Patent Choke Points in the Influenza-Related Medicines Industry: Can Patent Pools Provide Balanced Access?

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Release of samples of biological materials with high, imminent commercial potential, such as the influenza virus samples, is likely to cause a "race" to patent and to gain market share among recipients. This race may give rise to suboptimal functioning of the patent system, in the nature of patent thickets and holdouts, prompted by conditions such as multiple parties inventing based on a single biological resource, high growth markets, a congested patent scene, and narrow and fragmented patents.

This Article examines the causes of the suboptimal functioning of the patent system under these circumstances, using the World Health Organization (WHO) Pandemic Influenza Preparedness Framework (Framework) concluded in May 2011 as an empirical basis. It concludes that the absence of an intellectual property (IP) governance regime may cause the Framework to fail to achieve its stated objective of providing broad-based availability of affordably priced medicines. Based on the data points gathered in the course of the analysis, this Article proposes an approach that would help solve these shortcomings. The proposal is to condition release of culture materials on an agreement to "rebundle" or "reallocate" patent rights, in the form of a patent pool or comparable cross-licensing agreement. Its conceptual premises are that "freedom to operate" from a patent perspective, i.e., having permission to use the patents necessary for a product, generally suffices for a player to operate in the market and that the value of receiving samples of the biological materials outweighs the disadvantage of relinquishing full patent rights. Requiring all recipients of virus samples to join such an arrangement would reallocate rights to provide all players access to the technologies derived from the biological materials.

This approach would avoid patent thickets and holdouts, reduce transaction costs associated with individual licensing, and avoid uncertainty regarding the ability to secure freedom to operate. Under certain circumstances, this approach could further support other open access goals such as free use of the technologies for noncommercial purposes.

It is recognized that this model will primarily be effective with respect to materials with clear and imminent commercial prospects. Currently, it would apply best to influenza and other pandemic samples, but may be useful in the future with respect to any high value microorganisms.

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I. PREAMBLE

In 2006, an outbreak of the H5N1 influenza claimed large numbers of victims worldwide. The international health community led by the World Health Organization (WHO) through its Global Influenza Surveillance Network (GISN)[1] immediately sought to obtain influenza

1. WHO–GISN has been the sole mechanism for alerting the world to the emergence of influenza viruses with pandemic potential. Adam Kamradt-Scott & Kelley Lee, *The 2011 Pandemic Influenza Preparedness Framework: Global Health Secured or a Missed Opportunity*, 59 POL. STUD. 831 (2011).

virus samples from affected countries, in order to start development of diagnostics and therapeutics.[2]

Indonesia, one of the affected countries, refused to release virus samples located on its territory[3] in accordance with its rights under the U.N. Convention for Biological Diversity (CBD).[4] Only upon intervention by the WHO did Indonesia finally release the virus samples in March 2007.[5] In exchange, Indonesia demanded action by the WHO and industrialized countries to define terms of reference under which Indonesia and other developing countries would receive access at reasonable prices to technologies and medicines derived from virus samples that they might provide to the WHO in the future.[6]

The substratum of Indonesia's refusal to release virus samples is the deepgoing rift between developing and industrialized countries over access to medicines and IP rights. This rift is often blamed on the patent system.[7] The patent system functions well in the context of industrialized countries because these markets can support prices sufficient to finance research and development (R&D). However, the system does not scale well internationally, due to the embedded structural inequalities among countries.[8] A global solution for overcoming these IP-related issues in an international context, or even a conceptual approach for one, has yet to be developed. For now, international IP issues are approached on a case-by-case basis.

Negotiation out of this particular impasse was left to the WHO, the international organization primarily responsible for furthering global

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2. *See* EDWARD HAMMOND, AN UPDATE ON INTELLECTUAL PROPERTY CLAIMS RELATED TO GLOBAL PANDEMIC INFLUENZA PREPAREDNESS (Third World Network, Intell. Prop. Rts. Series, 2011).

3. Kamradt-Scott & Lee, *supra* note 1, at 831.

4. The Convention on Biological Diversity (CBD), concluded in 1993 under the auspices of the United Nations, is designed to preserve biological diversity and protection, conservation, and sustainable use of resources. Its provisions place the responsibility for these actions with the nations on whose territory such resources are located. To this end, individual states are granted sovereign rights over their biological materials, including access and equitable sharing of benefits. Convention on Biological Diversity, *opened for signature* June 5, 1992, 2 U.N.T.S. 47, *available at* http://www.cbd.int/convention/text.

5. *Indonesia To Resume Sharing H5N1 Avian Influenza Virus Samples Following a WHO Meeting in Jakarta*, WORLD HEALTH ORG. MEDIA CTR. (Mar. 27, 2007), http://www.who.int/mediacentre/news/releases/2007/pr09/en/index.html.

6. *See id.* For the terms resulting from Indonesia's negotiations with the World Health Organization (WHO), see *Pandemic Influenza Preparedness: Sharing of Influenza Viruses and Access to Vaccines and Other Benefits*, 60th World Health Assembly, May 14-23, 2007 WHASS1/2006-WHA60/2007/REC1 at 102, *available at* http://apps.who.int/gb/ebwha/pdf_files/WHASSA_WHA60-Rec1/E/WHASS1_WHA60REC1-en.pdf.

7. *See* WHA Res. 60.28, *supra* note 6, at 102.

8. *See* Kamradt-Scott & Lee, *supra* note 1, at 839.

health. Following the H5N1 crisis, the WHO established task forces with the mission of developing a framework for accessing influenza virus samples from member countries in exchange for sharing the benefits resulting from the use of the samples released.[9] Extensive negotiations finally resulted in the WHO's adoption of the Framework for Pandemic Influenza Preparedness (PIP).[10] PIP was agreed upon by all member states and some representatives of the pharmaceutical industry and adopted by the World Health Assembly in May 2011.[11]

II. INTRODUCTION

The WHO's PIP Framework achieves an important first step toward ensuring widespread access to reasonably priced, H5N1-based products in that it secures access to virus samples. However, it falls short of taking the requisite second step of establishing an IP governance regime that would help, rather than hinder, the achievement of the Framework's overall goals of availability and affordability in the influenza-related medicines market (IRM).

This Article starts at the point at which the PIP Framework leaves off: trying to establish the contours of an IP governance regime for inventions based on virus samples released by WHO Centers under the Framework.

The purpose of this Article is twofold. First, it intends to examine, from an IP perspective, the Framework's ability to meet its objective of generating broader availability of affordable H5N1-based medicines.[12] Given its virtual silence on IP issues, the Framework does not restrict the virus samples recipients' ability to obtain IP protection in any significant way. However, the specific conditions created by the Framework and

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9. *See* 64th World Health Assembly, May 16-24, 2011, *Report by the Open-Ended Working Group of Member States on Pandemic Influenza Preparedness: Sharing of Influenza Viruses and Access to Vaccines and Other Benefits*, Provisional Agenda Item 13.1, WHO Doc. A64/8 (May 5, 2011), *available at* http://apps.who.int/iris/handle/10665/3346.

10. *See* 64th World Health Assembly, May 16-24, 2011, *Pandemic Influenza Preparedness: Sharing of Influenza Viruses and Access to Vaccines and Other Benefits*, WHA64.5 (May 24, 2011), *available at* http://apps.who.int/iris/handle/10665/3558.

11. *See id.*; Kamradt-Scott & Lee, *supra* note 1, at 835-36. This Framework raises many unprecedented international legal issues, including the role of private parties in international treaty negotiation, unanticipated use of the CBD to deny access to needed ingredient for drug development, and the extraordinarily enhanced role of intellectual property.

12. The Framework's objectives include access to and distribution of affordable diagnostics and treatments, including vaccines, to those in need, especially in developing countries, in a timely manner and expanding the global capacity to produce influenza vaccine, including in developing countries. World Health Org. (WHO), PANDEMIC INFLUENZA PREPAREDNESS FRAMEWORK FOR THE SHARING OF INFLUENZA VIRUSES AND ACCESS TO VACCINES AND OTHER BENEFITS (2011), *available at* http://apps.who.int/iris/handle/10665/44796.

extant in the industry place considerable hurdles in the path of drug developers.

All recipients of the virus samples pursue development based on the same biological material—the H5N1 influenza virus—and seek to develop generally equivalent inventions—diagnostics and vaccines. They will compete with each other downstream for technologies and market share and tend to resist each other's requests for licenses.[13] All this occurs in the context of an already competitive and highly regulated industry. Cumulatively, these conditions result in a suboptimal functioning of the patent system and exacerbate the natural process of narrowing of the number of players who place product on the market. The end effect may be a single-player or even a no-player scenario at the commercialization stage, a result that cannot support the Framework's availability and affordability objectives. A different approach to IP governance could change that.

