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THE ECONOMICS OF INFORMATION, STUDIOUSLY IGNORED IN THE NAGOYA PROTOCOL ON ACCESS TO GENETIC RESOURCES AND BENEFIT SHARING

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1

INTRODUCTION

Economic thinking has been absent in all ten Conferences of the Parties (COP) to the United Nations Convention on Biological Diversity (CBD) despite its presence in the academic literature.¹ Perhaps as a consequence of faithful reporting, economics is also absent in the otherwise excellent overview by Kamau et al of the Nagoya Protocol on Access to Genetic Resources and Benefit Sharing.² By ignoring the abstraction that economics affords, ‘access and benefit sharing’ (ABS) has become needlessly complex and contentious. To resolve the issues so well identified by Kamau et al, we will apply the economics of information to ABS. What emerges is a radically different alternative to policymaking-as-usual. Key to our endeavor is a narrative that can penetrate the social sphere where ABS must achieve legitimacy. Language is of paramount importance.

2

INFORMATION AS THE OBJECT OF ACCESS

Access is a transitive verb. What is one accessing? The answer appears in the full title ‘The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation to the Convention on Biological Diversity’. ‘Genetic resource’ as the object is explicit in Article 3:

This Protocol shall apply to genetic resource within the scope of Article 15 of the Convention and to the benefits arising from the utilisation of such resources. This Protocol shall also apply to traditional knowledge associated with genetic resources within the scope of the Convention and to the benefits arising from the utilisation of such knowledge.³

Many Parties are dissatisfied. By transitivity, the definition of ‘genetic resource’ in Article 2 of the CBD is ‘any material of plant, animal, microbial or other origin that contains functional units of heredity’.⁴ The rub is that many patented biotechnologies do not access material with functional units of heredity and patent holders can thereby refuse to share benefits. Similarly, much associated traditional knowledge has long since fallen into the public domain. Recognising the first of these two lacunae, the concept of ‘derivative’ gained traction during the nine Ad-Hoc Working Groups on ABS that spanned some ten years. The second lacuna is more problematic as correctly perceived by Kamau et al, because ‘[t]he question must be answered according to general international law’.⁵ One notes that traditional knowledge does not appear in the title of the Protocol.

According to Article 2 (e) of the Protocol, “derivative” means a naturally occurring biochemical compound resulting from the genetic expression or metabolism of biological or genetic resources, even if it does not contain functional units of heredity’.⁶ Despite the introduction of ‘derivative’ in Article 2 (e), ‘derivative’ is not incorporated into Article 3 which defines the scope. Nevertheless, many delegates and scholars are not disheartened. They have inferred ‘derivative’ in the phrase ‘utilisation of such sources’.⁷ Unfortunately for the advocates, such an inference is not obvious and would morph ‘utilisation of such sources’ into a

1 Joseph Henry Vogel and Manuel Ruiz, ‘Wronged by the Wrong Language: The International Regime on Access and Benefit-Sharing’ 10/19 *Bridges Trade BioRes* (October 2010), available at <http://ictsd.org/i/library/90194/>.

2 Evanson Chege Kamau, Bevis Fedder and Gerd Winter, ‘The Nagoya Protocol on Access to Genetic Resources and Benefit Sharing: What is New and What are the Implications for Provider and User Countries and the Scientific Community?’ 6/3 *Law, Environment and Development Journal* 246 (2010), available at <http://www.lead-journal.org/content/10246.pdf>.

3 Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from Their Utilisation to the Convention on Biological Diversity, Nagoya, 29 October 2010, available at <http://www.cbd.int/decision/cop/?id=12267>.

4 See Convention on Biological Diversity, Rio de Janeiro, 5 June 1992, available at <http://www.cbd.int/convention/text/>.

5 See Kamau et al, note 2 above at 255.

6 See Nagoya Protocol, note 3 above, Art. 2 (e).

7 See Kamau et al, note 2, at 254, cell of Table 1: ‘Contentious Issues and Final Results’ at row entitled ‘Biochemical Derivatives’ and the column ‘Comment’.

