Penn State Journal of Law & International Affairs

Volume 12 | Issue 1

February 2024

The TRIPS Trap Revisited

Roya Ghafele

Adam Chaddock

ISSN: 2168-7951

Penn State
Journal of Law & International Affairs

2023 VOLUME 12 NO. 1

THE TRIPS TRAP REVISITED

By Roya Ghafele and Adam Chaddock[*]

TABLE OF CONTENTS

ABSTRACT....32
I. INTRODUCTION....32
II. THE WORLD TRADE ORGANIZATION (WTO) AND INTERNATIONAL DEVELOPMENT....35
III. WTO AND TECHNOLOGY TRANSFER....36
IV. THE WTO AND COMPULSORY LICENSING....38
V. REDUCED HARM TOBACCO TECHNOLOGIES AND THE TOBACCO INDUSTRY'S APPROACH TO THE SMOKING PANDEMIC....40
VI. METHODOLOGY....44
6.1.1. Selection of Sample Countries....44
6.1.2. Selection of Companies:....46
6.1.3. Patent Publication Scoping....47
6.1.4. Scoping Patent Litigation and Product Sales....49
VII. FINDINGS....51
7.1. China's Prevalence in Patent Publications....54
7.2. PCT Applications Compared to National Entry Publications....58
7.3. Litigation Analysis....59

[*] Professor Roya Ghafele is a Director of Law and Economics Consultancy at OxFirst. Additionally, Roya Ghafele is a visiting Professor in IP Law with the School of Law of Brunel University. Her Ph.D. was awarded the Theodor Koerner Research Prize by the President of the Republic of Austria. Dr. Ghafele was trained at Johns Hopkins University, School of Advanced International Studies, the Sorbonne, and Vienna University. During the course of her studies, she was four times awarded the Vienna University Grant for Excellence in Studies. She is native in German and fluent in English, French and Italian.

7.4. Most Litigated Reduced Harm Tobacco Technologies.....60
VII. CONCLUSIONS.....62
ANNEX:.....66

ABSTRACT

The TRIPS Agreement represented a concerted effort by the international community to establish a global minimum standard for intellectual property protection and bring developing countries into the global knowledge economy. Decades after that landmark international treaty came into place, the reality of Globalization presents itself quite differently. While international economic integration has become a reality for some, the vast majority of least developed countries and many low and middle income countries remain by and large cut off from patented technology. This study is one of the first to illustrate this dilemma quantitatively. Our research offers a detailed patent prosecution and enforcement landscape as it relates to reduced harm tobacco technologies in a selection of low and middle-income countries (LMICs). This study finds that, rather than being 'cannibalized' by the global patent system, these LMICs have close to no exposure to patents. There are hardly any patents filed and there is no patent litigation at all. With the exception of China, these LMICs have simply been bypassed by Globalization. We contend that being ignored may be just as problematic as being overwhelmed with patent protection. This is because it is an indicator of further marginalization and lack of exposure to economic activity. This risk is furthermore underlined by the fact that data on product sales of patent protected products is not even tracked in many countries by some of the most renowned data providers. This also suggests, that at least for reduced harm tobacco technologies, imitation as an innovation strategy has so far not worked. While the findings presented here pertain only to reduced harm tobacco technologies, we doubt that a different picture presents itself for other technology spaces.

I. INTRODUCTION

From the outset, the World Trade Organization's (WTO) Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) approach has been subject to much debate.[1] Advocates of international development raised serious concerns about TRIPS and subsequent bilateral trade agreements, known as TRIPS Plus regimes.[2]

---

[1] This study was funded with a grant from the Foundation for a Smoke-Free World, Inc. ("FSFW"), a US nonprofit 501(c)(3), independent global organization. This report is, under the terms of the grant agreement with FSFW, editorially independent of FSFW. The contents, selection, and presentation of facts, as well as any opinions expressed herein, are the sole responsibility of the authors and under no circumstances should they be regarded as reflecting the positions of FSFW.

[2] Rohit Malpani, *All costs, no benefits: How TRIPS-plus intellectual property rules in the US-Jordan FTA affect access to medicines*, OXFAM BRIEFING PAPER, (Mar. 21, 2007), https://oxfamilibrary.openrepository.com/bitstream/handle/10546/114080/bp10

By linking trade to intellectual property, the borderless world, so it was hoped, would find the necessary legal underpinnings to truly globalize business.[3] Yet, decades after the TRIPS Agreement came into place, the reality of Globalization presents itself quite differently. While international economic integration has become a reality for some, many least developed countries and many low mid-income countries remain by and large cut off. TRIPS compliant or not, these countries have been further marginalized in the global order. Rapid and inexpensive cross border trade has offered numerous opportunities for some, while others still struggle with establishing basic infrastructure.[4]

This study is one of the first of its kind to illustrate this dilemma quantitatively. Our research offers a detailed patent prosecution and enforcement landscape as it relates to reduced harm tobacco technologies, also known as reduced harm tobacco products and subsequently called 'RHPs', in a set of carefully selected low and middle-income countries (LMICs). The LMICs selected are all members of the World Trade Organization and would in principle qualify for an enhanced integration in the international economic order. Yet, this study finds that, rather than being 'cannibalized' by the global patent system, these LMICs have close to no exposure to patents. We find there are hardly any patents filed and there is no patent litigation at all. With the exception of China, this paper indicates LMICs have simply been bypassed by Globalization. We contend that being ignored may be just as problematic as being overwhelmed with patent protection. This is because it is an indicator of further marginalization and lack of exposure to economic activity. This risk is

---

2-all-costs-no-benefits-trips-210307-en.pdf%3Bjsessionid%3D089750820CF6751 73F0C3204C369D63F%3Fsequence%3D1; Peter K. Yu, *TRIPS and Its Discontents*, 10 MARQ. INTELL. PROP. L. REV. 370, 370-410 (Mar. 3, 2006); Correa, C. M. *Intellectual property rights, the WTO and developing countries: the TRIPS agreement and policy options*. ZED BOOKS 265 (2000); Ruth L. Gana., *Prospects for developing countries under the TRIPS Agreement*, 29 VAND. J. TRANSNAT'L L. 735, 735-75 (Oct. 1996).

[3] KENICHI OHMAE, THE BORDERLESS WORLD, x-xi, (Harper Business, 1990). We borrow Ohmae's language of "the borderless world" but acknowledge Ohmae perceived a borderless world of interlinked economies (ILEs) composed only of "the Triad" (the USA, Europe, and Japan). TRIPS extended beyond the Triad.

[4] THOMAS L. FRIEDMAN, THE LEXUS AND THE OLIVE TREE: UNDERSTANDING GLOBALIZATION, 223, (Farrar, Straus & Giroux, 1999).

furthermore underlined by the fact that data on product sales of patent protected products is not even tracked in many countries by some of the most renowned data providers worldwide.[5] While the findings presented here pertain only to reduced harm tobacco technologies, we doubt that a different picture presents itself for other technology spaces.

The study is structured as follows. We first discuss the TRIPS Agreement from an international development perspective and in doing so, take under consideration the role of compulsory licensing as an instrument of technology transfer. We pay special attention to the World Trade Organization's TRIPS regime as it was aimed at accelerating international economic integration. We then proceed to elaborate on the methodology of the patent landscape analysis, explain the underlying rationale of sample construction and approaches used to establish insights on the patent application and enforcement landscape. The empirical part of the study critically assesses the data gathered. Our conclusions lead us to suggest that, at least for reduced harm tobacco technologies, the myth of imitation as an innovation strategy does not hold.[6] A host of other entry barriers, such as access to relevant knowledge, know-how and technology infrastructure act as gate keepers that prevent LMICs to even consider making use of imitation to enable technological capabilities. International leadership is sorely needed to enable effective technology transfer, and that will require the cooperation of a range of stakeholders and actors, especially so from industry.

---

[5] *See Tobacco Market Size & Share Analysis*, MORDOR INTELLIGENCE (last visited Aug. 21, 2023) https://www.mordorintelligence.com/industry-reports/global-tobacco-market-industry (Of the 73 assessed countries, no reviewed data provider recorded tobacco sales data for more than 16 of them); Aniket K. & Roshan D., *Tobacco Market*, ALLIED MARKET RESEARCH, (May 2021), https://www.alliedmarketresearch.com/tobacco-market-A11180.; *Tobacco Market*, TECHNAVIO, (April 2023), https://www.technavio.com/report/tobacco-market-industry- analysis; and *Tobacco Market Size, Share & Trends Analysis Report*, GRAND VIEW RESEARCH, (last visited Aug. 21, 2023), https://www.grandviewresearch.com/industry-analysis/tobacco-market.

[6] Hong Hwang, Jollene Z. Wu & Eden S. H. Yu, *Innovation, imitation and intellectual property rights in developing countries*, 20 REV. OF DEV. ECON, 138, 138-151 (Jan. 28, 2016).

II. THE WORLD TRADE ORGANIZATION (WTO) AND INTERNATIONAL DEVELOPMENT

The international patent system remains quite new in the wider history of global trade. By linking trade to intellectual property, the WTO is the first international organization to provide 'teeth' to the enforcement of IP through its dispute resolution mechanism.[7] No other international patent treaty is linked to such strong enforcement mechanisms. As an institution, the WTO has hence reinforced the importance of patents in an increasingly globalizing world. Linking international patent law to a global trade agenda, has further highlighted the complex relationship between developing countries and patents.

The global patent regime has been driven predominantly by European and U.S. actors as well as other developed nations. Many developing countries inherited the patent system as part of their colonial past.[8] Critique has been levelled at it for preserving the systems of power, knowledge and governance which predominated in a nineteenth-century characterized by colonialism.[9] The criticisms levelled at TRIPS, for instance, focus on the imposition of developed countries IP infrastructure models and expectations onto the rest of the world.[10] Not surprisingly, TRIPS has been condemned by some as a "colonialist act imposing the western standard of the IPRs system on the rest of the world."[11] Others again have come to see the

---

[7] *Intellectual property: protection and enforcement*, WORLD TRADE ORGANIZATION (last visited Aug. 15, 2023) https://www.wto.org/english/thewto_e/whatis_e/tif_e/agrm7_e.htm.