The Article's second objective is to propose an IP governance regime that avoids the hurdles mentioned above and can better serve the Framework's goals of availability and affordability, by way of cross-licensing agreements structured in the form of a patent pool. The goal is to "unblock" the congested and adversarial downstream environment, by requiring all virus-sample recipients to contractually reallocate IP rights in a way that gives all parties freedom to operate from a patent perspective. The number of parties with access to proprietary technology would thus increase and improve the chances of broad-based, affordable commercialization.[14]

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13. For present purposes, the terms "upstream" and "downstream" denote the sequence of stages followed in product development, starting with research and development and ending with commercialization. These terms have also been used to refer to research intended to yield information, knowledge, or basic research (upstream) and to research that can directly form the basis of a product (downstream). *See* Rebecca Goulding et al., *Alternative Intellectual Property for Genomics and the Activity of Technology Transfer Offices: Emerging Directions in Research*, 16 B.U.J. SCI. & TECH. L. 194 (2010); Patrick Gaulé, *Towards Patent Pools in Biotechnology?*, (École Polytechnique Fédérale de Lausanne Coll. of Mgmt. of Tech., CDM Working Papers Ser. CEMI-REPORT-2006-010, 2006).

14. It is recognized that the IP regime is only one factor in a broad array of complex public health considerations that contribute to this ultimate goal. *See generally* Eileen Kane, *Achieving Clinical Equality in an Influenza Pandemic: Patent Realities*, 39 SETON HALL L. REV. 1137 (2009). However, discussion of the remaining considerations is beyond the scope of this Article.

A. The WHO Pandemic Influenza Preparedness Framework for the Sharing of Influenza Viruses and Access to Vaccines and Other Benefits (PIP)

The PIP Framework's intent is to facilitate access to H5N1 virus samples for purposes of drug development. Its mechanics are as follows: National Influenza Centers of WHO member states make available PIP biological materials to WHO Centers and agree to transfer those materials to third parties for purposes of development of influenza-related medicines (IRM).[15] The WHO Centers then provide material samples to qualified recipients, including influenza vaccine manufacturers, laboratories of the originating and other member states, as well as other laboratories that meet the requisite biosafety standards.[16] In exchange, recipients of the virus sample material are required to comply, inter alia, with certain benefit-sharing obligations in the form of monetary support, medicine donations, or technology transfers or licenses.[17] The benefit-sharing provisions are designed in the form of options, which require recipients to make a selection.[18] Due to the structure of options, the recipients can meet their obligations by providing product (vaccines or treatment courses) or monetary compensation, instead of licenses and technology transfers.[19]

The Framework covers "H5N1 and other influenza viruses with human pandemic potential."[20] From a structural standpoint, it consists of (1) a framework agreement that governs its general operations, including, inter alia, the deposit and transfer of virus samples, and (2) proposed

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15. WHO, *supra* note 12, ¶ 5.1.2.
16. *Id.* ¶ 6.3.
17. *Id.* ¶ 6.9.3, 6.13, 6.14.
18. *Id.*
19. WHO, *supra* note 12, Annex 2, SMTA 2, ¶ 4.1. A recipient outside of the WHO Global Influenza Surveillance and Response System (GISRS) may select from two out of six different choices, four of which relate to payment and pricing benefits. The remaining two relate to licensing and transferring of IP. Recipients may

> [(1)] Grant to manufacturers in developing countries licenses on mutually agreed terms that should be fair and reasonable including in respect of affordable royalties, taking into account development levels in the country of end use [sic] of the products, on technology, know-how, products and processes for which it holds [IP rights] for the production of (i) influenza vaccines, (ii) adjuvants, (iii) antivirals and/or (iv) diagnostics [or (2)] Grant royalty free licenses to manufacturers in developing countries or grant to WHO royalty-free, nonexclusive licenses on [IP rights], which can be sublicensed, for the production of pandemic influenza vaccines, adjuvants, antivirals products and diagnostics needed in a pandemic.

Id. ¶ 4.1.1.A5-A6. To the extent technology is licensed to the WHO, it may be sublicensed to manufacturers in developing countries.

20. WHO, *supra* note 12, ¶ 2(i).

Standard Material Transfer Agreements (SMTA) which bind recipients/developers to the terms of the Framework.[21]

In its approach to IP issues, the PIP seeks to strike a balance between public health needs and creating an incentive for private industry to develop and commercialize the medicines, including commercialization in "small and uncertain" markets.[22] Its guiding principles recognize both that "'intellectual property rights do not and should not prevent Member States from taking measures to protect public health' and 'that intellectual property rights are an important incentive in the development of new health care products.'"[23] The tension inherent in these guiding principles is reflected in the negotiations and the ultimately agreed-upon version of the Framework.

During the Framework's negotiation, a variety of proposals were made with respect to governance of IP rights to downstream improvements.[24] Some proposals sought to prohibit patenting of influenza biological materials outside the WHO system altogether.[25] Others required parties who made "patent protection or other intellectual property rights" claims based on the virus samples received to "disclose in the patent application, the country from where the Biological Materials were collected."[26] If commercialization were to result in financial gain, contributions should be made to the WHO's Coordinated

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21. *Id.* Two different standard MTA forms are provided, depending on whether the recipient party is "participating" or "nonparticipating" in funding the WHO Global Influenza Surveillance and Response System (GISRS) Centers, hereafter SMTA1 and SMTA2, respectively. *Id.* Annexes 1, 2.

22. *Id.* at 4 (citations omitted).

23. *Id.*

24. *See* 64th World Health Assembly, *supra* note 9.

25. This proposal was made by Bolivia, whose position was that the patenting of influenza biological materials in particular in a pandemic preparedness context, is against public health interests and thus contradicts the primary objective of the WHO's activities. 64th World Health Assembly, May 16-24, 2011, *Report by the Open-Ended Working Group of Member States on Pandemic Influenza Preparedness: Sharing of Influenza Viruses and Access to Vaccines and Other Benefits: Corrigendum*, Provisional Agenda Item 13.1, WHO Doc. A64/8 Corr.1 (May 12, 2011), *available at* http://apps.who.int/gb/ebwha/pdf_files/WHA64/A64_8Corr1-en.pdf. In the spirit of cooperation, Bolivia eventually withdrew this proposal, but indicated that it would reserve "its rights to seek a prohibition of the patenting of influenza biological materials outside WHO." Catherine Saez, *WHO Members on Verge of New Framework for Pandemic Flu Response*, INTELL. PROP. WATCH (May 23, 2011), http://www.ip-watch.org/weblog/2011/05/23/who-members-on-verge-of-new-framework-for-pandemic-flu-response/.

26. WHO Dir.-Gen., *Sharing of Influenza Viruses and Access to Vaccines and Other Benefits: Interdisciplinary Working Group on Pandemic Influenza Preparedness: Report by the Director-General* app. 3, at 7, WHO Doc. A/PIP/IGM/4 (Oct. 9, 2007), *available at* http://apps.who.int/gb/pip/pdf_files/pip_igm_4-en.pdf.

International Sharing of Influenza Viruses & Benefits Agreement.[27] Alternatively, it was proposed that as to

> [I]ntellectual property rights . . . obtained on inventions derived from the use of Materials, the holder/[provider] of such rights should grant to WHO a non-exclusive, royalty-free license, which WHO will sub-license to interested developing countries, for the purpose of maximizing availability of critical benefits on a non-profit basis, such as vaccines and anti-virals, for pandemic influenza preparedness purposes.[28]

Ultimately, none of these proposals were included in the final version and the Framework remains virtually silent on the divisive issue of IP rights.[29]

Our analysis will focus on the effect of the lack of any significant IP governance provisions in the Framework. To this end, the discussion will follow the virus samples' downstream path of development and seek to identify conditions that might develop into blockages or chokepoints. The goal is to develop data points that will inform the alternate IP regime proposed by this Article.

B. Attractiveness of the Influenza-Related Medicines (IRM) Market to Potential Developers

A threshold question to be addressed is whether the IRM market will be sufficiently attractive to potential developers, i.e., will there be takers for the virus samples released by the WHO Centers for purposes of development? This question must be viewed in the context of today's markets in which the development costs for a drug exceed $1 billion, and as a result, many new inventions remain on the shelves.[30] In this setting, only a strong market will attract developers and investors.

Review of the IRM product market indicates high growth rates. Following the 2005 and 2009 pandemics of the H1N1 and H5N1

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27. *Id.* However, it is unclear whether the influenza virus can properly be considered a "genetic resource" covered by the benefit sharing provisions of the CBD. The CBD has apparently been resolved in favor of including the influenza virus among genetic resources. *See* Frederick Abbott, *Unweaving Our Tangled Patent Web: Negotiating a Framework for the Sharing of Influenza Viruses with Human Pandemic Potential*, FREDERICKABBOTT.COM (Mar. 26, 2009), http://www.frederickabbott.com/frederickabbott/Portals/0/Documents/Abbott-Untangling_Web.pdf.

28. WHO, *Pandemic Influenza Preparedness, Outcome of the Open-Ended Working Group of Member States, Report by the Director-General*, A63/48, Annex (2010).

29. *See* WHO, *supra* note 12.