‘panchreston’, Garrett Hardin’s neologism for something that signifies everything and therefore means nothing.⁸

Should ‘user countries’ not interpret ‘derivatives’ as an object of access, ‘provider countries’ will probably persevere in future COPs to extend the scope of Article 3. The problem of perseverance lies in its opportunity costs. Besides the time and money, measured in many years and millions of dollars, *ad hoc* deliberations will forgo a robust reform that would include the Article 2 (e) definition of derivative as well as other deserving phenomena, some now scarcely imaginable. For example, we intuit designs inspired by nature (eg, biomimicry) and non-human culture (eg, chimpanzee pharmacology) as legitimate objects of access even though no ‘biochemical compound’ would have been accessed.⁹ While both natural designs and non-human culture fall outside the Art. 2 (e) definition of derivative, both can be interpreted as natural information. Once the parties choose the correct language for the object of access, they can apply the economics of information for which Nobel Memorial Prizes have been awarded.¹⁰

3 CONTENTIOUS ISSUES RESOLVED THROUGH THE LENS OF ECONOMICS

Almost all the contentious ABS issues tabulated by Kamau et al can be resolved by interpreting genetic resources as natural information and associated traditional knowledge as artificial information. Table 1 of this article is an adaptation of Table 1 in the article

by Kamau et al. The final three columns of the original table, viz. ‘Articles in ABS Draft Protocol’, ‘Articles reflecting or maintaining issue in Nagoya Protocol’, and ‘Variation/Comment’ have been replaced by ‘With natural information (n.i) instead of genetic resource (g.r) as object of ABS: Is issue resolvable? In favor?’ and ‘Explanation’. The first new column (5) answers whether or not a solution from economics exists and the next column, whether or not it favors the issue listed. For example, for the issue of benefit-sharing for biological resources: ‘Is issue resolvable?’ (Yes) even though the resolution from interpreting g.r. as n.i. goes against sharing any benefit: ‘In favor?’ (No). The final column offers a succinct explanation, in this case, ‘Biological resources also exhibit tangible aspects where value-added does not carry monopoly patent protection’. The explanation coheres with Retroactivity I, which is the linchpin in the North-South dispute over ABS: ‘Biological resources exhibit both tangible and intangible aspects, the latter conceptualised as a set of n.i. where value currently added in a patent is access to a subset not previously accessed.’ N.B. The protest of retroactive law in ‘3.2 Temporal Scope’ of Kamau et al no longer holds when genetic resources are recognised as intangible.¹¹

Table I: Contentious issues re-examined

8 Garrett Hardin, ‘Meaninglessness of the Word Protoplasm’, 82/3 *Scientific Monthly* 112 (1956).

9 Joseph Henry Vogel, ‘Architecture by Committee and the Conceptual Integrity of the Nagoya Protocol’, in Manuel Ruiz and Ronnie Vernooy eds., *The Custodians of Biodiversity: Sharing Access and Benefit Sharing to Genetic Resources* (Ottawa: International Development Research Council, forthcoming).

10 See The Sveriges Riksbank Prize in Economic Sciences in Memory of Alfred Nobel 2001: George A. Akerlof, A. Michael Spence, Joseph E. Stiglitz, available at http://nobelprize.org/nobel_prizes/economics/laureates/2001/.