[8] B. Zorina Khan, *An Economic History of Patent Institutions*, ECONOMIC HISTORY ASSOCIATION (last visited Nov. 14, 2023), https://eh.net/encyclopedia/an-economic-history-of-patent-institutions/.

[9] IRENE CALBOLI & MARIA L. MONTAGNANI, HANDBOOK ON INTELLECTUAL PROPERTY RESEARCH: LENSES, METHODS, AND APPROACHES, 260, 260-271 (Oxford Univ. Press, May 20, 2021).

[10] A. Samuel Oddi, *In Globalization and Intellectual Property: TRIPS—Natural Rights and a "Polite Form of Economic Imperialism"*, 139, 139-194 (Alexandra George, Routledge, Apr. 2, 2017).

[11] Daniele Archibugi & Andrea Filippetti, *The Globalisation of Intellectual Property Rights: Four Learned Lessons and Four Theses*, 1 GLOBAL POLICY 137, 137-47,

harmonization of minimum standards on IP protection as a dire necessity to be part of the global economy.[12] Archibugi & Filippetti for example argue that TRIPS, by linking IP to international trade and including a dispute resolution mechanism not provided for by previous international treaties, allows "advanced countries to increase further their bargaining power at the WTO."[13] It has furthermore been argued that "[t]he harmonization of IPRs introduced by the TRIPS Agreement has led to a race to the top which is certainly not advantageous to countries wishing to catch up by acquiring the expertise, knowledge and innovations of the leaders."[14] Yet others again, have concluded that the entire WTO's system's approach to international development is hinged on the myth of 'playing catch up at the international system;' whereby the act of catching up has so far proven to be more or less unsuccessful.[15] We accept such reasoning. The patent data presented here illustrates that this goal remains very hard to achieve and the single most difficult challenge of the WTO remains to identify avenues, which will lead to equitable dissemination to the world's patented technology assets.

III. WTO AND TECHNOLOGY TRANSFER

The WTO has sought to handle the antagonistic relationship between developing countries and the intellectual property (IP) system by emphasizing technology transfer, alongside exceptions and limitations to the TRIPS regime. TRIPS states:

> "The protection and enforcement of intellectual property rights should contribute to the promotion of technological innovation and to the transfer and

142 (May 2010) (citing Vandana Shiva, *Protect or Plunder? Understanding Intellectual Property Rights*, 17 JSTOR ORG. & ENV'T. 547, 547-49 (London: Zed Books, 2001)).

[12] Amanda Jakobsson & Paul S. Segerstrom, *In Support of the TRIPS Agreement*, RESEARCH COLLECTION SCHOOL OF ECONOMICS, 1, 1-57, 3 (Feb. 6, 2012).

[13] Archibugi, *supra* note 10 at 142.

[14] *Id.* (citing HA-JOON CHANG, *Kicking Away the Ladder: Policies and Institutions for Economic Development in Historical Perspective* (London: Anthem Press, 2003)).

[15] Mary Durfee & James N. Rosenau, *Playing Catch-Up: International Relations Theory and Poverty*, 25 MILLENIUM J. OF INT'L. STUDIES 521, 521-45 (1996).

> dissemination of technology, to the mutual advantage of producers and users of technological knowledge and in a manner conducive to social and economic welfare, and to a balance of rights and obligations."[16]

Technology transfer, although a term still not defined in the WTO's framework[17], has come to be seen as the primary strategy for developing countries to gain access to much needed, but legally protected, knowledge assets owned in developing countries.[18] Article 66 (Least-Developed Countries) places an onus on the most developed countries to provide incentives for the movement of technology to least developed countries; "Developed country Members shall provide

---

[16] WTO Agreement on Trade-Related Aspects of Intellectual Property Rights, Part 1 Art. 7.

[17] *Technology Transfer and Innovation*, UNEP (Jun. 14, 2014) https://www.wto.org/english/tratop_e/devel_e/RD_DEV_UNEP.pdf (the UNEP Risø Centre (now UNEP DTU Partnership) defines technology transfer in relation to climate technologies as "The flow of experience, know-how and equipment between and withing countries, which would typically combine market and non-market based technologies"); and *Knowledge for Policy, Competence Centre on Technology Transfer*, European Commission, (last updated Sep. 13, 2023) https://knowledge4policy.ec.europa.eu/technology-transfer/what-technology-transfer_en (the European Commission's Competence Centre on Technology Transfer defines it as "the process of conveying results stemming from scientific and technological research to the market place and to wider society, along with associated skills and procedures").

[18] *See* MARTIN BELL, '*International Technology Transfer, Innovation capabilities and sustainable directions of Development*, LOW-CARBON TECHNOLOGY TRANSFER: FROM RHETORIC TO REALITY, 20 (edited by David G. Ockwell, Alexandra Mallett, Routledge, 2012); Ana Pueyo et al, *The Role of Technology Transfer for the Development of a Local Wind Component Industry in Chile*, 39 ENERGY POLICY 4274, 4274-83 (2011); D.J. Teece, *Technology Transfer by Multinational Firms: The Resource Cost of Transferring Technological Know-How*, 87 THE ECON. J. 242, 242-61 (Jun. 1977); Wei Liu, *International Technology Transfer and Development of Technological Capabilities: A theoretical framework*, 17 TECH. IN SOC'Y 103, 103-20 (1995); B. Bozeman, *Technology Transfer and Public Policy: a review of research and theory*, 29 RESEARCH POLICY 627, 627-56 (2000); Nola Hewitt-Dundas, The role of proximity in university-business cooperation for innovation, 38 THE J. OF TECH. TRANSFER 93, 93-115 (2011) http://dx.doi.org/10.1007/s10961-011-9229-4.; Kamal Saggi, *Trade, Foreign Direct Investment, and International Technology Transfer: A Survey*, 17 THE WORLD BANK RESEARCH OBSERVER 191, 191-235 (2002); Andrew Schrank, *Ready-to-Wear Development? Foreign Investment, Technology Transfer, and Learning by Watching in the Apparel Trade*, 83 Social Forces, 123, 123-56 (2004).

incentives to enterprises and institutions in their territories for the purpose of promoting and encouraging technology transfer to least-developed country Members in order to enable them to create a sound and viable technological base." [19]

Thambisetty et al[20] for example argue the TRIPS waiver was "an essential legal instrument . . . for enabling a radical increase in manufacturing capacity . . . creating a pathway to achieve global equitable production and access."[21] They make clear that presented with a sufficiently threatening public health crisis, and insufficient cooperation from industry, it is legitimate for LMICs to seek options that overcome the perceived barrier associated with IP rights. Baccus counters this line of argument, suggesting that a waiver is "unnecessary" and suggests instead that compulsory licensing offers sufficient recourse to ensure access to products important for public health.[22] These two papers, then, cut to the heart of the debate, highlighting that whilst a short-term undermining of IP rights may provide access to products, in the long run doing so can "eliminate the incentives to innovation" and may prevent "the discovery and development of knowledge for new goods and services".[23]

IV. THE WTO AND COMPULSORY LICENSING

Adoption of a comprehensive and TRIPS compatible Intellectual Property regime, which includes among others the norms on compulsory licensing and parallel import, is regarded as an

---

[19] WTO Uruguay Round Agreement: Trips, Art. 66(2).

[20] Siva Thambisetty, et al., *The TRIPS Intellectual Property Waiver Proposal: Creating the Right Incentives in Patent Law and Politics to end the COVID-19 Pandemic*, LSE LEGAL STUDIES WORKING PAPERS 1, 2 (Jun. 2021).

[21] *Id.* at 2-3.

[22] James Baccus, 'An Unnecessary Proposal: A WTO Waiver of Intellectual Property Rights for COVID-19 Vaccines', 78 CATO INSTITUTE FREE TRADE BULLETIN 1, 1-4 (Dec. 2020).

[23] *Id.* at 4.

important development toward utilization of the flexibilities of TRIPS Agreement."[24]

Compulsory licensing is characterized as a strong-arm approach to enable the domestic production of generic patented products, or as a threat or bargaining tool to achieve a voluntary licensing agreement.[25] Dung made it clear that these flexibilities are conditional on the state developing TRIPS compliant domestic law, but that achieving this is a valuable asset for LMICs looking to promote technology transfer. They note that the Doha Declaration makes available to states the flexibility to achieve technology transfer through compulsory licensing to domestic producers under the TRIPS agreement.[26]

Domestic infrastructure is an important consideration when discussing compulsory licensing options. Juma argues that "[c]ompulsory licensing, as provided for in Article 31 of the TRIPS agreement, has often been promoted as a policy tool to address public interest concerns, but it is not widely used. . . . The ability to make effective use of patented technologies is largely dependent on existing technological capacity in a country. The more advanced a country is, the more likely it can benefit from compulsory licensing."[27] Tenni also reached this conclusion and noted that TRIPS flexibilities "cannot alone be a panacea".[28]

The primary instrument of technology transfer, the compulsory license, is a compromised one. In practice, the level of public health crisis which must exist before utilization is sought is high, likely too high to be applied to tobacco harm reducing technologies in

---

[24] Tran Viet Dung et al., Vietnam – *A Case Study for Sustainable Technology Transfer* 220, 258 (Jun. 10, 2011).

[25] *Id.* at 223.

[26] *Compulsory licensing of pharmaceuticals and TRIPS*, WORLD TRADE ORGANIZATION, (last visited Aug. 15, 2023) https://www.wto.org/english/tratop_e/trips_e/public_health_faq_e.htm.

[27] Calesous Juma, *Intellectual property rights and globalization: implications for developing countries*, SCIENCE, TECHNOLOGY AND INNOVATION DISCUSSION PAPER, p.14 (1999).