30. Francis S. Collins, *Reengineering Translational Science*, 3 SCI. TRANSLATIONAL MED. 1, 1 (2011); Hillary Greene, *Patent Pooling Behind the Veil of Uncertainty: Antitrust, Competition Policy and the Vaccine Industry*, 90 B.U. L. REV. 1397, 1410-11 (2010); *see infra* text accompanying note 83.

influenza strains, governments, national healthcare organizations, and international organizations started to provide increased support and funding for R&D and product development in influenza-related medicines (IRM), including diagnostics, prophylactics, and therapeutics.[31] These and other players began to further stockpile treatments as a method of preparedness and disease containment in case of a pandemic.[32] Partly, as a result, sales in the influenza-related drug industry have grown at a much faster rate than the overall pharmaceutical market.[33] Statistics show that "government spending worldwide on Pandemic Influenza Preparedness has more than tripled from $2.2 billion in 2004 to $7 billion in 2009" and is expected to reach "$10 billion by 2015."[34] These conditions would ensure that, at least at the outset, there is sufficient interest among potential developers of IRM to consider developing medicines in this field.[35]

C. Patenting Under the Framework

This Article will next examine whether potential developers face barriers to entry, first, with respect to obtaining virus samples under the Framework, and second, with respect to being able to secure patent protection.

1. Qualified Recipients of Virus Samples Under the Framework

Under the Framework, any manufacturers or laboratories that are qualified may obtain virus samples from WHO Centers.[36] Qualified recipients are those who meet the appropriate biosafety guidelines and best practices.[37] No other apparent limitations are placed on

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31. *See, e.g.*, U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-11-435, INFLUENZA VACCINE: FEDERAL INVESTMENT IN ALTERNATIVE TECHNOLOGIES AND CHALLENGES TO DEVELOPMENT AND LICENSURE 14 (2011) (describing how U.S. Congress increased funding for H5N1 research in 2005 and 2009). Influenza-related medicines are part of the "biologics" subset of the pharmaceutical industry in which products are created from living organisms (such as vaccines, antibiotics, and rDNA products). Greene, *supra* note 29, at 1407-08.

32. The WHO alone proposes to stockpile around 150 million doses of H5N1 vaccines. WHO, *supra* note 12, ¶ 6.9.2.

33. *See Global Pandemic Influenza Preparedness Market Forecast 2010-2015*, MARKET RES. MEDIA (March 2011), http://www.marketresearchmedia.com/?p=21.

34. *Id.*

35. This conclusion is also supported by the presence of numerous pharmaceutical manufacturers during the Framework's negotiations and their ultimate agreement to fund part of the operation. *See* Kamradt-Scott & Lee, *supra* note 1, at 835-36.

36. WHO, *supra* note 12, ¶ 6.3.

37. *Id.* ¶ 4.3. Recipients may be "outside the WHO GISRS," in which case SMTA1 governs, or "within the WHO GISRS," governed by SMTA2.

manufacturers or laboratories becoming qualified within the terms of the Framework. Nonetheless, the economic burden of meeting the requisite biosafety standards would likely have an inherently limiting effect on the number of potential recipients.

2. Patenting of the "Materials": Virus Samples

Recipients of virus samples are bound to a single mandatory provision regarding IP rights.[38] The provision states, "Neither the Provider nor the Recipient should seek to obtain any intellectual property rights (IPRs) on the Materials."[39]

The meaning of the term "materials" in this context is ambiguous: Does the prohibition against obtaining IP rights merely cover the sample's physical layer or does it extend to its informational layer, including its DNA structure?[40] The only other section in the Framework that makes reference to the issue of genetic data does not further illuminate the situation either. It requires that "[g]enetic sequence data . . . should be shared in a rapid, timely and systematic manner with the originating laboratory."[41] The framers clearly envisioned that genetic sequence data would be obtained and shared for purposes of follow-on research.[42] This fact would tend to imply unpatented genetic sequences, even though the possibility of sharing patented sequences cannot be ruled out. Two possible explanations for this lack of further specificity are (1) that genetic sequences are assumed to be part of the materials and fall under the prohibition against obtaining IP rights[43] or (2) that they are assumed not to be patentable inventions under national patent laws. Alternatively, the most plausible explanation is that these provisions simply did not undergo a thorough evaluation from a patent perspective.

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38. As mentioned earlier, the Framework does however contain a number of voluntary IP-related requirements. *See* discussion *supra* note 19.

39. WHO, *supra* note 12, Annex 1, ¶ 6.1 (Standard Material Transfer Agreement).

40. This question has also been posed in the context of plant genetic resources. Specifically, how the term "in the form received" is to be interpreted is unclear, as commented on in connection with section 12.3(d) of the International Treaty on Plant Genetic Resources for Food and Agriculture, Nov. 3, 2001, 2400 U.N.T.S. 303, *available at* http://www.planttreaty.org. Charles McManis & Eul Soo Seo, *The Interface of Open Source and Proprietary Agricultural Innovation: Facilitated Access and Benefit-Sharing Under the New FAO Treaty*, 30 WASH U. J.L. & POL'Y 405, 455 (2009); LAURENCE HELFER & GRAEME W. AUSTIN, HUMAN RIGHTS AND INTELLECTUAL PROPERTY: MAPPING THE GLOBAL INTERFACE 399 n.31 (2011).

41. WHO, *supra* note 12, ¶ 5.2.1.

42. The Framework clearly contemplates further development of the samples, in that it provides for "onward transfer and use." *Id.* ¶ 5.1.2., Annex 1 ¶¶ 1-2.

43. *See supra* text accompanying note 40.

This leaves the question of patentability to be determined under national patent laws.[44]

Most jurisdictions would preclude patentability of the virus samples as materials "occurring in nature."[45] Courts in some jurisdictions, however, have viewed isolated genes as "markedly different" from what exists in nature and considered them patent eligible.[46] Other jurisdictions view isolated genes as patentable even if they are similar to what exists in nature, albeit only if a specific useful function can be articulated.[47] The interpretation of the usefulness/industrial application requirement, however, varies quite significantly among jurisdictions.[48] Therefore, some recipients will, in all probability, seek and obtain early-stage, upstream patent protection for gene sequences, and in some cases, those patents may be granted based on relatively poorly articulated functions.

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44. Members of the Trade Related Aspects of Intellectual Property Agreement (TRIPS), may protect inventions in "all fields of technology," including biotechnology, that are new, display an inventive step, and are capable of industrial application. However, Member States may exclude certain biological processes that are related to "human . . . life or health" or "diagnostic, therapeutic, [or] surgical methods for the treatment of humans" under their national laws. Patentees of such inventions have the right "to prevent third parties not having the owner's consent from the acts of: making, using, offering for sale, selling, or importing" the patented product or process. Agreement on Trade-Related Aspects of Intellectual Property Rights, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Apr. 15, 1994, 1869 U.N.T.S. 299 [hereinafter TRIPS].

45. The materials would be viewed as discoveries or materials occurring in nature. *See* Diamond v. Chakrabarty, 447 U.S. 303 (1980) (holding that under title 25 U.S.C. § 101, "[a] live human-made micro-organism is patentable subject matter" and constitutes a new and useful "manufacture" or "composition of matter"); Convention on the Grant of European Patents art. 52.2(a), Oct. 5, 1973, 1065 U.N.T.S. 255 (stating that discoveries, scientific theories, and mathematical methods are not regarded as inventions capable of being granted patent protection).

46. Ass'n for Molecular Pathology v. Myriad Genetics, 653 F.3d 1329 (Fed. Cir. 2011) (holding that an isolated gene is "markedly different" in chemical structure from the one found in nature, which makes it a distinct chemical entity that is patentable, while questions remain as to purified genes). The treatment to be given to isolated or purified genetic sequences remains unclear under either patent law.

47. "An element isolated from the human body or otherwise produced by means of a technical process, including the sequence or partial sequence of a gene, may constitute a patentable invention, even if the structure of that element is identical to that of a natural element." Directive 98/44/EC of the European Parliament and of the Council of 6 July 1998 on the Legal Protection of Biotechnological Inventions, art. 5, 1998 O.J. (L 213) 30.7. pp.13-21 (1998). "[A] mere DNA sequence without indication of function does not contain technical information and is therefore not a patentable invention." *Id.* at 15.

48. *Compare* Burroughs Wellcome Co. v. Barr Labs., Inc., 40 F.3d 1223 (Fed. Cir. 1994) ("[T]he inventor must prove his conception by corroborating evidence, preferably by showing a contemporaneous disclosure . . . [and] describe his invention with particularity."), *with* Apotex Inc. v. Wellcome Found. Ltd., [2002] S.C.R. 153, 159, para. 3 (Can.) ("It was sufficient that at the time Glaxo/Wellcome scientists disclosed in the patent a rational basis for making a sound prediction that AZT would prove useful in the treatment and prophylaxis of AIDS, which it did.")

Such patents are difficult to invent around. A patent granted on a natural biologic, such as a gene, embodies the process of understanding and experimenting with foundational material over an extended period of time.[49] The party that isolates the particular gene holds considerable advantage over other researchers. Its patent may control all uses of the gene, including diagnostics, prophylactics, and treatment based on the respective sequence.[50] The owner of an upstream gene patent may therefore be able to exclude other sample recipients from developing technologies based on the respective patent and thus block or deter further downstream development.

