using carrots and sticks**, such that it becomes rational for the commercial actor to willingly engage in such transfer. This approach sits along a spectrum between purely voluntary, on the one end, and purely compulsory, on the other. At first glance, voluntary and compulsory approaches may seem to be polar opposites. But this is a false dichotomy. In practice, one often complements the other, as when private firms voluntarily adopt certain practices to avoid compulsory measures. For example, in 2016 the government of Malaysia negotiated with pharmaceutical company Gilead for a voluntary license on the hepatitis C drug sofosbuvir, but the parties did not reach agreement. In 2017, the government subsequently announced it would issue a compulsory license on Gilead's sofosbuvir patents; shortly thereafter Gilead added Malaysia, Thailand, Ukraine and Belarus to its voluntary license.[6]

5 Pandemic Agreement, text as of 6 December 2024, 17:23 CET, Article 9.2(a): "To this end, the Parties shall promote, within means and resources at their disposal, and in accordance with national and/or domestic law and policy: (a) sustained investment and support for research institutions and networks that can rapidly adapt and respond to research and development needs in the event of a pandemic emergency…"

6 Saez, C. 2017. Malaysia grants compulsory licence for generic sofosbuvir despite Gilead licence. Health Policy Watch. 15 September. https://healthpolicy-watch.news/malaysia-grants-compulsory-licence-generic-sofosbuvir-despite-gilead-licence/

Greened text in the draft Pandemic Agreement already provides **some carrots and sticks**. Articles relevant for technology transfer include not only *Article 11. Transfer of technology and know-how for the production of pandemic related health products*, but also other articles such as those on R&D (Art. 9), production (Art. 10), pathogen access and benefit-sharing (PABS) (Art.12) and procurement (Art.13).

First, the text establishes the norm that regionally-diversified production is important for addressing pandemics (Article 10), and that technology transfer is expected behavior for pandemic products. That is, technology transfer is articulated and agreed as the right thing to do. Firms that engage in such transfer could be rewarded with reputational benefits. Such soft norms are important for setting expectations and a benchmark for subsequent accountability efforts, even if they lack the enforceability of harder rules.

Second, A*rticle 9.5 Research and development* commits States Parties to develop and implement policies regarding conditions on publicly-funded R&D that promote equitable access, including through technology transfer, among other provisions.[7] Governments can implement this commitment by requiring commercial actors that conduct publicly-financed R&D on pandemic products to transfer technology as a condition of such funding. Firms are not required to accept public funding. If and when they do, they would also be voluntarily accepting a legally-binding commitment to transfer technology. Preferably, technology transfer would be required as early as possible and for as wide a use as possible, but the exact terms of funding contracts will be determined at national level and, to some extent, case-by-case. Transparency of such contracts will help to monitor implementation and push for improvement where needed.

Third, greened sections of Article 11 (focused on technology transfer) include commitments to promote, facilitate or incentivize technology transfer; publish the terms of licensing agreements; encourage patent-holders to forgo or charge reasonable royalties during pandemic emergencies; promote technology transfer to regional or global technology transfer hubs; support capacity building; reaffirm the right to use TRIPS flexibilities and to respect their use; strengthen or develop mechanisms for technology transfer, and consider amending national legislation to implement this article. After painstaking negotiation, much has been agreed.

Keeping this in mind, there are a number of clauses still under negotiation where additional carrots and sticks could be included. For example:

1. Parties could commit to mandate private firms to share disembodied aspects of technology (e.g. documents, data, regulatory filings) in Article 11.

2. Parties could commit to make available licences on government-funded or government-owned technologies in a transparent, non-exclusive manner worldwide (as reflected in draft Article 11.1(b) which is "yellowed" text as of Dec 2024, reflecting widespread agreement if not yet consensus).

3. Parties could commit to provide technology transfer, or finance or offer other incentives for such transfer, as a benefit under the PABS system in Article 12. For example if revenues are generated through the PABS system, some could be used to pay technology-holders that engage in transfer. Other public funds could also be allocated for this purpose, unrelated to PABS.