11 See Kamau et al, note 2 above at 255.

A \ Scope (quoted from Kamau et al.)	Issue(s) (quoted from Kamau et al.)	Position of parties (quoted from Kamau et al.)		With natural information (n.i) instead of genetic resource (g.r) as object of ABS		Explanation
		Providers	Users	Is issue resolvable?	In favor?	
Retroactivity I	Benefits from genetic resources accessed pre-CBD	Yes	No	Yes	Yes	Biological resources exhibit both tangible and intangible aspects, the latter conceptualised as a set of n.i. where value currently added in patent is access to a subset not previously accessed.
Retroactivity II	Benefits from genetic resources accessed pre-ABS Protocol where no benefit-sharing agreement has been established in accordance with the CBD	Yes	No	Yes	Yes	Same as explanation of Retroactivity I
Retroactivity III	Benefits from continuing & new uses of genetic resources & traditional knowledge accessed pre-CBD	Yes	No	Yes (g.r)/ No (t.k.)	Yes (g.r)/ No (t.k.)	For g.r. same as Retroactivity I; for traditional knowledge (t.k.), non-technical issues of redefining public domain
Retroactivity IV	Benefits from traditional knowledge accessed pre-ABS Protocol	Yes	No	No	No	Issues of redefining public domain
Biological/ genetic resources	Should ABS Protocol also apply to biological resources?	Yes	No	Yes	No	Biological resources also exhibit tangible aspects where value-added does not carry monopoly patent protection
Biochemicals/ derivatives	Benefits from biochemicals/derivatives from entry into force of ABS Protocol	Yes	No	Yes	Yes	Derivatives are n.i.

B\ Fair & equitable benefit sharing						
Ex situ collections	Benefits from traditional knowledge associated with ex situ genetic resources	Yes	No	No	No	Issues of redefining public domain
C\ Access to genetic resources						
Ownership of genetic resources	PIC, approval & involvement of indigenous & local communities needed in access to genetic resources	Yes	Yes/No?	Yes	No	Bounded openness where a uniform royalty rate remits to countries of origin upon successful commercialisation of patent; royalties for ubiquitous n.i. remit to the International Barcode of Life (iBOL)
National ABS measures	Provide for legal certainty, clarity & transparency	No/Yes	Yes	Yes	No	Not necessary
Non-commercial research	Provide simplified access	No/Yes	Yes	Yes	Yes	Non-patented uses are open access
D\ Compliance						
Checkpoints	Identification & establishment of checkpoints to enhance monitoring, tracking & reporting utilisation of genetic resources, derivatives & traditional knowledge	Yes	No	Yes	Yes	Disclosure of species in patent application with subsequent determination of countries of origin and respective habitats for share in royalty revenues
Certificate	Internationally recognised certificate should be evidence of compliance with PIC & MAT requirements	Yes	No	Yes	No	No certificate is needed
Disclosure of origin/source	Should be made mandatory: -Failure to disclose: user should be given fixed time to comply/remedy - Refusal to disclose: application shall not be further processed	Yes	No	Yes	Yes	In addition, tariffs should be levied on exports exhibiting patented value added to n.i. from non-ratified countries

4

CARTELISATION

All the explanations in the last column of Table I emanate from the economics of information. To understand the application of that economics to ABS, we will analogise an excerpt from the landmark textbook *ECONOMICS* authored by Paul A. Samuelson a half century ago and co-authored with William D. Nordhaus in the recent editions.

Information is expensive to produce but cheap to reproduce. To the extent that the rewards to invention are inappropriable, we would expect private research and development to be underfunded...special laws governing patents [and so on]...create intellectual property rights. The purpose is to give the owner special protection against the material's being copied and used by others without compensation to the owner of the original creator...Why would governments actually *encourage* monopolies?...By creating property rights, governments encourage artists and inventors to invest time, effort, and money in the creative process.¹²

Cutting and pasting the CBD language into the Samuelson and Nordhaus quote renders:

Genetic resources and associated traditional knowledge are expensive to conserve but cheap to access. To the extent that the rewards to conservation are inappropriable, we would expect conservation efforts to be underfunded...an international regime governing access and benefit-sharing can create oligopoly rights. The purpose is to give the countries of origin and communities special protection against the information's being accessed and used by others without compensation to all the countries and communities, which have conserved the respective habitat and knowledge...Why would governments actually *encourage* oligopolies?...by

creating a cartel over genetic resources and associated traditional knowledge, user countries encourage provider countries and communities to invest time, effort, and money in conserving habitats and knowledge.