3. Patenting of Derivatives and Improvements

Most inventions based on the virus samples will involve derivatives of the materials received or improvements thereto. Improvements and derivatives are likely patentable under the laws of TRIPS member countries, to the extent that such inventors meet the requirements for patentability.

The right to make improvements to an existing invention is reserved to the patent owner, as the process of follow-on invention requires use of the underlying invention.[51] An upstream patentee may therefore prevent third parties' development efforts, unless applicable national law provides for antiblocking mechanisms.[52] Consequently, derivatives and improve-

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49. Linda J. Demaine & Aaron Xavier Fellmeth, *Reinventing the Double Helix: A Novel and Nonobvious Reconceptualization of the Biotechnology Patent*, 55 STAN. L. REV. 303, 418 (2003).

50. Greene, *supra* note 30, at 1404.

51. *See generally* Marc A. Lemley, *The Economics of Improvement in Intellectual Property Law*, 75 TEX. L. REV. 989 (1997); *see also* Jerome H. Reichman, *Intellectual Property in the Twenty-First Century: Will the Developing Countries Lead or Follow?*, 46 HOUS. L. REV. 1115, 1135-37 (2010) (suggesting that the ability of foundational patent holders to block improvements is an obstacle to the creation of cutting-edge technologies in developed countries).

52. TRIPS article 31 permits use without the authorization of the rightsholder of a first patent for exploitation of a second patent provided that "the invention claimed in the second patent shall involve an important technical advance of considerable economic significance in relation to the invention claimed in the first patent." TRIPS, *supra* note 44, art. 31. Treatment differs depending on the degree of "significance" the dependent patent is required to have. *Id.* § (1)(i); *See, e.g.*, Patents Act, 1977, § 48A(1)(b)(i) (U.K.) (requiring an "important technical advance of considerable economic significance"); Patentgesetz [Patent Act], § 85(1) (as amended through July 31, 2009), *translated in Germany: Patent Law (as Amended by the Law of July 31, 2009)*, WIPO LEX, WORLD INTELL. PROP. ORG., http://www.wipo.int/wipolex/en/text.jsp?file_id=238776 (mandating that the use of a dependent patent is "urgently required in the public interest"). Given these limitations, antiblocking statutes may not provide a significant amount of relief.

ments of the virus samples tend to remain under the control of the initial sample recipients or their licensees engaged in development.[53]

D. Summary of Upstream Conditions

Next, this Article will take stock of the findings so far. Review of the Framework's IP provisions reveals that from an economic standpoint, the IRM industry appears sufficiently attractive for firms to consider investing into R&D and commercialization. From a legal standpoint, recipients of virus samples are free to seek patent protection for sample-based inventions. Allowable patenting is coextensive with national patent laws.

It is then reasonable to assume that all, or at least the majority, of sample recipients would pursue development based on the virus samples received from the WHO Center. If so, they would seek to develop either diagnostics or vaccines, both of which require use of the actual H5N1 strain. Several, if not all, recipients will seek patents based on the sample's genetic structure. All inventors will race to be the first to patent the invention in the most favorable jurisdiction possible.[54] Some inventions will be eliminated at the patenting stage, as only the first party to file a successful patent application is rewarded with a patent.[55] Any subsequently filed identical inventions are deemed to fail the novelty requirement.[56] Inventions that are not identical but generally functionally equivalent remain patentable in most jurisdictions, despite potential overlaps among them that result from the fact that they are based on the same biological resource and seek to patent similar functionalities.[57] These overlaps will ultimately require the patentees to seek licenses from each other in order to gain freedom to operate from a patent perspective. Because the virus sample recipients/patentees will be competing against

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53. For the view that the issue of allocation of rights to such improvements is not well solved by the patent system, see Reichman, *supra* note 51.

54. Subject to the fact that some inventors may drop out due to their inability to achieve an invention.

55. U.S. law grants patent rights to the first party to invent. 35 U.S.C. § 102 (2006). Starting March 16, 2013, the United States will grant patent rights to the first party to file. America Invents Act of 2011, Pub. L. No. 112-29, § 3(b)(1), (n), 125 Stat. 285, 293 (2011) (to be codified at 35 U.S.C. § 102).

56. *See, e.g.*, European Patent Convention, *supra* note 45, art. 54 (defining the novelty requirement for patents).

57. World Intell. Prop. Org. [WIPO], *Patent Search Report on Pandemic Influenza Preparedness (PIP) Related Patents and Patent Applications* (Apr. 1, 2011), *available at* http://www.wipo.int/patentscope/en/programs/patent_landscapes/documents/patent_landscapes/influenza_full_report_01_04_2011.pdf.

each other for a share of the same market, these overlaps may become problematic further downstream.

E. Downstream Conditions that Impact Patenting Under the Framework

1. Numerous Fragmented Patents Give Rise to Patent Thickets

Continuing the journey downstream, the next step is to consider how downstream conditions impact the ability of patent holders to develop a product in the IRM industry. In the biotechnology field, inventions tend to be "numerous and narrow."[58] Often, many different technologies are required to make up a product. The virus sample may yield different types of inventions, such as recombinant gene sequences, extracts, and derivatives of the virus genome, and new genetic constructs making use of material diagnostics.[59] A product would further require use of non-virus-based technologies, such as adjuvants and other formulation technologies, production technologies, or combinations thereof.[60] These various technologies are generally the subject of different patents and are likely owned by different patent holders.[61]

The rapid growth of the IRM industry, discussed above, further adds to the complexity of the technological landscape.[62] Readily available funding and a high market-growth rate have attracted a wide array of private and public players—governments, university research, small R&D companies, and vaccine manufacturers—into the upstream influenza drug space.[63] This heightened research activity is correlated with intensified patenting.[64] A sharp rise in patent applications based on the H5N1 virus was noted just shortly after the outbreak of the H5N1 2005 pandemic.[65] For instance, sixty-three H5N1 and H1N1 virus-strains-related vaccine applications were filed under the PCT in 2010,

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58. *See* Dan. L. Burk & Mark A. Lemley, *Biotechnology's Uncertainty Principle*, 54 CASE W. RES. L. REV. 691, 738 (2004). For example, in the case of H5N1 patent applications, "specific sequences from specific H5N1 strains are claimed, but within a very narrow composition of matter," and the resulting patent's scope is often narrower than the scope of the corresponding patent application. WIPO, *supra* note 57, at 31.

59. *Id.* at 8.

60. EDWARD HAMMOND, SUNSHINE PROJECT, SOME INTELLECTUAL PROPERTY ISSUES RELATED TO H5N1 INFLUENZA VIRUSES, RESEARCH AND VACCINES 4 (2007), *available at* http://www.sunshine-project.org/flu/patent_report.pdf.

61. Burk & Lemley, *supra* note 58.

62. *See supra* text accompanying notes 31-35.

63. Greene, *supra* note 30, at 1409-10.

64. HAMMOND, *supra* note 60.

65. *See id.*

compared to 19 applications in 2001,[66] mainly by pharmaceutical manufacturers, biotech companies, and research centers from the United States, Belgium, Switzerland, the Netherlands, and France.[67] As a result of this heightened activity, the IRM industry is a congested and competitive scene, which adversely impacts the ability to put together a product.

To assemble the requisite "technology package," i.e., to gather all the technologies necessary for development of a product, a drug developer must identify the technologies, locate their owners, and negotiate a freedom to operate arrangement for each technology.[68] The entire development process is governed by uncertainty: uncertainty regarding the success of patent applications[69] and uncertainty as to the fact that multiple licenses must be secured in a competitive market.[70]

Cumulatively, the difficulties that face a developer diminish the incentive to invest in commercialization.[71] These obstacles form what is known as a "patent thicket" or "anticommons."[72]

2. Patent Thickets, Holdouts, and Anticommons

Patent thickets occur when multiple owners hold patents that are necessary for a particular product.[73] A product developer is confronted

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66. *Id.* The applications considered in this study include only the patents narrowly derived from this particular strain.

67. *See id.* A further study performed under the auspices of WIPO indicates a similar rise in patent applications for the H5N1 and the H1N1 viruses. WIPO, *supra* note 57, at 3. While providing valuable analysis on the types of patents filed, the WIPO study, in its own terms, does not evaluate the situation from a "freedom-to-operate" perspective.

68. Anatole Krattiger & Stanley P. Kowalski, *Facilitating Assembly of and Access to Intellectual Property: Focus on Patent Pools and a Review of Other Mechanisms*, *in* INTELLECTUAL PROPERTY MANAGEMENT IN HEALTH AND AGRICULTURAL INNOVATION: A HANDBOOK OF BEST PRACTICES 132 (A. Krattiger et al. eds., 2007), *available at* http://www.iphandbook.org.

69. Burk & Lemley, *supra* note 58, at 737-38. The validity of a patent is only determined once an appellate level court has ruled on it.

70. Empirical evidence indicates that in the field of genetic inventions, commercialization of the final product is jeopardized when more than one to three licenses are necessary to develop the product. Rebecca Eisenberg, *Noncompliance, Nonenforcement, Nonproblem? Rethinking the AntiCommons in Biomedical Research*, 45 HOUS. L. REV. 1959, 1064 n.27 (2008).