[28] Brigitte Tenni et al., *What is the impact of intellectual property rules on access to medicines? A systematic review*, 18 GLOBALIZATION AND HEALTH p.36 (2022).

combating the smoking epidemic in the near future.[29] This is especially true whilst the health benefits of tobacco harm reducing technologies remain contested at the highest levels.

This speaks to an essential tension in the legal instrument; those most in need are often, and in the case of tobacco harm reducing technology, the least developed and are therefore the least able to benefit. This may hold not only for a compulsory licensing's value proposition as an instrument of technology transfer, but also for its ability to act as a threat in licensing negotiations.

V. REDUCED HARM TOBACCO TECHNOLOGIES AND THE TOBACCO INDUSTRY'S APPROACH TO THE SMOKING PANDEMIC

More than 80% of the world's smokers live in the developing world and each year a significant number of deaths from smoking occur.[30] Several measures have been adopted to stem the "smoking epidemic".[31] Most prominent amongst these, is the Framework Convention on Tobacco Control (FCTC). The FCTC aims "to protect present and future generations from the devastating health, social, environmental and economic consequences of tobacco consumption and exposure to tobacco smoke."[32] The Framework uses the phrase

---

[29] Ellen 't Hoen, PRIVATE PATENTS AND PUBLIC HEALTH: CHANGING INTELLECTUAL PROPERTY RULES FOR ACCESS TO MEDICINES, 54 (Health Action International, 2016). 't Hoen shows thirty-four instances of compulsory licensing in twenty-four countries for reasons of access to treatment, of which twenty instances concern access to HIV/AIDS medication, between 2001 and 2014.

[30] *Tobacco*, WORLD HEALTH ORGANIZATION, (May 24 2022), https://www.who.int/news-room/fact-sheets/detail/tobacco; *see also* Table 5 in Annex.

[31] Xaiochen Dai et al., Evolution of the global smoking epidemic over the past half century: strengthening the evidence base for policy action, 31 TOBACCO CONTROL,129, 129-37 (2022); Robert N. Proctor, *The global smoking epidemic: a history and status report*, 5 CLINICAL LUNG CANCER 371, 371-76 (2004); Maarten Wensink et al., *Progression of the smoking epidemic in high-income regions and its effects on male-female survival differences: a cohort by age analysis of 17 countries*, BMC PUBLIC HEALTH (2020), https://doi.org/10.1186/s12889-020-8148-4.

[32] *WHO FCTC: 15 years protecting and saving lives*, WHO FRAMEWORK CONVENTION ON TOBACCO CONTROL, (Feb. 27 ,2020) https://fctc.who.int/newsroom/news/item/27-02-2020-who-fctc-15-years-protecting-and-saving-lives.

"tobacco control" to refer to a "range of supply, demand and harm reduction strategies" that have the aim of improving "the health of a population by eliminating or reducing their consumption of tobacco products and exposure to tobacco smoke."[33] The FCTC particularly emphasizes on technology transfer.[34]

This is made more concrete in Article 22 "Cooperation in the scientific, technical and legal fields and provision of related expertise" which requires that Parties "cooperate . . . [to] promote the transfer of technical scientific and legal expertise and technology . . . to establish and strengthen national tobacco control strategies."[35] Interestingly, despite recognizing the value of technology transfer, the FCTC does not address the role of patents in these objectives. This is an oversight. The tobacco industry's response has been to invest and develop tobacco harm reducing technology (RHPs). 'Smokers smoke for the tobacco, but die of the tar,' remains a leading rationale for the industry's altered approach to cigarettes.[36] As strategy to come to grips with the smoking pandemic, RHPs will however always remain second best to stopping smoking all together.

Despite having spent significant sums into the development of these new technologies, the evidence presented in this paper indicates most of the tobacco industry's attention is not on technology transfer or expansion of RHPs into LMICs. The tobacco industry's approach to mitigate the risks of smoking has been met with severe skepticism from health activists.[37] Up until now the World Health Organization

---

[33] *WHO Framework Convention on Tobacco Control*, WHO, p.4 (2005) https://apps.who.int/iris/bitstream/handle/10665/42811/9241591013.pdf.

[34] *Id.* at p.6.

[35] *Id.* at p.20.

[36] M. A. H. Russell, *Low-tar medium nicotine cigarettes: A new approach to safer smoking*, 1 Brit. Med. J. 1430, 1430-33 (1976).

[37] Amelia Lucas, *FDA banes Juul e- cigarettes as U.S. pursues broader crackdown on nicotine products*, CNBC, (Jun. 23, 2022) https://www.cnbc.com/2022/06/23/fda-bans-juul-e-cigarettes-as-us-cracks-down-on- nicotine-products.html (whilst in the USA concerns around the dangers of e-cigarettes led to bans on the sale of some of these products and bans on some flavoured e-cigarette liquids); *US announces countrywide ban on flavoured e-cigs*, BBC NEWS, (January 2 2020) https://www.bbc.co.uk/news/business-50978321).

(WHO) has not recognized RHPs as a means to control the smoking pandemic.[38]

Reduced harm tobacco products have, however, been approved by some regulatory authorities around the world. Particularly the British Government has embraced reduced harm tobacco products as a means to come to grips with the adverse effects of combustible cigarettes.[39] In the United States of America, some reduced harm technologies have also been to a limited extent approved by US Food and Drug Administration.[40] Reduced harm tobacco products (RHPs) refer to electronic nicotine delivery systems[41] (ENDS), heated tobacco products[42] (HTPs) or smokeless tobacco products which are designed to deliver nicotine using methods other than combustion. ENDS and HTPs are similar in mechanism of consumption but differ in the underlying technologies. It furthermore differentiates between heated tobacco technology, nicotine vapor technology and smokeless (or oral) tobacco technology.

---

[38] *Electronic nicotine delivery systems*, WORLD HEALTH ORGANIZATION, (July 21 2014) https://apps.who.int/gb/fctc/PDF/cop6/FCTC_COP6_10-en.pdf.; Benjamin Mason Meier & Donna Shelley, *The Fourth Pillar of the Framework Convention on Tobacco Control: Harm Reduction and the International Human Right to Health*, 121 Public Health Rep. 494, 494-500 (2006).

[39] Department of Health and Social Care & Neil O'Brien MP, *Smokers urged to swap cigarettes for vapes in world first scheme*, GOV.UK, (Apr. 11, 2023), https://www.gov.uk/government/news/smokers-urged-to-swap-cigarettes-for-vapes-in-world-first- scheme (for instance, the UK government has introduced a scheme to encourage smokers to swap cigarettes for vaping products).

[40] The Tobacco and Related Products Regulations, 2016 No. 507, 31-40.; *E-Cigarettes, Vapes, and other Electronic Delivery Systems (ENDS)*, U.S. FOOD & DRUG ADMINISTRATION, (Jul. 21, 2023) https://www.fda.gov/tobacco-products/products-ingredients-components/e-cigarettes-vapes-and-other-electronic-nicotine-delivery-systems-ends.

[41] *E-Cigarettes, Vapes, and other Electronic Nicotine Delivery Systems (ENDS)*, *supra* note 39 (Also called e-cigarettes or vapes).

[42] *How are Non-Combusted Cigarettes, Sometimes Called Heat-Not-Burn Products, Different from E-Cigarettes and Cigarettes?*, U.S. FOOD & DRUG ADMINISTRATION, (May 1, 2020) https://www.fda.gov/tobacco-products/products-ingredients-components/how-are-non-combusted-cigarettes-sometimes-called-heat-not-burn-products-different-e-cigarettes-and (Also called non-combusted cigarettes or heat-not-burn products).

The US Food and Drug Administration (FDA) splits recreational nicotine products into several categories and regulates all of these.[43] This study focused on smokeless tobacco products[44], heated tobacco products[45] and electronic nicotine delivery systems (ENDs).[46] In this study we refer to these definitions to guide our analysis.

Product Space	Technology Areas	Application
Non-combustible	Inhaling appliances Construction details (including cartridges and battery parts) Shape/Structure and nature of electric heating Temperature control	Nicotine vapour product
		Heated tobacco products
Smokeless Oral Nicotine Products	Mixture of active ingredients	Pouches
		Chewing

[43] *Products, Ingredients & Compounds*, U.S. FOOD & DRUG ADMINISTRATION, (May 28, 2020) https://www.fda.gov/tobacco-products/products-guidance-regulations/products-ingredients- components.

[44] *Smokeless Tobacco Products, Including Dip, Snuff, Snus, and Chewing Tobacco*, U.S. FOOD & DRUG ADMINISTRATION, (Jun. 7, 2023,) https://www.fda.gov/tobacco-products/products-ingredients-components/smokeless-tobacco-products-including-dip-snuff-snus- and-chewing-tobacco.

[45] *FDA Authorizes Three New Heated Tobacco Products*, U.S. FOOD & DRUG ADMINISTRATION, (Jan. 26, 2023) https://www.fda.gov/tobacco- products/ctp-newsroom/fda-authorizes-three-new-heated-tobacco-products (the FDA does not define heated tobacco products, instead authorising them as 'modified risk tobacco products); *Heated Tobacco Products*, CENTERS FOR DISEASE CONTROL AND PREVENTION, (last visited Aug. 16, 2023) https://www.cdc.gov/tobacco /basic_information/heated-tobacco-products/index.html (The Centers for Disease Control and Prevention, another US federal body, defines heated tobacco products).

[46] *E-Cigarettes, Vapes, and other Electronic Nicotine Delivery Systems (ENDS)*, *supra* note 39.

VI. METHODOLOGY

6.1.1. Selection of Sample Countries

The WTO refrains from defining the term 'developing country.'[47] Hence, we used the World Bank's classification scheme, which categorizes countries according to their gross national income ('GNI').[48] Low-income countries are considered those below 1,085 USD ($), lower-middle income countries have a range between $1,086-4,225. Upper-middle income is between $4,256-13,205 and high-income countries are over $13,205.[49] For the purpose of our study we included low income, lower-middle and upper middle- income countries.