7 Pandemic Agreement, text as of 6 December 2024, 17:23 CET, Article 9.5: "Each Party shall develop and implement national and/or regional policies, adapted to its domestic circumstances, regarding the inclusion of provisions in publicly funded research and development grants, contracts and other similar funding arrangements, particularly with private entities and public-private partnerships, for the development of pandemic-related health products, that promote timely and equitable access to such products, particularly for developing countries, during public health emergencies of international concern including pandemic emergencies, and regarding the publication of such provisions. Such provisions may include: (i) licensing and/or sublicensing, particularly to manufacturers of developing countries and for the benefit of developing countries, preferably on a non-exclusive basis; (ii)affordable pricing policies: (iii) technology transfer; (iv) publication of relevant information on clinical trial protocols and relevant research results; and (v) adherence to product allocation frameworks adopted by WHO. [NOTE: Pending final discussion of Article 11 regarding licensing and tech transfer]."

4. Parties could commit to make technology transfer a condition of publicly-financed procurement contracts for stockpiling (in interpandemic times) and for supply (during pandemics) in Article 13. (Licensing is envisioned in Article 13(bis).2 as a potential condition in public procurement contracts, but not technology transfer more broadly.)

These are non-exhaustive illustrations for how States Parties can use the Pandemic Agreement as a vehicle to commit to use carrots and sticks to induce technology transfer for pandemics.

What role for a treaty?

International legally-binding obligations on technology transfer serve several functions. First, they set norms for expected behavior by both state and non-state actors. Second, they structure cooperation between states for mutual benefit. States can commit to each other through a treaty that they will ensure technology transfer to the best of their ability, with the understanding that enabling all states to control potential and actual pandemics increases health security for all. Such state commitments are important because private firms are not directly bound by public international law. It is up to states to regulate private firms in their territories. If a private firm in Country A holds a technology needed to combat a pandemic emergency in Country B, it is the government of Country A that has the authority to mandate actions by that firm. A treaty gives Country B greater confidence that Country A will take the steps that will facilitate cross-border technology transfer. Historically, vaccine technology has been concentrated in a few advanced industrialized countries. But a number of middle-income countries demonstrated their growing vaccine R&D capacity during the Covid-19 crisis.[8] In future, international rules that ensure cross-border technology transfer for pandemic emergencies could spur South-South cooperation, and/or provide for technology transfer to high-income countries as well. Finally, a treaty binds states to other commitments that increase the likelihood that technology transfer will successfully deliver improved access to pandemic products. Practitioners emphasized that technology transfer alone is not sufficient to sustain local production, but that a conducive ecosystem is required. Provisions in *Article 10, for example, commit states to support skills development and capacity building, promote investments in production facilities including through purchasing arrangements, and Article 14 commits states to strengthening their regulatory systems. A full package of commitments in the Pandemic Agreement could help deliver on the promise of local production*.

Conclusion

Full agreement on technology transfer has not yet been achieved in Pandemic Agreement negotiations, but ensuring effective provisions is critical for achieving the broader objective of geographically-diversified production capacity. Governments may wish to fund and ensure they retain sufficient control of **non-commercial technology**, and commit to transferring it for pandemic products, as they have in the past. For commercially-controlled technologies, governments could **mandate the sharing of disembodied** aspects of technology (e.g. documents, data, regulatory filings), but full technology transfer for the complex process of manufacturing biologics seems also to require the **voluntary participation of the technology-holder, particularly for embodied** aspects of the technology that require one person to teach another. However, that willingness need not only rely on the charitable impulses of the technology holder, which are likely to be insufficient in the face of strong business incentives not to transfer at all. Governments can commit through the treaty to use all the legal, financial and political means at their disposal to push and pull technology holders to share technologies needed to address pandemics. The sum total of such measures—carrots and sticks—should make technology transfer the rational choice for commercial actors, and could include: mandates to share disembodied aspects of

8 Alonso Ruiz, A., Bezruki, A., Shinabargar, E. et al. Which roads lead to access? A global landscape of six COVID-19 vaccine innovation models. Global Health 20, 25 (2024). https://doi.org/10.1186/s12992-024-01017-z

technology combined with reputational benefits, conditions on public funding (e.g. for R&D and procurement contracts), PABS-related conditions, and financial incentives (e.g. direct payments). Taken together, these could push and pull commercial actors so that technology transfer becomes the expected, accepted and likely course of action for pandemic products.

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