71. *See* Burk & Lemley, *supra* note 58, at 724-26.

72. Goulding et al., *supra* note 13, at 204. Parties wishing to commercialize must find their way through the "tangled, twisted mass of IPRs, which criss-cross the established walkways of commerce . . . requir[ing] numerous contracts with multiple, independent right holders." Robert P. Merges, *Contracting into Liability Rules: Intellectual Property Rights and Collective Rights Organizations*, 84 CALIF. L. REV. 1293, 1296 (1996); Eisenberg, *supra* note 70, at 1060 (footnote omitted) (citation omitted). A player would be faced with an anticommons if the burden of negotiating the licenses necessary is disproportionate to the expected value of the product or the expected gain.

by "a dense web of overlapping intellectual property rights" that it must negotiate through in order to commercialize its product.[74] The greater the number of patents required to assemble the product, the more daunting the hurdles, as each license involves separate negotiations, uncertainty of outcome, delays, and costs.[75] These conditions are prone to holdouts, strategic behavior that prompts the holder of a technology essential to the product to refuse to license.[76]

> Because a given project will fail without their cooperation, "holdouts" may be prompted to demand a bribe close to the value of the entire project. And of course, every property holder needed for the project is subject to this same incentive; if everyone holds out, the cost of the project will rise substantially, and probably prohibitively.[77]

An anticommons in IP, first referred to in the seminal article by Heller and Eisenberg, is described as "too many IP rights in 'upstream' research results that could . . . restrict 'downstream' research and product development by making it costly and burdensome to collect all the necessary licenses."[78] As an overlapping, impenetrable rights structure, it would result in "underuse [of] scarce resources because too many owners can block each other."[79] A developer would have to obtain "rights to many different discrete components" of the product and, if unsuccessful, will not make use of the technology.[80] It seems that this theory is reflective of the biotechnology space, where "patents are numerous and narrow. Production of any given product may require bargaining with multiple patent holders. The potential for divided patent entitlements to prevent efficient integration into products is particularly high."[81] A study conducted by Rebecca Eisenberg reaffirms the fact that instances which

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73. Carl Shapiro, *Navigating the Patent Thicket: Cross-Licenses, Patent Pools, and Standard Setting*, *in* 1 INNOVATION POLICY AND THE ECONOMY 119, 120 (Adam. B. Jaffe et al. eds., 2001), *available at* http://www.nber.org/chapters/c10778.

74. *Id.* (expressing the concern that "stronger patent rights can have the perverse effect of stifling, not encouraging, innovation").

75. *See* Eisenberg, *supra* note 70, at 1073.

76. Burk & Lemley, *supra* note 58, at 728-29.

77. *Id.* at 733. *See generally* Mark A. Lemley & Carl Shapiro, *Patent Holdup and Royalty Stacking*, 85 TEX. L. REV. 1991 (2007).

78. Michael A. Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998).

79. *Id.* at 698.

80. Mark Lemley, *Contracting Around Liability Rules*, 100 CALIF. L. REV. 463 (2012).

81. Burk & Lemley, *supra* note 58, at 732. Following the seminal article by Heller and Eisenberg, *supra* note 72, there has been a great deal of debate on the concept of anticommons. *See* Goulding et al., *supra* note 13, at 204-05; Ronald Bailey, *The Tragedy of the Anticommons*, REASON.COM (Oct. 2, 2007, 3:10 PM), http://www.reason.com/archives/2007/10/02/the-tragedy-of-the-anticommons.

involve a scarce physical resource in a commercial setting, such as the PIP Framework, give rise to greater difficulties in obtaining access to research and technologies.[82]

Under the definition provided by Professor Lemley, the instant situation presents characteristics of both thickets and anticommons, in that (1) a developer in the IRM space must obtain "rights to many different discrete components" of the product (anticommons) and (2) in order to practice any invention based on the virus-sample, licenses are likely necessary to overlapping virus-sample patents.[83] Under either definition, the existence of a large number of patents, particularly genetic patents, presents the potential of a blockage.[84] The end effect is that a congested patent scene makes it difficult for innovators to conduct research and for developers to effectively access necessary patents.[85] Parties that develop in this space may be eliminated because they are unable to negotiate freedom to operate. Depending on the density of the thicket (number of patents to be licensed, economic and political dynamics among the players, etc.) it is possible that none of the players will be able to assemble all the requisite rights to a product.

3. Burdensome Regulatory Requirements

Finally, once the product has been developed and all rights have been assembled, manufacturers must contend with complex regulatory environments and clinical trial requirements. Many patented or

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82. In her paper *Noncompliance, Nonenforcement, Nonproblem? Rethinking the Anticommons in Biomedical Research*, *supra* note 70, at 1098-99, Rebecca Eisenberg points to circumstances in which an anticommons would be most likely, specifically listing situations that involve a physical resource developed for immediate commercial use.

83. Lemley, *supra* note 80. Aoki describes a similar situation in the field of genetic resources that results in an anticommons in the field of biology:

> These "transformation technologies" combine information "from many areas of biology, including crop genetics, breeding, agronomy, pest control and agro-ecology" that make "innovation . . . cumulative, in the sense that each invention builds on previous inventions, and complementary, in the sense that each invention contains elements derived from more than one source.
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> . . . .
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> . . . What these various proprietary claims on plant phenotype, genotype, and gene sequences within the plant begin to create is an "anticommons." Here, an "anticommons" entails a situation in which a particular resource is underutilized because of too many bottlenecks where several permissions must be obtained due to overlapping property/ownership claims.

Keith Aoki, *"Free Seeds, Not Free Beer": Participatory Plant Breeding, Open Source Seeds, and Acknowledging User Innovation in Agriculture*, 77 FORDHAM L. REV. 2275, 2296-97 (2009) (alterations in original).

84. Goulding et al., *supra* note 13, at 204.

85. *Id.* at 204-05.

patentable inventions remain on the shelves at research centers because bringing the invention to the market stage is too costly and uncertain.[86] Furthermore, the biologics industry, of which IRM are a part, is subject to "particularly rigorous" manufacturing standards.[87] Combined, these conditions result in a cost of bringing a drug to the market that can reach $700 million,[88] a fact which may further reduce the number of players that ultimately bring products to market.

F. Summary of Downstream Conditions

The journey along the downstream path of the virus samples yields the following conclusion: the absence of any IP governance provisions in the Framework has significant potential to undermine the Framework's overall goal of achieving broad-based availability of affordable medicines in the IRM space.

The upstream segment, from receipt of the samples through filing of applications for patent rights, unfolds normally as intended by the patent system. All sample recipients/inventors are likely to race to patent their invention in a favorable jurisdiction. Nonetheless, several factors signal the possibility of problems emerging downstream: early filing of gene patents, multiple parties conducting research on the same biological resources, and the fact that many will seek patents for functionally equivalent products.

This latent problem is then exacerbated by the specific conditions prevailing in the downstream IRM space: narrow and fragmented patents, a congested patent scene, and lengthy and expensive regulatory review and manufacturing. Most important, however, is the fact that all sample recipients/inventors will be competing for the same market. This may lead to strategic behavior such as seeking exclusive rights and implicitly barring others from use of ancillary technologies, such as adjuvants, or refusals of competitors' license requests.

Two phenomena may occur as a result: players may exit the race due to impenetrable patent thickets or, alternatively, the market may be monopolized by a single party in a holdout position. This could produce a "single-player," or alternatively, a "no-player" outcome when it comes to commercialization. Otherwise described, the cumulative effect of the conditions discussed above is akin to a funnel that progressively narrows the number of parties who successfully bring medicines to market.

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86. Arti Rai et al., *Pathways Across the Valley of Death: Novel Intellectual Property Strategies for* Accelerated *Drug Discovery*, 8 YALE J. HEALTH POL'Y, L. & ETHICS 53, 61 (2008).

87. Greene, *supra* note 31, at 1408 (footnote omitted) (citation omitted).

88. *Id.* at 1411 (footnote omitted) (citation omitted).

While many different conditions contribute to the funnel effect, IP rights have the ability to exacerbate and, under certain circumstances, even block it, with the result that the product cannot be commercialized. An alternative IP governance regime could help defuse the competitive tensions that exist in the downstream space and remove IP-related choke points to allow products to reach the market.

G. Other Models

The following Parts will examine models that could help eliminate IP-related choke points.

1. Nonproprietary, Open Source, and Compulsory License Approaches

The broadest accessibility to technologies would be achieved by prohibiting patenting of both materials and improvements altogether.[89] Because no patent protection is involved, the thicket problem can be avoided and no competitive tensions would arise downstream. However, absence of exclusivity in the context of the investment-intensive pharmaceutical industry is likely to deter firms from investing.