Following this, several additional criteria were applied. To be selected, a country had to be member of the WTO and be part of the other two critical international patent treaties regulating the global patent system; namely the Paris Convention for the Protection of Industrial Property of 1883[50] and the Patent Cooperation Treaty (PCT) of 1978.[51]

The Paris Convention is a foundational agreement for global patent rights, which establishes common rules for all contracting states to follow. The Paris Convention aims at protecting against unfair competition. It does so, by setting forth the principle of national

---

[47] *Who are the developing countries in the WTO*, WORLD TRADE ORGANIZATION, (last visited Aug. 10, 2023) https://www.wto.org/english/tratop_e/devel_e/d1who_e.htm.("There are no WTO definitions of "developed" and "developing countries. Members announce for themselves whether they are "developed" or "developing" countries.").

[48] Nada Hamadeh et al., *New World Bank country classifications by income level: 2022-2023*, WORLD BANK BLOGS, (Jul. 1 2022) https://blogs.worldbank.org/opendata/new-world-bank-country-classifications-income-level-2022-2023#_ftn1.

[49] *Id.*

[50] *Summary of the Paris Convention for the Protection of Industrial Property (1883)*, WIPO, (last visited Mar. 9, 2023) https://www.wipo.int/treaties/en/ip/paris/summary_paris.html.

[51] Patent Cooperation Treaty, art. 1, Jun. 19, 1970, 35 USC 351.

treatment, the right of priority and the principle of territoriality of the patent system.

The PCT provides a unified procedure for filing patent applications in the contracting states and hence simplifies global patent protection. Under the PCT, a single patent application can be filed rather than several separate applications.[52] Both are administered by the World Intellectual Property Organization (WIPO).[53] Countries deemed fragile or conflict-affected were excluded from the study. It is not reasonable to expect effective technology transfer in such environments. Data for this criterion was sourced from the World Bank.[54] The legality of reduced harm tobacco technologies is the final exclusionary criterion. Countries where RHPs are illegal to either produce or sell were excluded from our study. It is not reasonable to expect technology transfer related to reduced harm tobacco technologies into regions where these products would be illegal. Data was sourced from Global State of Tobacco Harm Reduction's Tobacco Harm Reduction Database.[55]

For e-cigarettes potential categories were 'banned' where a regulation specifically prohibits the product, 'allowed' or 'no specific law'. For snus, the categorizations are either 'allowed' or 'banned' in each jurisdiction. For heated tobacco products (HTPs), products are either 'available' or 'not available' reflecting if the product was marketed or not, and 'allowed' or 'banned'. Note that in many cases, HTPs may be permitted (or at least, not prohibited) in the jurisdiction but not available for purchase on the formal market.[56]

---

[52] *Introduction to the International Phase*, WIPO 4.003 (last visited Mar. 9 2023) https://www.wipo.int/pct/en/guide/ip04.html.

[53] *WIPO-Administered Treaties*, WIPO (last visited Aug. 10, 2023) https://www.wipo.int/treaties/en/.

[54] *FY23 List of Fragile and Conflict-affected Situations*, WORLD BANK (last visited Jan. 27, 2023) https://thedocs.worldbank.org/en/doc/69b1d088e3c48 ebe2cdf451e30284f04- 0090082022/original/FCSList-FY23.pdf (The World Bank's methodology for determining fragility or conflict-affected status).

[55] *Global smoking and THR database*, GLOBAL STATE OF TOBACCO HARM REDUCTION (last visited Jan. 27, 2023) https://gsthr.org/countries/ (GSTHR uses refers to the Republic of Eswatini as Swaziland).

[56] Ibid.

Nicotine replacement therapies (NRTs) are classified as 'available' regardless of whether a prescription was required to access them or not and whether the product was sold in pharmacies or other vendors as well.[57] 'Not available' applied to jurisdictions where NRTs are not marketed.[58] Only those jurisdictions where all four technologies were 'banned' were excluded from this study. Following this elimination process, the countries within the index scope can be seen in Table 6 in the Annex.

6.1.2. Selection of Companies:

We selected those companies that have a total of more than 100 patents relevant to the 73 LMICs within the index scope across all three technology spaces. Where patent owners are subsidiaries of another, we consider the parent company to include the patents of the subsidiaries and have consolidated those into the parent company:[59]

- Altria Group, Inc.*
- British American Tobacco (including Nicoventures, R.J. Reynolds Tobacco Company and Reynolds American as subsidiaries of BAT)*
- Changzhou Paiteng Electronic Technology Service Co., Ltd.
- China National Tobacco Corporation*
- Imperial Brands (including Fontem Ventures B.V. and Nerudia as subsidiaries of Imperial Brands)*
- Japan Tobacco Inc.*
- JWEI Group

[57] Ibid.

[58] Ibid.

[59] Those companies indicated by an asterisk (*) are also assessed in the Tobacco Transformation Index 2022.

- Kimree, Inc.
- O-Net Automation Technology Shenzhen Ltd.
- Philip Morris International Inc. (including Swedish Match AB following acquisition in December 2022)
- Shenzhen FirstUnion Technology Co., Ltd.
- Shenzhen Innokin Technology Co., Ltd.
- Shenzhen IVPS Technology Co., Ltd.
- Shenzhen Smoore Technology Ltd.
- Shenzhen Woody Vapes technology Co., Ltd.
- Shenzhen YouMe Information Technology Co., Ltd.

6.1.3. Patent Publication Scoping

Data was sourced from the World Intellectual Property Organization's (WIPO) Patentscope database relevant to RHPs. As of October 2022, the WIPO Patentscope database holds collections from 76 national/regional patent offices.[60] EPO's data is accessible by WIPO and is incorporated into their dataset. Patentscope distinguishes between PCT and national/regional office entries and the two can be easily filtered.[61] Patentscope counts a patent application, successive publications, and the potential patent to be one document.[62] This improves the data retrieval process.

Using the US FDA's categorization of reduced harm tobacco technologies, we identified the relevant keywords for heated tobacco technologies, nicotine vapor technologies and smokeless (or oral)

---

[60] *National Collections – Data Coverage*, WIPO PATENTSCOPE, (last visited Nov. 14 2023), https://patentscope.wipo.int/search/en/help/data_coverage.jsf.

[61] Ibid.; PATENTSCOPE, WIPO, (last visted Nov. 14 2023), https://www.wipo.int/patentscope/en/.

[62] *PATENTSCOPE: Frequently Asked Questions*, WIPO, (last visited Feb. 13, 2023) https://www.wipo.int/patentscope/en/faqs_patentscope.html.

tobacco technology. The most prominent patent litigations in each technology field were reviewed. The keyword search was furthermore complemented by a review of the rather limited scholarly literature on reduced harm tobacco technologies. The sources for heated tobacco technology,[63] nicotine vapor technology,[64] and smokeless (or oral)

---

[63] Case HP-2022-000002, Nicoventures Trading Ltd v. Philip Morris Products SA, 2023 EWHC 854, 3-48; case HP-2020-000012, Philip Morris Products, SA v. Rai Strategic Holdings, Inc., 2021 EWHC 537, 3-44; Stéphanie Boué et al., *State-of-the-art methods and devices for the generation, exposure, and collection of aerosols from heat-not-burn tobacco products*, 4 TOXICOLOGY RESEARCH AND APPLICATION (2020); Massimo Caruso et al., *Comparative assessment of electronic nicotine delivery systems aerosol and cigarette smoke on endothelial cell migration: The Replica Project*, DRUG TEST ANALYSIS 1-10 (2022); Holger Behrsing et al., *Characterization of a Vitrocell VC1 Using Nicotine Dosimetry: An Essential Component Toward Standardized In Vitro Aerosol Exposure of Tobacco and Next Generation Nicotine Delivery Products*, 4 APPLIED IN VITRO TOXICOLOGY 159-66 (2018); K. McAdam et al., *Influence of machine-based puffing parameters on aerosol and smoke emissions from next generation nicotine inhalation products*, 101 REGUL TOXICOL PHARMACOL. 156-65 (2019): *Tobacco Industry Product Terminology*, TOBACCO TACTICS, (Jul. 20, 2023) https://tobaccotactics.org/wiki/tobacco-industry-product-terminology/; Mateusz Jankowski et al., *New ideas, old problems? Heated tobacco products - a systematic review*, 32 INT'L. J. OCCUP. MED. ENV'T. HEALTH 595-634 (2019); Reto Auer et al., *Heat-Not-Burn Tobacco Cigarettes: Smoke by Any Other Name*, 177 JAMA INTERN MED. 1050-52 (2017).

[64] RAI Strategic Holdings, Inc. et al. v. Altria Client Services LLC. et al., 1:20-cv-00393-LMB-TCB, (Va. D.C. 2020); Altria Client Services LLC v. R.J. Reynolds Vapor Co., 2021 U.S. Dist. LEXIS 90537 (N.C.D. May 2021); 9 cases involving VPR Brands, LP: v. Myle Vape Inc and MVH I Inc in New York, v. HqdTech USA LLC in Florida, v. PHD Marketing Inc in California, v. Monq, LLC in Tennessee, v. B&G Trading LLC D/B/A Vapor Tech in Arizona, v. Lightfire Holdings LLC in Florida, v. Jupiter Research, LLC in Arizona, v. Cool Clouds Distribution, Inc. in California, v. XL Vape in California; James Nicol et al., *Comprehensive Chemical Characterization of the Aerosol Emissions of a Vaping Product Based on a New Technology*, 16 CHEM. RES. TOXICOLOGY 789-799 (2020); D. Breheny et al., *The in vitro assessment of a novel vaping technology,* 7 TOXICOLOGY REPORTS 1145-1156 (2020); Grant O'Connell et al., *An experimental method to determine the concentration of nicotine in exhaled breath and its retention rate following use of an electronic cigarette*, 2 J. OF ENV'T. ANALYTICAL CHEMISTRY (2015); Emily Bonner et al., *The chemistry and toxicology of vaping*, 225 PHARMACOLOGY THERAPIST (2021).; Jude A. Frie et al., *OpenVape: An Open-Source E-Cigarette Vapour Exposure Device for Rodents*, 7 ENEURO (2020).; Zachary B. Massey et al., *Dripping Technology Use Among Young Adult E-Cigarette Users*, 14 TOBACCO USE INSIGHTS (2021); LM. Dutra et al., *Philip Morris research on precursors to the modern e-cigarette since 1990*, 26 TOBACCO CONTROL 97-105 (2017).

tobacco technology are cited below.[65] The result of this work is presented in table 6 in the Annex.