The Protocol seems to be moving toward cartelisation by circumscribing the power of bilateral negotiation. As noted by Kamau et al, 'Although the Protocol reaffirms sovereign rights of parties over their genetic resources, its provisions on transboundary cooperation, in case the same genetic resources or traditional knowledge straddle national boundaries, constitute a kind of, though weak, derogation of absolute state sovereignty. In such cases, parties shall 'endeavour to cooperate' with a view to implement the objectives of the Protocol'.¹³ Despite the explicit recognition of transboundary resources in Articles 10 and 11, the application of rigorous economics slashes any hope that the Protocol will ultimately achieve cartelisation. We return to the choice of language. Oligopolies are difficult to maintain because not all members 'cooperate' and the Protocol only requires that they '*endeavor* to cooperate' (emphasis added). Failed cartels in bananas, coffee, and sugar are legendary. OPEC succeeds because Saudi Arabia assumes a disciplinary role due to its high share of total world reserves and willingness to punish members who violate production quotas. For an oligopoly to succeed in natural and associated artificial information, the Protocol must reflect 'mutual coercion, mutually agreed upon', another apt phrase from Hardin.¹⁴ Again, the analogy with monopoly patents is fruitful: coercion underpins the Trade Related Intellectual Property Rights (TRIPs) agreement which has been hugely successful in achieving enclosure for new artificial information.

Coercion is not enough. This is a central message from Christopher May in *The Global Political Economy of Intellectual Property Rights*¹⁵ 'Certainly the institution of property is firmly established enough in modern societies that the explicit sanction of the state to support or enforce this control is seldom needed, once something

¹² Paul A. Samuelson and William D. Nordhaus, *ECONOMICS* 195 (New York: McGraw-Hill Irwin, 18th ed. 2005).

¹³ See Kamau et al, note 2 above at 253.

¹⁴ Garrett Hardin, 'The Tragedy of the Commons', 162 *Science* 1243 (1968), available at <http://dieoff.org/page95.htm>.

¹⁵ Christopher May, *The Global Political Economy of Intellectual Property Rights: The New Enclosures* (USA: Routledge, 2nd ed, 2010).

has been accepted as property by those involved in social relations'.¹⁶ May itemises the extensive resources devoted by the World Intellectual Property Organisation to create that mindset and observes that '[t]echnical assistance is not merely important in the aid it provides governments and legislators to establish specific legislation, but is also an important political or even, ideological, programme of social reorientation'.¹⁷ He is fiercely critical of the 'political project to firmly establish all unauthorised use as *theft*'¹⁸ and advocates 'bounded openness'¹⁹ with a nuanced approach in the social bargain between the public and the private. The parallels between TRIPs and an International Regime on ABS are multiple.

What would be the target audience for 'social reorientation' of an oligopoly over natural and associated artificial information, i.e., a biodiversity cartel? The answer is the US as so pathetically alluded in Article 24 'Non-Parties'. As long as this major user *and* provider country lies outside the CBD and the International Regime, there will be no cartel (barring punitive tariffs, see the cell of Table 1 at row 'Disclosure of origin/source of' and column 'Explanation'). Social reorientation means convincing a critical mass in the US Congress that cartelisation behoves the US, economically so. Such a sea change in policy is hardly fanciful should national interests become sufficiently evident. May notes 'Despite arguing for the sanctity of IPRs in the face of the AIDS crisis in Africa, when in November 2001 it seemed possible that the US had been the target of a bio-terrorist attack using anthrax, suddenly compulsory licensing became a legitimate strategy in health emergencies. We should recall that five people died and a further thirteen fell ill in this supposed terror action (which is not to devalue these deaths, only to note the comparison with the millions dying of AIDS)'.²⁰

16 *Id.*, at 16.

17 *Id.*, at 103. Human evolution may have made social reorientation far more difficult for intangible than tangible property. The theme is explored in Joseph Henry Vogel ed., *The Museum of Bioprospecting, Intellectual Property, and the Public Domain: A Place, A Process, A Philosophy* (London: Anthem Press, 2010) and coheres with the research streams suggested by Gad Saad in *The Evolutionary Bases of Consumption* (Mahwah, NJ: LEA/Psychology Press, 2007).