A semiproprietary, yet more accessible option is offered by the open source model, frequently encountered in the software industry.[90] The goal of an open source model is to allow contributors and users freedom of access to, and use of, existing innovation.[91] In a biotechnology context, an open source model would start out with certain patented material.[92] Subsequent transfers would be based on open source terms.[93] Such terms generally include nonexclusive licenses and reach-through obligations that bind successive transferees to share improvements on the provisions set forth in the original license.[94] A grant-back provision might require that improvements be licensed back to the original patentee/licensor who would then act as a repository of knowledge related to the particular technology and make it openly available.[95]

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89. This solution was proposed by some of the Member States. *See* 64th World Health Assembly, *supra* note 25.

90. *See* Goulding et al., *supra* note 13.

91. *See id.* at 206; Robin Feldman, *The Open Source Biotechnology Movement: Is It Patent Misuse?*, 6 MINN. J.L. SCI. & TECH. 117, 118 (2004).

92. Goulding et al., *supra* note 13, at 206.

93. *Id.*

94. *See* Feldman, *supra* note 91, at 145-59.

95. Goulding et al., *supra* note 13, at 207.

This solution is conceptually akin to the General Public License (GPL)[96] open source license in the software field. Initially, this form of software licensing was met with considerable resistance from larger software producers.[97] However, in recent years, large software companies have begun to rely increasingly on open source software as part of their enterprise software strategy.[98] Would an open source model in a biotechnology/pharmaceutical setting follow the same course? The oft-cited differences between the two fields—including the long development timeline, the need for elaborate laboratory infrastructure, and the regulatory oversight imposed on the biotechnology and pharmaceutical industries—would probably make open source difficult to accept in the traditional, commercial, biotechnology/pharmaceutical context.[99] Nonetheless, the model remains viable for nontraditional applications, such as platforms to share biotechnological knowledge for use in underserved communities that are funded by means other than the patent system.[100]

Finally, a compulsory license approach would require recipients to grant licenses under specified terms and conditions to parties such as the WHO or member states in exchange for using the materials. In principle, a compulsory license would be only marginally more appealing to potential patentee/developers than a nonproprietary or semiproprietary solution. Nonetheless, the ultimate acceptability of a licensing solution is a function of the specific terms and conditions imposed.

2. Compensatory Liability Approach

In situations involving microbial samples, Professor Reichman proposes implementation of a compensatory liability model[101] that

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96. *GNU General Public License Versions*, OPEN SOURCE INITIATIVE, http://www.opensource.org/licenses/gpl-license.php (last visited Oct. 20, 2012).

97. Brent K. Jesick, *Democratizing Software*, FIRST MONDAY (Oct. 6, 2003), http://firstmonday.org/htbin/cgiwrap/bin/ojs/index.php/fm/rt/printerFriendly/1082/1002.

98. *Open Source Software Market Accelerated by Economy and Increased Acceptance from Enterprise Buyers, IDC Finds*, BUS. WIRE (July 29, 2009, 08:00 AM EDT), http://www.businesswire.com/news/home/20090729005107/en/Open-Source-Software-Market-Accelerated-Economy-Increased.

99. *See* Goulding et al., *supra* note 13, at 207.

100. *Id.* An example of such a platform is the nonprofit research institute known as the CENTER OF APPLICATIONS OF MOLECULAR BIOLOGY TO INTERNATIONAL AGRICULTURE (CAMBIA), http://www.cambia.org (last visited Sept. 28, 2012), which deals in the proliferation of life sciences technology.

101. Jerome H. Reichman, *A Compensatory Liability Regime To Promote the Exchange of Microbial Genetic Resources for Research and Benefit Sharing*, *in* DESIGNING THE MICROBIAL RESEARCH COMMONS: PROCEEDINGS OF AN INTERNATIONAL WORKSHOP 43, 48 (Paul F. Uhlir ed., 2011).

"provides an intermediate zone, where Creative Commons licenses are insufficient but exclusive rights and concomitant restrictions on research would impose unnecessary overkill in relation to the still uncertain value of the upstream inputs."[102]

Unlike the PIP Framework's purely proprietary approach, the compensatory liability model envisions a semicommons that would allow members to freely use microbial material deposited in collections without prior permission. Under Professor Reichman's model, if the research is put to commercial use, regardless of whether it is based on a proprietary invention or not, recipients would be required to pay royalties of two to four percent of gross sales.[103] This obligation is incurred contractually, *ex ante*. It gives recipients of the microbial material a conditional right to use and the owner/depositors a conditional entitlement to collect royalties in the event of successful commercialization.[104] Downstream transfers of the materials are subject to the same obligations.[105]

In situations with imminent prospects of commercialization in the context of a strong market, the compensatory liability model would not avoid the patent thicket effect likely to evolve in the downstream space. This model therefore remains better suited for situations where the commercial end point is more remote, and where funding through the patent system plays a less significant role.

H. Conceptual Basis for an Alternative Solution

Review of the models discussed above reveals that none of them appear suited to resolve the specific issues presented by the PIP Framework. We will therefore seek to develop a new approach to IP governance that addresses these problems, drawing on the data points gathered in the foregoing discussion. The following are some of the considerations that should inform its structure.

First, the ability to patent inventions based on the virus samples must be preserved. Absent the prospect of patent exclusivity, players would be reluctant to invest in research and development.

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102. *Id.* at 48.

103. *Id.* at 47.

104. The depositor would not "forfeit all rights to benefit from downstream commercial applications," and would instead share in them, should such applications emerge. *Id.* at 45; *see also* Jerome H. Reichman, *Of Green Tulips and Legal Kudzu: Repackaging Rights in Subpatentable Innovation*, 53 VAND. L. REV. 1743 (2000) (arguing that a compensatory liability regime would help to protect "small-grain-sized" innovations).

105. *See* Reichman, *supra* note 101, at 47.

Second, a solution would have to be directed primarily at the competitive situation downstream. Sample recipients typically compete for two reasons. The first reason is to gain priority in patenting. This race is part of the normal operation of the patent system, which is designed to reward the winner and to eliminate identical or virtually identical inventions filed at a later time.[106] The second reason for which players compete is to gain a share of the market. This race takes place among the winners in the first race, i.e., patentees of inventions that are largely functionally equivalent. Their goal is to gain as large a share of the market as possible and concomitantly to exclude each other from the market. These efforts are not based on actual patent rights, but they are related in that they would not occur but for the existence of patent rights. They could be described as "patent-related interests" and would probably form a gray area between acceptable competitive practices and practices that might violate antitrust laws.[107] By way of example, practices prompted by patent-related interests might include seeking to obtain an exclusive license on the only adjuvant suitable for production of vaccines of this particular influenza strain, or alternatively, denying a license needed by another recipient/patentee for freedom to operate.

Intervention by way of an alternative approach would have to occur at the level of the second race and would prohibit patentees from acting in pursuit of such patent-related interests. Instead of competing against each other, the patentees would be required to license to each other the rights necessary to operate freely in the market. But would this deal be sufficiently attractive to keep the players in the game?

The conceptual premise is that "freedom to operate" from a patent perspective generally suffices for a player to function in the market and make at least a modest profit. While by cross-licensing the patentees give up their exclusivity and their patent-related interests, their freedom to operate is assured, since they gain rights from all other patentees that they would otherwise have had trouble acquiring. Requiring all players to cross-license to each other would reduce each individual player's profit potential, but at the same time it would reduce the risk of not being able to commercialize at all (e.g., as a result of a holdout by another player). In effect, the patentee/developer would swap a low probability of gaining

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106. *See supra* text accompanying footnotes 54-57.

107. "The value of patent pooling within the biotechnology and related fields has received considerable attention, primarily by commentators, owing to the perceived promise of improved social welfare (including decreased transaction costs, increased pricing efficiency, and faster innovation) and despite the acknowledged potential for antitrust issues." Greene, *supra* note 31, at 1413 n.69; *see* discussion *infra* note 119.

a large market share with the strong probability of gaining a smaller market share.

Another way of conceptualizing this approach is to view the patentee's overall interest as consisting of the patent right plus the patent-related interest. Combined, the two form too capacious a right and risk, crossing the line into anticompetitiveness. To avoid this result, a certain quantum of this right would need to be relinquished. This could occur by re-bundling the combined rights of the patentee/developers in a manner that prevents each individual's interest from becoming unduly extensive. Of course, this solution would have to be carefully calibrated to avoid an excessive reduction of the profit potential, in which case players might drop out or refrain from participating in the first place. However, if applied carefully the solution has the potential of keeping multiple players in the game and would likely avoid a no-player/single-player scenario.

I. Leveraging the Asymmetry in Bargaining Power

On the assumption that a sufficiently well-calibrated reallocation can be reached, an obvious question must be addressed: By what means can patentees be persuaded to relinquish some of the patent exclusivity to which they are entitled?

The Framework is actually well positioned to impose conditions on sample recipients. The fact that the WHO acts as gatekeeper to the virus samples gives rise to a certain bargaining asymmetry in its favor and allows it to act in a quasi-legislative capacity with respect to downstream IP treatment. By way of the SMTA, the Framework can affirmatively shape the recipients' downstream behavior,[108] including obligating them to enter licensing arrangements.[109] Nonetheless, because the Framework is reached by consensus among participants, this asymmetry is not so strong as to give the WHO unlimited discretion. A viable approach must not deprive the recipients of profit potential and must achieve an acceptable balance between the Framework's policy objective, the interests of member states, and those of the pharmaceutical industry at present.[110]

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108. *See* Michael Halewood, *Governing the Management and Use of Pooled Microbial Genetic Resources: Lessons from the Global Crop Commons*, 4 INT'L J. COMMONS 404, 426-27 n.17 (2010).