As a quality control measure, the output datasets for each of the three different technology sectors are compared, and duplicates between technology spaces identified. These are then checked and assigned on a best-fit basis to the most applicable technology space through examination of patent title, description and claims using the Patentscope database.

Furthermore, we verified patent entry into national phases. A single PCT application may have multiple 'designated states' in which patent protection is sought.[66] A PCT application is not an international patent and protection is not granted in every state. Our research found companies tend to designate many states, including many LMICs, in PCT applications, but do not then realize those applications in national-phase patent applications. In most instances, these designations do not realize into actual patent publications once the application enters national phase. We hence corrected our database for national entry phases in a second step.

6.1.4. Scoping Patent Litigation and Product Sales

Patent litigation data since 2000 was obtained from publicly available sources, including court records such as The National

---

[65] Dryft Sciences, LLC v. Swedish Match North America, LLC, 2023 U.S. Dist. LEXIS 23207 (Ca. D.C. 2023); Pinkerton Tobacco Co., LP et al v. Kretek International, Inc., 2021 U.S. Dist. LEXIS 77280 (Ky. D.C. 2021); Adrienne B. Mejia & Pamela M. Ling, *Tobacco Industry Consumer Research on Smokeless Tobacco Users and Product Development,* 100 AM. J. PUB. HEALTH 78-87 (2010); C.M. Carpenter et al., *Developing smokeless tobacco products for smokers: an examination of tobacco industry document*, 18 TOBACCO CONTROL 54-59 (2009); Göran Pershagen, *Smokeless tobacco*, 52 BRITISH MED. BULLETIN 50-57 (1996); Meagan O. Robichaud et al., *Tobacco companies introduce 'tobacco-free' nicotine pouches*, 29 TOBACCO CONTROL 145-146 (2020):.; Umesh Wadgave & L. Nagesh, *Nicotine Replacement Therapy: An Overview*, 10 INT'L. J. HEALTH SCI. (Quassim) 425-35 (2016); Silvy Peeters & Anna B. Gilmore, *Transnational Tobacco Company Interests in Smokeless Tobacco in Europe: Analysis of Internal Industry Documents and Contemporary Industry Materials*, 10 PLOS MED. (2013).

[66] *Patent Cooperation Treaty (PCT)*, WIPO, (last visited Nov. 14 2023), https://www.wipo.int/treaties/en/registration/pct/.

Archives and similar sources, as well as the legal press.[67] In each case, the parties involved, patents in dispute, technology space, and outcome were recorded where possible. Consistent with the treatment of subsidiaries in the patent prosecution landscape, the litigative actions of subsidiaries are included within those of the parent company to provide the clearest picture of the litigative landscape.

Whilst we do not claim this process was exhaustive, given the limitations of public sources and the possibility that some case data is not available, we have been able to identify 100 cases involving assessed companies since 2000. This offers a valuable insight into the litigative landscape and reveals extensive litigation with a focus on reduced harm tobacco technologies. Except for China, none of these pertain to the sample countries.

Data on Product Sales was sourced from several market data providers we deem to be reliable. Of these providers, none were able to retrieve data for more than sixteen countries out of a total qualifying sample of 73 countries.[68] For the remaining 57 countries no data on RHPs is retrievable. To the extent that sales data exists, it pertains by and large to upper mid-income countries. Only for ten low-mid income countries can data even be found. In none of the least developed countries can sales for RHPs be documented.[69]

---

[67] *Find case law*, NAT'L ARCHIVES, (last visited Mar. 7, 2023) https://caselaw.nationalarchives.gov.uk/; *Home*, PACER (last visited Mar. 7, 2023) https://pacer.uscourts.gov/; *Home*, CHINA JUDGEMENTS ONLINE, (last visited Mar. 7, 2023) https://wenshu.court.gov.cn/website/wenshu/181029CR4M5A62CH/index.html?#; *Home*, ITALGIUREWEB (last visited Mar. 7, 2023) https://www.italgiure.giustizia.it/; *Căutare jurisprudență*, SCJ (last visited Mar. 7, 2023) http://www.scj.ro/736/Cautare-jurisprudenta; *IP Judgements Database*, INTELL. PROP. HIGH CT. (last visited Mar. 7, 2023) https://www.ip.courts.go.jp/app/hanrei_en/search. The legal press was also reviewed to guide this research.

[68] These are : Brazil, Bulgaria, China, Colombia, Egypt, India, Indonesia, Malaysia, Mexico, Peru, the Philippines, Russia, South Africa, Thailand, Turkey and Vietnam.

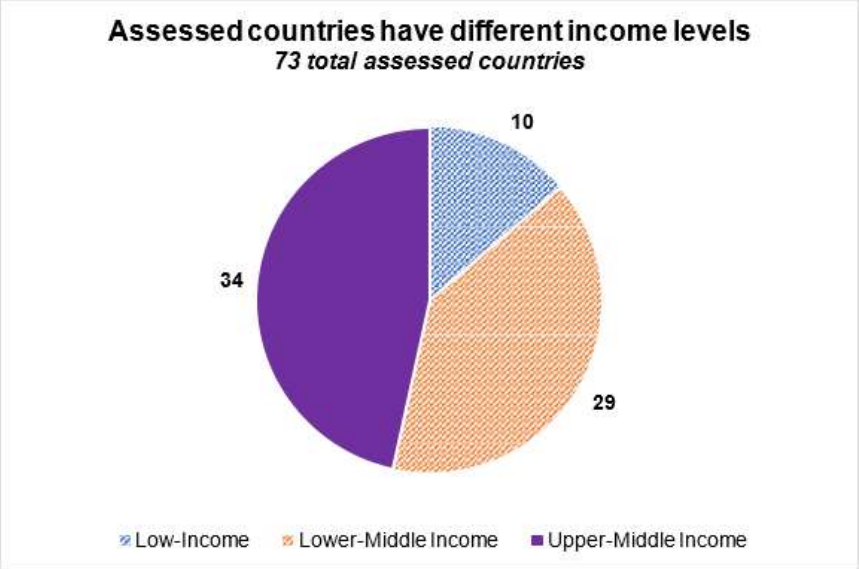
[69] *Tobacco Market Size & Share Analysis*, MORDOR INTELLIGENCE, (last visited Aug. 21, 2023) https://www.mordorintelligence.com/industry-reports/global-tobacco-market-industry; *Tobacco Market*, ALLIED MARKET RESEARCH (May 2021) https://www.alliedmarketresearch.com/tobacco-market-A11180; *Tobacco Market*, TECHNAVIO (Apr. 2023) https://www.technavio.com/report/tobacco-market-

This lack of data stands in contrast to the smoking prevalence in these countries. In Albania for example 32% of the population over the age of fifteen smoked in 2019, Botswana and Cambodia report over 20% of smokers and in Georgia, Lao or Mongolia nearly 30% of the country's population smokes.[70]

VII. FINDINGS

The data confirms that insufficient attention is currently paid to LMICs from a patent perspective. No low-income countries have any patent publications related to reduced harm tobacco technologies, and beyond China and a few select nations including Russia, Brazil, India, Malaysia and Mexico, most lower-middle and upper-middle income countries also display no patent publications. (See Figure 1.).[71]

FIGURE 1: ASSESSED COUNTRIES BY INCOME LEVEL



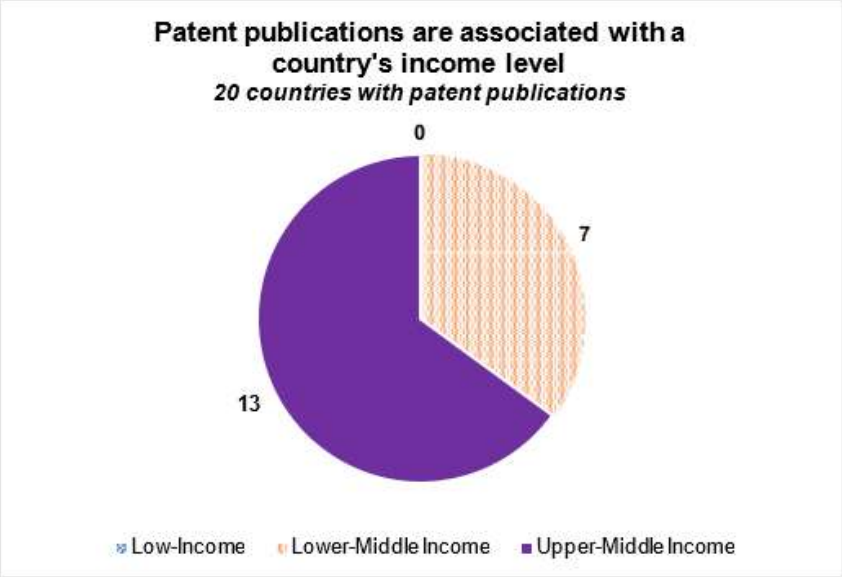
industry-analysis; *Tobacco Market Size, Share & Trends Analysis Report*, GRAND VIEW RESEARCH (last visited Aug. 21 2023) https://www.grandviewresearch.com /industry-analysis/tobacco-market.

[70] See Table 5 in the Annex.

[71] 'Patent publications' included published applications and granted patents.

In all, 53 of the assessed 73 countries have no patent protection; this is remarkable; tobacco companies owning reduced harm tobacco patents are, overall, currently not concerned with enabling access to these products amongst low- and middle-income country (LMIC) populations. There is an evident association between a higher income level and a higher likelihood that a country has patent publications for reduced harm tobacco technologies; just under 40% of assessed upper-middle income countries had patent publications related to reduced harm tobacco technologies, compared with under 25% of lower-middle income countries and 0% of assessed low-income countries.