18 See May, note 15 above 152.

19 *Id.*, at 142.

20 *Id.*, at 120.

5 PENETRATING THE SOCIAL SPHERE TO GAIN LEGITIMACY

Alas, when the CBD has penetrated the social sphere in the US, its expression seems right out of the biotechnology playbook. Shortly after COP-VI, Andrew Revkin from *The New York Times*, wrote an article entitled 'Biologists sought a treaty, now they fault it'.²¹ It too was devoid of any economic thinking and thereby missed an opportunity for a more sophisticated journalism.²² However, the place to penetrate the social sphere is not *The New York Times* whose readership would probably support an economically sound International Regime. Instead, plebian venues from swing states like Florida should be the target. As an illustration, we have chosen *The Tampa Tribune* where Jeff Houck publishes every year '50 things that we know now (that we didn't know this time last year)'.²³ Some of those things now known would qualify as bio-discoveries and lend themselves to a discussion about ABS and cartelisation. Table II looks at seven of the two dozen learned since 2006. The sobriquets are our suggestion for any journalist who wishes to do a follow-up piece on a particular bio-discovery.

Table II: Bio-discoveries from '50 things we know now' by Jeff Houck, *The Tampa Tribune*

21 Andrew C. Revkin, 'Biologists Sought a Treaty: Now They Fault it', *The New York Times*, 7 May 2002, available at <http://www.nytimes.com/2002/05/07/science/biologists-sought-a-treaty-now-they-fault-it.html>

22 Joseph Henry Vogel, 'Reflecting Financial and Other Incentives of the TMOIFGR: The Biodiversity Cartel', in Manuel Ruiz and Isabel Lapeña eds., *A Moving Target: Genetic Resources and Options for Tracking and Monitoring their International Flows* 47-74 (Gland, Switzerland: IUCN, 2007), available at <http://data.iucn.org/dbtw-wpd/edocs/EPLP-067-3.pdf>.

23 Jeff Houck, '50 Things We Know Now (That We Didn't Know This Time Last Year)', *The Tampa Tribune*, 16 December 2010, available at <http://www2.tbo.com/content/2010/dec/16/16161802/httpwwwwebmdcomparentingnews20101107unprotected-se/>.

Sobriquet	Year of publication in '50 things'	Ranking of bio-discovery in '50 things'	Description quoted from Houck	Reference in Scientific Literature	Open Access Publication (abstract/ full text)
Airborne intelligence	2010	42	A common 'friendly' bacteria found in soil boosts intelligence and speeds learning time. The same microbe, which is blown around by the wind and inhaled, appears to act as a natural antidepressant	Lowry, C.A., Hollis, J.H., Vries, A. de Pan, B., Brunet, L.R., Hunt, J.R.F., Paton, J.F.R., van Kampen, E., Knight, D.M., Evans, A.K., Rook, G.A.W. & Lightman, S.L. (2007) Identification of an immune-responsive mesolimbocortical serotonergic system: Potential role in regulation of emotional behavior. 146 (2) <i>Neuroscience</i> 756	Yes/No
Bacterial Titanic Busters	2010	17	A species of metal-eating bacteria discovered on the sunken hull of the Titanic may be speeding the decay of the wreck	Sánchez-Porro C., Kaur, B., Mann, H. and Ventosa A. (2010) <i>Halomonas titanicae</i> sp. nov., a halophilic bacterium isolated from the RMS Titanic. <i>International Journal of Systematic and Evolutionary Microbiology</i> , 60, 2768	Yes/No
Evolutionary Insecticide	2006	11	Wasps spray an insect version of pepper spray from their heads to temporarily incapacitate their rivals	Goubalt, M., Batchelor, T.P, Linforth, R.S.T, Taylor, A.J, & Hardy, I.C.W. (2006) Volatile emission by contest losers revealed by real-time chemical analysis. <i>Proceedings of the Royal Society Biological Sciences</i> , 273(1603), 2853-2859	Yes/Yes
Malaria-resistant Mosquitoes	2006	32	A group of genes makes some mosquitoes resistant to malaria and prevents them from transmitting the malaria parasite	Riehke, M.M., Markianos, K., Niare, O., Xu, J., Li, J., Toure, A., Podiougou, B., Oduol, F., Diawara, S., Diallo, M., Coulibaly, B., Outara, A., Kruglyak, L., Traore, S.F. & Vernick, K. (2006) Natural Malaria Infection in <i>Anopheles gambiae</i> is Regulated by a Single Genomic Control Region. <i>Science</i> 312, 577-579	Yes/No