109. The legal vehicle by which the Framework imposes obligations on virus sample recipients is a Standard Material Transfer Agreement (SMTA). *See supra* notes 16-20 and accompanying text.

110. With regard to the Framework's negotiations with the pharmaceutical industry, balancing is of great importance as there is always a "risk that pharmaceutical manufacturers

J. A Patent Pool as an Alternative Solution

This Part will explore the more precise contours of the alternate approach discussed above.

As a formal structure for a cross-licensing requirement, this Article proposes a patent pool. Patent pools are conceptually premised on a contractual variance of legislatively allocated IP rights. Full patent rights are "rebundled" to grant participants sufficient rights to ensure freedom to operate from a patent perspective.[111] In a congested space, rebundling in the form of a patent pool provides a more flexible and efficient allocation of rights. Pooling helps players assemble the necessary technologies, reduces transaction costs, and avoids the inefficiencies that result from patent thickets.[112] Under certain circumstances pooling may also support noncommercial uses and allowances for CBD obligations.[113] A pool is likely to enjoy broader overall acceptance because it seeks to reconcile the interests of all stakeholders.

Patent pools are informally defined as agreements "between two or more patent owners to license one or more of their patents to one another or third parties."[114] Members of a pool assign their rights in patents and patent applications to a separate administering entity, which then licenses these rights in rebundled form to pool members and third parties, subject to terms and in accordance with rules agreed upon by the members.[115] By providing participants with freedom to operate from a patent perspective, product development is stimulated.[116]

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might choose to exit the industry if too many barriers or obligations were imposed upon them." Kamradt-Scott & Lee, *supra* note 1, at 839.

111. *See* Goulding et al., *supra* note 13, at 210. The concept of contractually rebundling IP rights with the intent to direct the innovation process has been given relatively little attention. *But see* Michael W. Carroll, *One Size Does Not Fit All: A Framework for Tailoring Intellectual Property Rights*, 70 OHIO ST. L.J. 1361 (2009) (proposing a tailoring framework for IP rights).

112. Goulding et al., *supra* note 13, at 210.

113. *See* Halewood, *supra* note 108, at 428-29 (describing how patent pooling has been used to held the Board of the European Culture Collections Organization).

114. JEANNE CLARK ET AL., U.S. PATENT & TRADEMARK OFFICE, PATENT POOLS: A SOLUTION TO THE PROBLEM OF ACCESS IN BIOTECHNOLOGY PATENTS? 4 (2000), *available at* http://www.uspto.gov/web/offices/pac/dapp/opla/patentpool.pdf (footnote omitted) (citation omitted). "Just as there is no formal legal definition of the term 'patent pool,' there are no national or international laws or regulations guiding the formation of patent pools." Goulding et al., *supra* note 13, at 211 n.87.

115. *See* Merges, *supra* note 72, at 1340; *see also* Josh Lerner & Jean Tirole, *Public Policy Toward Patent Pools*, *in* 8 INNOVATION POLICY AND THE ECONOMY 157, 159 (Adam B. Jaffe et al. eds., 2008).

116. *See* Lerner & Tirole, *supra* note 115, at 159; Krattiger & Kowalski, *supra* note 68, at 143; Merges, *supra* note 72, at 1340-42.

With the growth of the biotechnology industry, bioinformatics, and related industries, patent pools have increasingly come under consideration in the life sciences field.[117] Industry resistance to patent pools is decreasing, and governments tend to encourage at least those pools perceived to provide a social benefit.[118]

K. Considerations in Establishing a Patent Pool

Depending on their specific licensing terms, patent pools present the risk of being viewed as anticompetitive by antitrust/competition authorities. The underlying licensing agreements are therefore subject to review as to whether their competitive benefits outweigh the potential harm to competition.[119]

In general, competition-regulating authorities view patent pools as procompetitive. The United States Department of Justice's IP Guidelines point to the fact that pools provide benefits such as "integrating complementary technologies, reducing transaction costs, clearing blocking positions, and avoiding costly infringement litigation."[120] The USPTO has also opined favorably on the formation of patent pools, because "the social and economic benefits of [the pooling of biotechnological patents] outweigh their costs."[121]

In evaluating the acceptability of an individual patent pool in the biotechnology area, it must be kept in mind that the IP Guidelines contemplate primarily patent pools in the electronics industry, which are largely organized around industry standards and may respond to different needs. Much of antitrust law in the biotech area is still limited to "merely

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117. Greene, *supra* note 107.

118. *See, e.g.*, Sarah Boseley, *Big Pharma Shows Willingness To Pool HIV and AIDS Drug Patents*, Posting on *Sarah Boseley's Global Health Blog*, GUARDIAN (Feb. 10, 2011), http://www.guardian.co.uk/society/sarah-boseley-global-health/2011/feb/10/drugs-pharmaceuticals-industry (discussing how even major pharmaceutical companies are interested in at least negotiating towards a patent pool); *G8 Encourages Drug Companies To Work with the Pool*, MEDICINES PATENT POOL (May 27, 2011), http://www.medicinespatentpool.org/G8-encourages-drug-companies-to-work-with-the-pool (highlighting how the Medicines Patent Pool encourages HIV medication innovation and development).

119. The United States Department of Justice (DOJ) inquiry is focused on the issues of (1) whether the proposed licensing program is likely to integrate complementary patent rights, and if so, (2) whether the resulting competitive benefits are likely to be outweighed by competitive harm posed by other aspects of the program. U.S. DEP'T OF JUSTICE, ANTITRUST GUIDELINES FOR THE LICENSING OF INTELLECTUAL PROPERTY (1995), *available at* http://www.usdoj.gov/atr/public/guidelines/ipguide.htm. The Department of Justice's assessment of whether patent pools would be deemed pro- or anticompetitive are set forth in the DOJ *Antitrust Guidelines for the Licensing of Intellectual Property* (*IP Guidelines*).

120. U.S. DEP'T OF JUSTICE, *supra* note 119, at 28.

121. CLARK ET AL., *supra* note 114, at 8.

importing existing norms developed within the standard-setting context"[122] without addressing specific issues raised by the biotechnology industry, despite the existence of a good number of scholarly writings on the topic.[123]

Electronics industry precedents limit pool membership to "essential" patents and concomitantly exclude "substitute" patents.[124] This requirement could be an obstacle in the case of early pool formation, such as in an influenza virus-based pool, because the technological relations among the patents are still undefined. Some authors have proposed a more liberal interpretation of the essentiality requirement for biotechnology pools.[125] In general, development of biotechnology or pharmaceutical products requires assembly of a large number of patents. Pool formation occurs necessarily at an early stage as part of the product development strategy.[126] Because at this stage the products are not in existence yet, it is difficult, if not impossible, to determine whether any given patent pool is indispensable, rather than substitutable.[127] Applying the essential patent limitation in the context of an influenza virus-patent pool, for instance, would be based on a mere assumption of their technological relation.[128] An erroneous decision in this regard could render the pool useless.[129] This constitutes a strong argument in favor of forgoing the essentiality requirement in the case of

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122. Greene, *supra* note 31, at 1455.

123. *E.g.*, Josh Lerner & Jean Tirole, *Efficient Patent Pools*, 94 AM. ECON. REV. 691, 691 (2004) (discussing antitrust law as it applies to patent pooling in the biotechnology industry); Krattiger & Kowalski, *supra* note 68 (same); Courtney C. Scala, *Making the Jump from Gene Pools to Patent Pools: How Patent Pools Can Facilitate the Development of Pharmacogenomics*, 41 CONN. L. REV. 1631 (2009) (same); Goulding et al., *supra* note 13 (same); Gaulé, *supra* note 13 (same).

124. Because the IP Guidelines require that the pool contain only "essential patents"—i.e., those which are necessary to implement the technology—the implication is that substitutes, either within or outside the pool, should not be accepted. Lerner & Tirole, *supra* note 115, at 160; Greene, *supra* note 31, at 1439. Whether government pronouncements in this regard hold true with respect to the biotech and, in particular, the antiviral industry remains to be seen. In general, an individual pool is likely to pass muster under competition rules, if it (1) serves no ancillary purpose, (2) allows independent licensing by participants, (3) includes only essential patents, and (4) avoids grant-backs. *See* Scala *supra* note 123, at 1653-54; Lerner & Tirole, *supra* note 115, at 177.

125. Some scholars believe that there is no harm to competition as long as at least one valid essential patent is included in the pool and independent licensing by all patentees is permitted. *See* Richard J. Gilbert, *Antitrust for Patent Pools: A Century of Policy Evolution*, 2004 STAN. TECH. L. REV. 3, http://stlr.stanford.edu/pdf/gilbert-patent-pools.pdf; *see also* Lerner & Tirole, *supra* note 115.

126. *See* Greene, *supra* note 31, at 1437.