FIGURE 2: ASSESSED COUNTRIES WITH REDUCED HARM TOBACCO TECHNOLOGY PATENT PUBLICATIONS, BY INCOME LEVEL

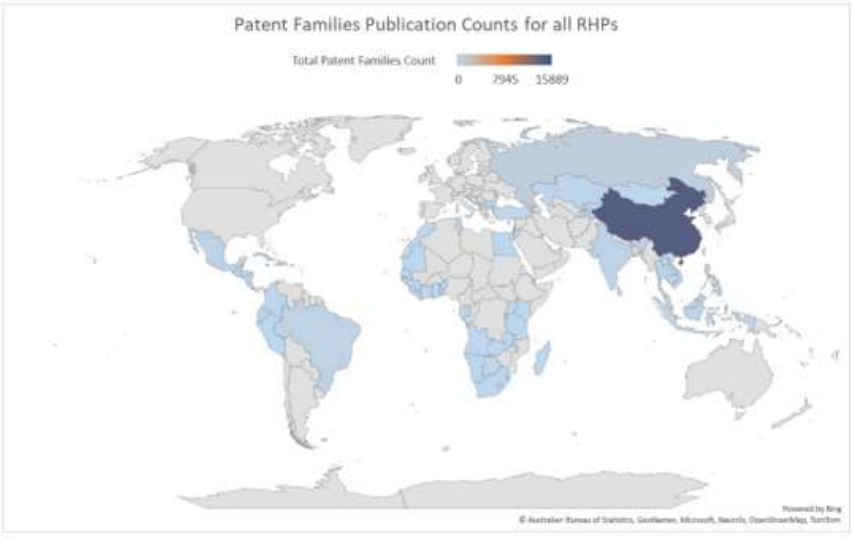


The number of patents relevant to each technology space varies considerably. Nicotine vapor technologies are, with over 13,000 patent publications in LMICs, by far the most patented. Heated tobacco technologies have with just about 2,000 patent publications in LMICS, a much more limited patent volume. The nicotine vapor space

is dominated by China-headquartered companies, whilst heated tobacco shows established tobacco companies competing. The volume of patent activity for smokeless tobacco technologies are essentially insignificant with just over 300 in LMICs, although this technology space is notable for the presence of non-tobacco industry actors, such as pharmaceuticals.

Amongst the 73 assessed LMICs, only 20 have any patent protection for reduced harm tobacco technologies at all, and only nine of these have more than 100 patents filed (see Figure 3). Africa is underserved by current patent management practices. In a continent of 54 countries only South Africa, Egypt, Tunisia and Morocco enjoy any patent protection for reduced harm tobacco technologies. The situation is marginally better in Southern and Central America as well as in Asia, but several nations from these continents also remain without protection.

FIGURE 3: GEOGRAPHIC DISTRUCTION OF RHP PATENT PUBLICATIONS



This is concerning, given all 73 of these countries meet a host of criteria that would, at least in principle, facilitate access to patents and hence technology transfer. As detailed in the country selection criteria (see

6.1.1), they are all members of the World Trade Organization (WTO) and hence subject to the obligations of the Agreement on Trade Related Intellectual Property Rights (TRIPS). They are all signatories to the World Intellectual Property Organization's (WIPO) Patent Cooperation Treaty (PCT), adhere to the Paris Convention for Industrial Property and are not categorized as high-risk countries by the World Bank.

7.1. China's Prevalence in Patent Publications

Of the top ten companies across the reduced harm tobacco technology space, seven are Chinese and account for 5,937 granted patents (29.86%) (See Table 1.). Two companies, China National Tobacco Corporation (CNTC) and Kimree, Inc., account for 3,433 (17.27%) of all granted patents alone.

Company	Total patents across all three technology spaces	Nation of headquarters
China National Tobacco Corporation	2097	China
Kimree, Inc.	1336	China
Philip Morris International Inc.	1142	Switzerland
Paiteng electronic Technology Service Co., Ltd.	876	China
Japan Tobacco Inc.	799	Japan
FirstUnion Technology Co., Ltd.	584	China
IVPS Technology Co., Ltd.	425	China
British American Tobacco	356	UK
JWEI Group	317	China
Smoore Technology Ltd.	298	China

TABLE 1: TOP 10 PATENT OWNERS ACROSS ALL THREE TECHNOLOGY SPACES ASSESSED, AND THE LOCATION OF THEIR HEADQUARTERS

Chinese companies tend to concentrate their patent filings in China. Across all assessed companies and all three technology spaces, an average of 92.04% of Chinese companies' portfolios are applicable to China (see Table 2). Whilst reasonable to say Chinese companies are making a major contribution to patent activity in LMICs, their focus is very evidently on protecting innovations in the domestic market.

Company	Patents filed in China	Total Patents	Percentage of patents filed in China (%)
CNTC	2001	2097	95.42
Kimree, Inc.	1257	1336	94.09
Paiteng Electronic Technology Service Co., Ltd.	827	876	94.41
FirstUnion Technology Co., Ltd.	436	584	76.66
IVPS Technology Co., Ltd.	380	425	89.41
JWEI Group	271	317	85.49
Smoore Technology Ltd.	260	302	86.09
YouMe Information Technology Co., Ltd.	152	153	99.35
Innokin Technology Co., Ltd.	123	129	95.35
Woody Vapes Technology Co., Ltd.	119	119	100.00
O-Net Automation Ltd.	111	113	98.23
Average			**92.04**

TABLE 2: THE PROPORTION OF PATENTS FILED IN CHINA BY CHINESE COMPANIES

We can observe a range of approaches to patent management amongst the assessed Chinese companies. CNTC's approach contrasts with its nearest rival by portfolio size, Kimree, Inc. Much of Kimree's portfolio appears to be PCT applications, with each application relevant to several states. Of the 1,336 patents in the portfolio, Kimree holds 800 patents in 59 states, indicating 800 PCT patents filed by the company. Kimree, Inc. also holds 868 patents in Albania, Bulgaria, North Macedonia and Turkey, which are all member states of the European Patent Organization and from which we can infer are benefiting from the same 68 European Patents in addition to the PCT applications.[72]

CNTC holds 152 patents in 57 states, indicating only 152 PCT patents in its portfolio. Amongst those member states of the EPO assessed in this report, CNTC holds 224 patents in each. Compared against the total patents held by the company, 2,097, the much smaller proportion of patents filed under the PCT or EPO indicates a difference in focus between NTC and Kimree, Inc, whereby CNTC is much more focused on ensuring protection within China and less

[72] *Member states of the European Patent Organization*, EPO (last visited Mar. 2, 2023) https://www.epo.org/about-us/foundation/member-states.html.

concerned than Kimree, Inc. in protecting its innovations in the rest of the world.

CNTC's approach is typical of the assessed companies: China has the greatest patent count, followed by EPO states and then PCT patents. For each company there are some anomalous countries, for example the Russian Federation, where the number of patents does not match any other nation. Two notable exceptions amongst the assessed Chinese companies are IVPS Technology Co., who appear to have filed no PCT patents and have sought protection in only EPO states and China, and Woody Vapes Technology Co., who have sought protection in China alone.

The interest of Chinese companies is not uniformly distributed across the three technology spaces. In the nicotine vapor technology space, seven of the top ten patent holders assessed are Chinese companies. In the heated tobacco space, four of the top ten patent holders assessed are Chinese companies. Finally, in the smokeless technology space, only one of the top ten patent holders assessed is a Chinese company. Interestingly, a correlation with between the prevalence of Chinese companies and total patent volume in each technology space can be observe, (see Table 3).

	Number of assessed Chinese companies in top 10 patent holders	**Total technology space patent count**
Nicotine vapour technologies	7	16,039
Heated tobacco technologies	4	3,254
Smokeless tobacco technologies	1	591

TABLE 3: THE ASSOCIATION BETWEEN CHINESE PRESENCE IN A TECHNOLOGY SPACE AND TOTAL PATENT VOLUME

The data confirms the importance of China in the RHP patent landscape, both from the perspective of the substantial patent portfolios held by Chinese-headquartered companies, and for the interest all assessed companies displayed in ensuring they publish in China. This is particularly true in the nicotine vapor space.

International tobacco companies are also very active in China. We estimate that Philip Morris International files 33% of its LMIC patents in China. British American Tobacco has filings of 42%, Japan Tobacco of 66% and Imperial Brands of 55% of their LMIC patents in China. Imperial and Altria lag slightly behind in terms of patent numbers. In the case of Altria this is perhaps explained by a focus on the US market only and a determination that protection in LMICs is not valuable. Imperial appears to be adopting a similar approach, focusing on heated tobacco products in Europe and "selective market opportunities" for vapor products.[73]

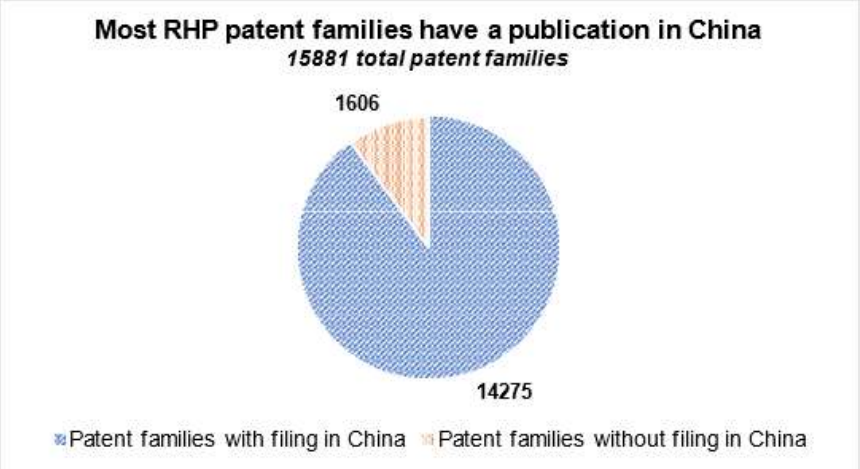
Company	Patents filed in China	Total patents	Percentage of patents filed in China (%)
Philip Morris International, Inc.	403	1208	33.36
British American Tobacco	350	826	42.37
Japan Tobacco Inc.	529	803	65.88
Imperial Brands plc	124	227	54.63
Altria Group, Inc.	69	167	41.32
Average			**47.51**

TABLE 4: THE PROPORTION OF PATENTS FILED IN CHINA BY NON-CHINESE COMPANIES

China also has, by far, the greatest level of patent activity amongst assessed LMICs. Over 14000 patents in total among LMICs are published here, of which over 12000 (85.2%) related to nicotine vapor technologies (see Figure 4.). The result is a skewed market and further illustrates the marginalization of developing nations from a reduced harm tobacco patent perspective.