Onion Recall	2007	29	Onions contain a sulfur-based antioxidant that binds with harmful toxins in the brain and flushes them out of the body, helping to prevent memory loss	Nishimura, H., Higuchi, O., Tateshita, K., Tomobe, K., Okuma, Y. & Nomura, Y. (2006). Antioxidative activity and ameliorative effects of memory impairment of sulfur-containing compounds in <i>Allium</i> species. <i>BioFactors</i> . 26, 135-146	Yes/No
Pumpkin Power	2009	13	Pumpkin skin contains a substance that inhibits growth of microbes that cause yeast infections	Park, S.C., Kim, J.Y., Lee, J.K., Hwang, I., Cheong, H, Nah, J.W., Hahm, K.S. & Park, Y. (2009) Antifungal Mechanism of a Novel Antifungal Protein from Pumpkin Rinds against Various Fungal Pathogens. <i>J. Agric. Food Chem.</i> 57, 9299–9304	Yes/No
Tequila is an Industrial Diamond's Best Friend	2009	47	Diamond thin films were grown using Tequila as precursor by Pulsed Liquid Injection Chemical Vapor Deposition (PLI-CVD) onto both silicon (100) and stainless steel 304 at 850 °C	J.Morales, J., Apátiga, L. M. & Castaño, V.M. (2009) Growth of Diamond Films from Tequila. <i>Rev. Adv. Mater. Sci.</i> , 21(2009), 134-138	Yes/Yes

Alternatively, the journalist may follow-up the bio-discoveries by integrating diverse examples around one of the contentious issues of ABS. Table III classifies the bio-discoveries according to the issue and ease in journalistic exposition. As one sees from the many blank cells for 'C\ Access to genetic resources' and 'D\

Compliance', the journalist would have to go into great depth to plumb the mechanisms of checkpoints, certificates and disclosure, i.e., compliance. There is no easy way to describe a legal labyrinth.

Table III: Bio-discoveries and the contentious issues

A\ Scope (quoted from Kamau et al)	Issue(s) (quoted from Kamau et al)	Airborne Intelligence	Bacterial Titanic Buster	Evolutionary Insecticide	Malaria-resistant Mosquitoes	Onion Recall	Pumpkin Power	Tequila is an Industrial Diamond's Best Friend
Retroactivity I	Benefits from genetic resources accessed pre-CBD							
Retroactivity II	Benefits from genetic resources accessed pre-ABS Protocol where no benefit-sharing agreement has been established in accordance with the CBD	X	X	X	X	X	X	X

Retroactivity III	Benefits from continuing & new uses of genetic resources & traditional knowledge accessed pre-CBD					X	X	
Retroactivity IV	Benefits from traditional knowledge accessed pre-ABS Protocol						X	
Biological/ genetic resources	Should ABS Protocol also apply to biological resources?							
Biochemicals/ derivatives	Benefits from biochemicals/derivatives from entry into force of ABS Protocol							
B\ Fair & equitable benefit sharing								
Ex situ collections	Benefits from traditional knowledge associated with ex situ genetic resources					X	X	
C\ Access to genetic resources								
Ownership of genetic resources	PIC, approval & involvement of indigenous & local communities needed in access to genetic resources							
National ABS measures	Provide for legal certainty, clarity & transparency							
Non-commercial research	Provide simplified access							
D\ Compliance								
Checkpoints	Identification & establishment of checkpoints to enhance monitoring, tracking & reporting utilisation of genetic resources, derivatives & traditional knowledge							
Certificate	Internationally recognised certificate should be evidence of compliance with PIC & MAT requirements							
Disclosure of origin/source	Should be made mandatory: -Failure to disclose: user should be given fixed time to comply/remedy - Refusal to disclose: application shall not be further processed							