127. *See id.*

128. *See id.*

129. *See id.*

biotechnology pools, but it is currently untested. As a precaution, a potential pool's legal position would have to be bolstered by additional arguments.

Lerner and Tirole suggest that a pool that allows independent licensing by the parties would stand a good chance of passing antitrust muster.[130] In fact, Lerner and Tirole propose a "safe harbor" model in which prima facie antitrust compliance could be achieved by meeting only two criteria: that the pool "(1) serve[s] no ancillary purpose (i.e. traditional collusion or market division) and (2) allow[s] for independent licensing of the individual patents by their respective owners."[131] A structure based on this approach would have a better chance of not being found anticompetitive, even in the absence of clarity on the question of patent essentiality.

L. The SARS Patent Pool

Relatively few precedents of biotechnology patent pools exist.[132] The only pool in the influenza field is the genomic patent pool involving the SARS coronavirus (severe acute respiratory syndrome).[133]

Following the SARS outbreak in 2003, a number of institutions, including major research centers such as the Berhardt Nocht Institute, the British Columbia Cancer Agency (BCCA), the U.S. Center for Disease Control (CDC), and Hong Kong University (HKU) began simultaneously sequencing the SARS virus.[134] Each of these institutions had filed patent applications with the USPTO on the coronavirus' genomic sequence, along with a general description of how the knowledge contained therein would be converted into diagnostics and treatments.[135]

The number of prospective patent holders gave rise to the concern that patent rights to the SARS genomic sequence would be excessively

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130. Lerner & Tirole, *supra* note 115, at 160, 163-67.

131. Lerner and Tirole based their findings on a study of sixty-three different patent pools. *Id.* at 177.

132. *See, e.g.*, *Medicines Patent Pool: Facilitating Access to HIV Treatment*, WIPO MAG., June 2011, http://www.wipo.int/wipo_magazine/en/2011/03/article_0005.html (discussing the Medicines Patent Pool that deals in HIV medicines); Esther van Zimmeren, *From One-Stop to One-Stop-Shop* 26 (July 6, 2006) (unpublished working paper) (on file with University of California, Berkeley) (discussing the use of patent pooling for the *Aequorea victoria* fluorescent protein).

133. Van Zimmeren, *supra* note 132, at 23.

134. Matthew Rimmer, *The Race To Patent the SARS Virus*, 5 MELB. J. INT'L L. 335, 336, 340-49 (2004); *see also Summary of Probable SARS Cases with Onset of Illness from 1 November 2002 to 31 July 2003*, WHO (Sept. 26, 2003), http://www.who.int/csr/sars/country/table2003_09_23/en.

135. *See* Rimmer, *supra* note 127.

fragmented.[136] As a result of the probability of quasi-simultaneous filing by multiple entities, interference proceedings were anticipated and the uncertainty over patent rights was feared to cause manufacturers to delay investment decisions.[137] To overcome these concerns, all patent holders agreed to cooperative pooling, combining their technologies by licensing them to a separate entity that would make them available to licensors and third parties by way of nonexclusive licenses.[138] Because it took an extended period of time to agree which patents to include, to craft the pool structure agreement and its licensing terms, and to ensure that antitrust and other regulations were met,[139] the SARS outbreak was contained before the pool was ever completed. Because a business review was not requested and the proposed structure has not been ruled upon by the United States Department of Justice (DOJ),[140] whether the pool would have been successful remains inconclusive.[141]

Nonetheless, the SARS pool experience presents a few practical steps to consider. As circumstances will inevitably demand urgency, advance development of a legal blueprint for formation of similar patent pools would be useful. The blueprint should consider, inter alia, the fact that influenza virus pools are likely to consist in part or entirely of patent applications.[142] The risk of non-issuance would therefore have to be neutralized.[143] Further, because of the lengthy R&D process, the commercial endpoint is often not clear until the development process has concluded.[144] Therefore, determinations of essentiality and substitutability at the stage of formation are virtually impossible. Arguments regarding the pool's legality under antitrust laws should also

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136. *Id.* at 351; James H.M. Simon et al., *Managing Severe Acute Respiratory Syndrome (SARS) Intellectual Property Rights: The Possible Role of Patent Pooling*, 83 BULL. WORLD HEALTH ORG. 707, 707-08 (2005), *available at* http://www.scielosp.org/scielo.php?pid=S0042-96862005000900017&script=sci_arttext&tlng=e.

137. *Id.*

138. Goulding et al., *supra* note 13, at 211.

139. *Id.*

140. *Id.*

141. A number of other pooling arrangements exist, such as the pool for neglected tropical diseases formed by drug manufacturer Glaxo Smith Kline and one for diagnostic genetics that creates patent pools for technical standards and other technology platforms. *Medicines Patent Pool*, *supra* note 132.

142. Goulding et al., *supra* note 13, at 198.

143. *Id.*

144. In the SARS context, the relationship between the patents and specific commercial products that might incorporate the patents' teachings differed from the historical precedents. In the SARS case, as for genomics in general, commercial, therapeutic, and prophylactic products can be placed on the market only after a lengthy research and development process, and the range of possible commercial endpoints remains only partially defined until well into the development process. *See id.* at 210-11.

be part of the blueprint. Along the lines suggested by Lerner and Tirole and Gilbert, the pool should provide for independent licensing.[145]

Assuming an influenza-based patent pool can successfully overcome these hurdles and address the requisite antitrust problems,[146] it would provide considerable benefits over individual licensing. Such a patent pool would promote participation of multiple players in the market,[147] stimulate innovation by granting access for research purposes, and allow more efficient pricing.[148] Pooling of patents derived from the influenza virus would diffuse the tension among the recipient/patentees who compete for a share of the market by forcing them to cross-license in a situation in which they might have denied licenses to each other. The number of players in a position to bring products to market would therefore be increased. In short, it appears that a patent pool could serve as a beneficial IP governance model for the Framework.

M. Enforcing the Pooling Agreement

This leads to a final consideration, namely the vulnerability of the proposed structure to reluctant recipients. A recipient of virus samples, required by the SMTA to participate in a patent pool, can too easily prevent the pool's formation by stalling negotiations.[149] The entire structure would then become illusory. The SMTA could be given "teeth" by providing that failure to form a pool that would trigger default to a pre-established fixed royalty. The royalty could be a percentage of revenue from products based on the virus samples, which the recipient/patentee would become obligated to pay in the event a patent pool is not established.

The critical element for this structure to be successful is the level at which the royalty rate is set. If the rate is too low, not pooling may become preferable to the patent pool. It would allow parties to "buy" their exclusivity in the market by way of a low royalty and avoid sharing technologies with potential competitors. The result would in effect be a compensatory liability regime, which, as discussed above, is not

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145. Lerner & Tirole, *supra* note 115; Gilbert, *supra* note 125.

146. Some commentators suggest that patent pools are more appropriate in mature industries, in particular those with surrounding industry standards. *See* Krattiger & Kowalski, *supra* note 68, at 141; Rimmer, *supra* note 127, at 358.

147. The usefulness of a patent pool increases with the number of patents required for assembling a product, and the number of individual transactions required to do so. Merges, *supra* note 70, at 1319.

148. Greene, *supra* note 31, at 1424.

149. *See supra* note 76 and accompanying text.

equipped to deal with patent thickets.[150] If, on the other hand, the default rate is too high, it may be a deal breaker *ab initio*, in that parties might not enter the SMTA. The default rate would have to be just high enough to make a patent pool a more attractive option and deter parties from electing not to pool. Therefore, if calibrated correctly, a default royalty rate can operate as a safety mechanism to ensure that a patent pool is in fact formed.

III. CONCLUSION

The PIP Framework does not provide for an IP governance regime for inventions based on H5N1 virus samples released by WHO Centers to private parties under the Framework. The resulting unrestricted patenting does not, contrary to conventional belief, result in broad-based availability of products. Examination of the conditions along the downstream path of the virus samples reveals that the cumulative effect of a number of conditions causes the patent system to function suboptimally. These conditions include the fact that all recipient/ inventors rely on the same biological resource, that they seek to patent largely similar functionalities, that gene patents are sought early upstream, and that patents in the field are narrow and fragmented. As a result, each developer must license multiple patents in order to obtain freedom to operate. These conditions give rise to patent thickets and render development of products difficult or impossible. Furthermore, many of the licenses must be secured from competitors in the same market, a situation that is prone to holdouts. When it comes to commercialization, the strong risk of a "single-player" or a "no-player" scenario exists, a setting that does not support the Framework's overall goal of providing broad-based availability of affordable medicines.

Based on the data points generated by the analysis, this Article considers an IP governance model that better meets the Framework's goal of availability and affordability. The proposal is a cross-licensing arrangement in the nature of a patent pool. Its conceptual premise is to reallocate IP rights among the recipient/inventors so that each has freedom to operate from a patent perspective. This would reduce the players' profit potential, but, on the other hand, would also reduce their risk of not being able to commercialize. A larger number of players would bring products to market. Overall, the proposed model would better meet the objectives of broader availability and affordability of influenza-related medicines.

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150. *See supra* text accompanying notes 101-104.