[73] *Our strategic priorities*, IMPERIAL BRANDS (last visited Apr. 24, 2023) https://www.imperialbrandsplc.com/how-we-are-transforming/our-strategy.

[FIGURE 4: PROPORTION OF ALL PATENT FAMILIES WITH PATENT PUBLICATION IN CHINA]

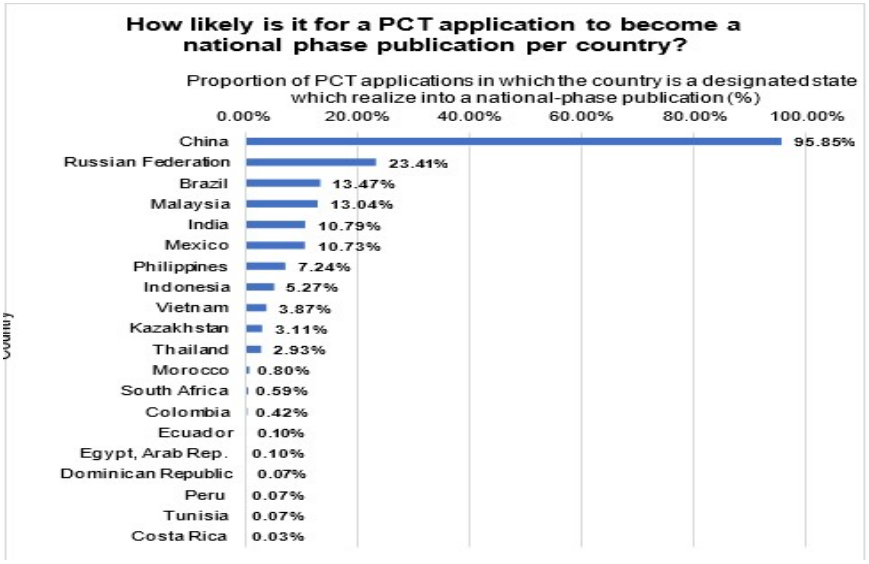


7.2. PCT Applications Compared to National Entry Publications.

Our research would suggest that companies tend to designate many states, including many LMICs, in the PCT application phase, but do not then realize those applications in national phase patent applications. An interview with a top executive in a tobacco company confirmed this practice, and the data suggests this is an industry-wide trend.[74] While designations in China realize by 96% into a national phase publication and countries such as Russia or Brazil still see a close to 20% conversion rate, most PCT patents tend to get dropped once they reach national entry phase in LMICs. Countries such as Morocco, Ecuador or Peru convert in roughly 0.5% of all patent publications through the PCT into a national patent publication. This data points to the marginalization of LMICs in the global patent system.

FIGURE 5: PROPORTION OF PCT APPLICATIONS IN WHICH AN ASSESSED COUNTRY IS DESIGNATED FROM WHICH A NATIONAL PHASE PUBLICATION IS REALIZED

[74] *Anonymized interview with a Senior Vice President of Patents in a major multinational tobacco company*, (Mar. 3 2023), 14:00GMT.



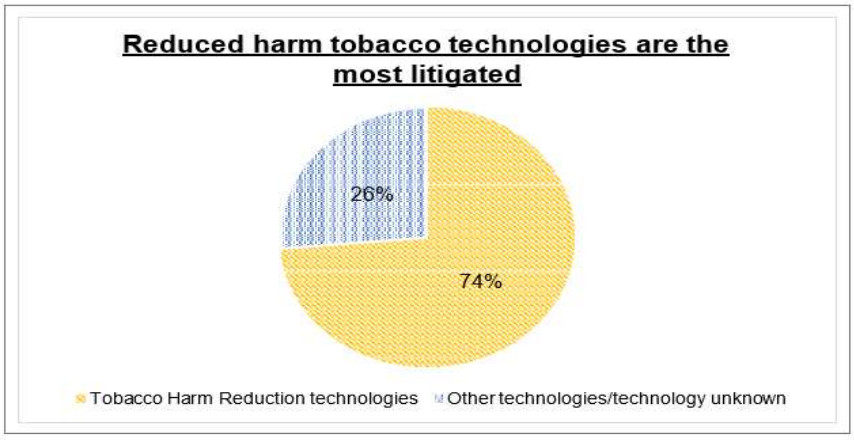
7.3. Litigation Analysis

There were about 100 patent litigations in the tobacco space since 2000. Sixty-one of these pertained to the United States of America, twenty-one to China, eight to Japan and six to the UK.[75] We were unable to find a single patent litigation in any of the countries in the sample studied, except for China.

Almost three-quarters of the identified cases involved reduced harm tobacco technologies. (See figure 6.). Altria, BAT and PMI share a similar spilt in the proportion of their litigation related to RHPs, each with approximately 70% of disputes being related to reduced harm tobacco technologies. The fact that all three multinational firms have such a high proportion of litigation related to reduced harm tobacco technologies, despite the multiple product lines they have, shows the high level of conflict surrounding patents associated with these technologies. The trend is continued through Imperial where, despite also being a multinational tobacco company, 100% of litigation with which it was involved in, related to reduced harm tobacco technologies.

[75] *See* Find case law supra, note 68.

FIGURE 6: PROPORTION OF ALL LITIGATION INVOLVING ASSESSED COMPANIES SINCE 2000 INVOLVING REDUCED HARM TOBACCO TECHNOLOGIES



We hypothesize that RHP specialists would see a greater proportion of the litigation with which they are involved to be related to reduced harm tobacco technologies.[76] Smoore and JWEI Group, the two companies of this type from whom there is data, appear to confirm this hypothesis, although the data is limited. JWEI, for instance, were involved in only one litigation overall and this was related to reduced harm tobacco technologies. Smoore were involved in seven, of which six (86%) can be concretely tied to reduced harm tobacco technologies. In the seventh case, patent information is not available and so the technology space cannot be determined.

7.4. Most Litigated Reduced Harm Tobacco Technologies

E-cigarettes were the most litigated reduced harm tobacco technology, followed by heated tobacco products. Only three cases since 2000 involving the assessed companies were concerned with nicotine pouches for oral nicotine consumption. In broad terms, this technology split resembles the patent landscape, where the greatest number of patent applications have been for e-cigarette technologies,

[76] Companies that do not have combustible tobacco product lines.

followed by heated tobacco products and the least being for smokeless technologies. The greater number of e- cigarette litigations may therefore simply reflect that there are more patents in this technology space, and therefore greater likelihood of infringement.

The increased litigation may further be attributed to the nature of the e-cigarette market which is far more heterogenous than the other technology spaces, having many more participants. All litigation related to heated tobacco products amongst the assessed companies involved either Philip Morris International or British American Tobacco. It is notable that no other assessed companies display a desire to engage in litigation around this technology space, despite having products of their own in it. We suggest there may be two reasons for this. Firstly, companies other than British American Tobacco and Philip Morris International may not have the specific IP to leverage in litigation and assert against competitors. That said, it is interesting that both companies have broadly avoided engaging other companies with heated tobacco/heat-not-burn products in litigation. This gives rise to the second point, that only Philip Morris International and British American Tobacco see the costs and risks of extensive patent litigation to be worthwhile for the benefits it might offer, likely because of their leading global market shares. For companies with only a small share of the market, such costs are likely not worth assuming. It is evident from this data that large tobacco companies are utilizing patents for reduced harm tobacco technologies to offensively pursue litigation in developed countries. The motivation for this is either to win market share through utilization of the courts – as in the case of Philip Morris International and British American Tobacco or to extract from other market participants royalty payments – as in the case of Imperial.[77] More recently, Smoore unsuccessfully attempted to apply the same strategy as imperial to extract licensing rates.[78]

---

[77] *See* supra, note 57

[78] See International Trade Commission, *Certain Oil-Vaping Cartridges, Components Thereof, and Products Containing the Same; Commission Determination Not to Review an Initial Determination Granting in Part Complainant's Motion to Amend the Complaint and Notice of Investigation and to Terminate the Investigation with Respect to a Respondent*, FEDERAL REGISTER (Mar. 24 2022) (last visited Aug. 15, 2023) https://www.federalregister.gov/documents/2022/03/24/2022- 06207/certain-

The volume of litigation involving reduced harm tobacco technologies – almost 75% of cases since 2000 involving the assessed companies – is disproportionate to the current market value of these products when compared to traditional combustible products.[79] Yet it confirms that the assessed companies see value in this segment and are willing to incur substantial expenses by pursing multinational litigation to win it.

VII. CONCLUSIONS

The biggest challenge for the global community that remains to be solved is how to bring LMICs into the international system. Bridging the gap between developed and developing nations, remains unresolved, yet a dire necessity for the preservation of wealth and stability in developed and developing nations alike. Our data illustrates that, except for China, LMICs have hardly any exposure to patent prosecution and literally none to patent enforcement in the RHP space. Data on patented product sales is for many of these countries not even collected. This leads us to conclude that the TRIPS Agreement has so far not achieved its goal. TRIPS only has meaning where there are patents, but it has no grip in countries that fail to attract patented technologies all together.