All the twists and turns of compliance explained by Kamau et al can be obviated by a cartel. The only requirement of the cartel would be disclosure of the species to which value was added in a patent. Inasmuch as 99.8 per cent of patents do not result in anything commercially viable, also duly cited by Kamau et al,²⁴ the cartel eliminates the transactions costs of pursuing ABS on dead-ends. Royalties would only be levied on the commercially viable patents. The rows of C and D would be replaced by a simple disclosure of species-an extra line or electronic cell in a standardised patent application. *Ergo*, cartelisation enhances both efficiency and equity which is a rare and fortuitous occurrence in policymaking.

Table IV analyses who would benefit from the cartelisation for the bio-discoveries listed in *The Times Tribune*. The results are counterintuitive. For example, if the protein found in the pumpkin is in the four species of the genus *Cucurbita*, not only Mexico and Central America but also the US would be a country of origin, according to the criterion of Vavilov Centers of Diversity.²⁵ Without the cartel, it behooves the Korean patent holder to pass off provision of the specimens researched in Korea as the US rather than Mexico or even Korea. Who would know? Indeed, the US is probably the country where most genetic resources are appropriated for the simple reason that biopiracy does not exist there *de jure*, i.e., one cannot steal what is *res nullius*. Indeed 'appropriation' is the wrong word. Thinking of block-buster biotechnologies that originate in natural product chemistry, the US Treasury is being deprived of billions of dollars of tax revenue.

No less interesting for ABS stories are genetic resources found worldwide. 'Airborne intelligence' derives from a bacterium that is blowing in the wind, globally. If everyone is an owner, no one is an owner. Should ubiquity mean free? The answer from economics is no: exemption would introduce a distortion for industry to avoid royalties by researching just the ubiquitous genetic

resources which are the least threatened with extinction.²⁶ Instead, the royalties collected should go to finance the fixed costs associated with the cartel.²⁷ Outstanding among those costs are the classification of species and the determination of geographic distribution of habitat. Such data become the baseline in calculating the fair share of benefits for each cartel member. Fortunately, a technological infrastructure exists that seems custom-made to the task: The International Barcode of Life.²⁸ In other words, iBOL enables ABS through information on species and ABS enables iBOL through financing from ubiquitous genetic resources.²⁹ One should note that the proportionality inherent in calculating the royalty share also achieves the objective of the Protocol of Article 1 that links ABS to conservation and sustainable use. Senior management from iBOL is exploring how to deal with ABS and has addressed the issues in top-tier journals.³⁰

Table IV: Benefit sharing under a cartel

26 Joseph Henry Vogel, 'From the "Tragedy of the Commons" to the "Tragedy of the Commonplace" Analysis and Synthesis Through the Lens of Economic Theory', in Charles McManis ed., *Biodiversity & Law* 115-136 (London: Earthscan, 2007).

27 Joseph Henry Vogel, *Genes for Sale* 96 (New York: Oxford University Press, 1994).

28 Mark Y. Stoeckle and Paul D. N. Hebert, Barcode of Life, *Scientific American* 82-88, October 2008.

29 Joseph Henry Vogel, 'iBOL as an Enabler of ABS and ABS as an Enabler of iBOL', in *Proceedings of the Seminar 'Barcoding of Life: Society and Technology Dynamics – Global and National Perspectives'* 38-47, UNEP/CBD/WG-ABS/9/INF/15 (10 March 2010) available at <http://www.cbd.int/doc/meetings/abs/abswg-09-3rd/information/abswg-09-3rd-inf-15-en.pdf>.

30 Ronnie Vernooy et al, 'Barcoding Life to Conserve Biological Diversity: Beyond the Taxonomic Imperative', 8(7) *PLoS Biol* (2010), e1000417, available at <http://www.plosbiology.org/article/info%3Adoi%2F10.1371%2Fjournal.pbio.1000417> and David Schindel, 'Biology without Borders', 467 *Nature* 779 (October 2010).

24 99.8 per cent commercially nonviable is inferred as the complement of 0.2 per cent that are viable. See Kamau, et al, note 2 above at 262.

25 Museum of Learning, 'Centres of Origin of Main Cultivated Plants: Vavilov Centers', available at http://www.museumstuff.com/learn/topics/centres_of_origin_of_main_cultivated_plants::sub::Vavilov_Centers.

Sobriquet	Provider Country	User Country	Beneficiaries (Countries of Origin, iBOL, exempt, or ISE of UNCLOS)	ABS Agreement (response from email enquiry)	Patents granted or pending	Commercial applications
Airborne Intelligence	Uganda	UK	iBOL	No	US Patent No. 472411 and 6328978; pending 20030170275	Skin disorders; Tuberculosis; Leprosy; Adjuvant to Chemotherapeutics; Conditions of the Central Nervous System
Bacterial Titanic Buster	Disputed/ US Continental Shelf but beyond 200 nm	Canada	International Seabed Authority	No response	None discovered	Pipe corrosion for submarine structures
Evolutionary Insecticide	USA	UK	Uruguay stated, but if ubiquitous across bees, wasps, and beetles, then iBOL	No	No	Proven to be effective as an insecticide
Malaria-resistant Mosquitoes	Mali	US	Exempt as human pathogen (referenced in Preamble of Protocol)	No	No	Worldwide in tropics and subtropics
Onion Recall	Unstated	Japan	Central Asia	No response	Japanese Patent No. 3725079 Alliumvinale	Treatment of schizophrenia, Alzheimer's and other mental illnesses
Pumpkin Power	Unstated	Korea	Mexico, Central America and US	No response	None discovered	Fungicide
Tequila is an Industrial Diamond's Best Friend	Mexico	Mexico	Mexico	No response	None discovered	Industrial uses of diamonds

6 CONCLUSION

years to go. In the meantime, expect more avoidable extinction due to an international regime that is devoid of economic thinking.

Kamau et al close on a hopeful note, encouraging the Parties to ratify the Protocol. We are less enthusiastic. The Protocol is not a move toward cartelisation that the economics of information would justify but its exact opposite: a move toward perfect competition. Again, we return to the power in economic abstraction. Joan Robinson, arguably John Maynard Keynes' best student, pioneered the concept of 'monopolistic competition' by which products are differentiated to secure some minimal economic rent.³¹ From the economics perspective, The Clearing House Mechanism and Information Sharing of Article 14 would tend to eliminate monopolistic competition. Once every other element of access is non-differentiated through 'model contractual clauses' (Art. 19), industry will be able to drive down the royalty even further from the already laughable percentages.³² 'Confidential business information' will be solemnly invoked to preempt any cry of unfairness. In such a scenario, the operability of the Nagoya Protocol will hinge on whether WikiLeaks and similar endeavors can be permanently shut down not a very promising proposition.

Economics need not be dismal or despised. The historian of economic thought will note that David Ricardo (1772-1823) explained tirelessly how the Corn Laws in Britain protected the landed gentry at the expense of industrial development. Only after Ricardo's death did the rising industrial class prevail. In 1842, the Parliament dismantled the tariffs on imported cereals, twenty-seven years after Ricardo published 'Essay on the Influence of a Low Price of Corn on the Profit of Stock'.³³ If history is any guide, we have another nine

31 See Samuelson and Nordhaus, note 12 above at 168-169.

32 The Edmonds Institute, 'Mexico's Genetic Heritage Sold for Twenty Times Less Than the US Got in Yellowstone', Press Release, 28 September 1999, available at http://www.biotech-info.net/genetic_heritage.html.

33 David Ricardo, *The Concise Encyclopedia of Economics: Library of Economics and Liberty*, available at <http://www.econlib.org/library/Enc/bios/Ricardo.html>.

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