Even though we have not assessed to what extent our sample of LMICs is de facto TRIPS compliant, it must be underlined that they adhere at least in principle to the TRIPS agreement. This may suggest that poor nations remain cut off, no matter whether they seek to comply with TRIPS or not. Factors not regulated by TRIPS, such as growth and market expectations may lead corporations to stay away from such countries.

Against this background the impact of compulsory licensing is also minimal. While, in principle, compulsory licensing is designed to

---

oil-vaping-cartridges-components-thereof-and-products-containing-the-same-commission.

[79] *Global Trends in Nicotine*, FOUNDATION FOR A SMOKE-FREE WORLD (Dec. 2021), https://www.smokefreeworld.org/wp-content/uploads/2021/12/Global%20Trends%20in%20Nicotine%20Report%20December%202021.pd f, 5.

accelerate technology transfer, it has no effect in countries that have no exposure to patents. These countries can also not use compulsory licensing to enhance the bargaining position in licensing negotiations.

Paradoxically, the threat of a compulsory license has been quite successfully leveraged by developed nations, as the example of the USA in the global Anthrax crisis illustrates.[80] The ability to make effective use of patented technologies is largely dependent on existing technological capacity in a country. The more advanced a country is, the more likely it can benefit from compulsory licensing.[81]

It is our opinion that there is a dire need to broaden the geographical scope of patent protection, so to include also LMICs. It is common market practice to only operate in markets, where technology products are patent protected. That companies would sell proprietary technology without assuring adequate patent protection also runs against any business rationale. No reasonable person would risk exposing technology in markets without assuring adequate underlying patent protection. The patent statistics presented here also underline the relationship between lack of patents and lack of patent protected products in LMICs.

We recognize that this view runs afoul of the opinion of patent sceptics who maintain that less patent protection in LMICs translates into enhanced product access. Cavicchi & Kowalski are a good example of this school of thought. Their view is summarized as such: "IP constraints restricting access present a critical problem; impeding and even inhibiting effective and equitable transfer of essential innovation".[82]

---

[80] Reichman Jerome, *Compulsory Licensing of patented pharmaceutical inventions: evaluating the options*, 37 J. L. Med. Ethics, p.6 (2009).

[81] Calesous Juma, *Intellectual property rights and globalization: implications for developing countries*, 4 SCIENCE, TECHNOLOGY AND INNOVATION DISCUSSION PAPER, 14 (1999).

[82] Jon R. Cavicchi & Stanley P. Kowalski, IP and the Global Public Interest: Challenges and Opportunities, GERMESHAUSEN CENTER NEWSLETTER, p.12 (Winter/Spring 2007).

We would hence encourage patenting activities in LMICs as a means to disseminate RHPs in LMICs. We caution however that such a rationale may not hold in developed countries, where extensive patent fortresses paired with quasi-automatic injunctions may stifle innovation.[83]

RHPs are the tobacco industry's response to the world's smoking crisis. These products enjoy strong patent protection in the developed world, but our research highlights this level of protection is not shared by the developing world. If technology aimed at reducing tobacco harm is not protected in poor regions, it suggests tobacco companies have no interest in making arguably less harmful cigarettes available to LMIC populations. This exacerbates differences between the haves and have-nots. Those areas with the greatest burden from smoking are also provided with the least opportunity to adopt potentially less harmful alternatives.

In that respect, the rising prominence of China deserves special attention. Our data confirms the importance of China in the RHP patent landscape, both from the perspective of the substantial patent portfolios held by Chinese-headquartered companies, and for the interest all assessed companies displayed in ensuring a strong patent position in China. Chinese companies have established control of the e-cigarette manufacturing market. In the current geopolitical context, China presents a huge unknown factor. If and to what extent Chinese tobacco companies will display an interest and motivation in making RHP technologies available to LMICs remains entirely unclear.

We encourage the tobacco industry to urgently explore avenues to offer tobacco harm reduction technologies also to LMICs, even where the business rationale does not justify this. The obligation

---

[83] Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard Setting*, 1 INNOVATION POLICY AND THE ECONOMY 119-50 (2000); Tom Nicholas, *Are Patents Creative or Destructive?*, 2 ANTITRUST L. J. 405-21 (2014); John F. Luman III and Christopher L. Dodson, *No Longer a Myth, the Emergence of the Patent Troll: Stifling Innovation, Increasing Litigation and Extorting Billions*, 18 Intell. Prop. & Tech. L. J. (2006) https://www.edegan.com/pdfs/Luman%20Dodson%20(2006)%20%20No%20longer%20a%20myth%20the%20emergence%20of%20the%20patent%20troll.pdf.

to do so does not only stem from a responsibility towards society, but also from the TRIPS Agreement and the FCTC, which both underline the necessity to assure adequate technology transfer.

Imitation as an innovation strategy has not occurred in this sector, this suggests that there are quite substantial entry barriers to this technology. Against this background, it is necessary to involve various capacity building activities, such as engagement with local universities, training and awareness raising. Firms may also need to assist with the transmission of tacit knowledge, the practical know-how that facilitates the employment of shared patents in R&D activities or in the manufacture of tobacco harm reduction technologies. Any such activities must go hand in hand with regulatory approval of tobacco harm reduction technologies, so to assure that tobacco harm reduction technologies really hold the promise of reducing the risks of smoking.

The issue of LMIC exclusion from the global economy through patents represents a failure of global governance. Rectifying this will require the combined effort of a range of stakeholders and actors, particularly businesses. International law, NGOs, charities and universities also have a role to play. Effective technology transfer, which is applicable to a wide range of patented technologies and not just those cases studied here, stands to impart real and tangible human benefit. It would be aided by the integration of China and Chinese commercial actors too, as the data in this paper has so clearly demonstrated. There exists, therefore, an opening for international leadership that will drive the necessary international cooperation on this issue. We hope others will consider the questions raised in this paper and encourage them to do so, but equally we note the urgency with which answers need to be found to those questions so that LMICs might finally be properly integrated into the globalized world to the benefit of all.

ANNEX:

TABLE 5: ASSESSED COUNTRIES WITH KEY DATA

Country	WTO	Income	Paris Conv.	PCT	Conflict	Smoker over 15+, 2019	Total Population	GNI/capita, PPP	Product Sales	HTPs	Legality of RHPs e-cigs	Snus	NRT
Albania	Yes	Upper middle	Yes	Yes No		32%	2,775,630	18210	No	Not Available	No specific law	Allowed	Not Available
Angola	Yes	Lower middle	Yes	Yes No		10%	33,933,611	6060	No	Not Available	No specific law	Allowed	Not Available
Armenia	Yes	Upper middle	Yes	Yes No		28%	2,780,470	18120	No	Available	No specific law	Allowed	Available
Belize	Yes	Upper middle	Yes	Yes No		6%	12,451,031	3750	No	Not Available	No specific law	No InformationNot Available	
Benin	Yes	Lower middle	Yes	Yes No		6%	13,352,660	4020	Modelled	Not Available	No specific law	No InformationNot Available	
Botswana	Yes	Upper middle	Yes	Yes No		22%	2,397,240	16650	Modelled	Not Available	No specific law	Allowed	Available
Brazil	Yes	Upper middle	Yes	Yes No		9%	213,993,441	15550	No	Not Available	Banned	No InformationAvailable	
Bulgaria	Yes	Upper middle	Yes	Yes No		38%	6,465,100	32520	Yes	Available	Allowed	Banned	Available
Cabo Verde	Yes	Lower middle	Yes	Yes No		6%	561,901	6890	Modelled	Not Available	No specific law	No InformationNot Available	
Cambodia	Yes	Lower middle	Yes	Yes No		21%	16,767,840	5080	No	Banned/Not Availabl	Banned	No InformationNot Available	
China	Yes	Upper middle	Yes	Yes No		27%	1,412,360,000	19170	Yes	Not Available	Allowed	Allowed	Not Available
Colombia	Yes	Upper middle	Yes	Yes No		12%	51,874,020	19480	Yes	Available	Banned	Allowed	Available
Costa Rica	Yes	Upper middle	Yes	Yes No		11%	5,180,830	22820	Yes	Not Available	Allowed	Allowed	Available
Côte d'Ivoire	Yes	Lower middle	Yes	Yes No		N/A	27,053,629	5760	No	Not Available	Allowed	Allowed	Available
Cuba	Yes	Upper middle	Yes	Yes No		25%	1,002,197	5740	No	Not Available	No specific law	No InformationNot Available	
Djibouti	Yes	Lower middle	Yes	Yes No		25%	1,120,850	5780	No	Not Available	No specific law	No InformationNot Available	
Dominica	Yes	Upper middle	Yes	Yes No		11%	72,740	13540	No	Not Available	No specific law	No InformationNot Available	
Dominican Republic	Yes	Upper middle	Yes	Yes No		11%	10,953,714	19730	Yes	Available	No specific law	Allowed	Available
Ecuador	Yes	Upper middle	Yes	Yes No		15%	18,001,000	12630	Yes	Not Available/Allowe	Allowed	No InformationNot Available	
Egypt, Arab Rep.	Yes	Lower middle	Yes	Yes No		24%	104,258,327	12910	Yes	Not Available	Banned	Allowed	Not Available
El Salvador	Yes	Lower middle	Yes	Yes No		10%	6,518,500	9120	Yes	Not Available	Allowed	Allowed	Available
Eswatini	Yes	Lower middle	Yes	Yes No		9%	1,172,369	8870	Modelled	Not Available	No specific law	Allowed/Availa Available	
Gabon	Yes	Upper middle	Yes	Yes No		12%	2,278,829	14560	Modelled	Not Available	No specific law	Allowed	Available
Gambia, The	Yes	Low income	Yes	Yes No		11%	2,486,937	2370	Modelled	Not Available	Banned	Allowed	Not Available
Georgia	Yes	Upper middle	Yes	Yes No		29%	3,712,500	15830	Yes	Available/Allowed	Allowed	Allowed	Available
Ghana	Yes	Lower middle	Yes	Yes No		6%	31,732,128	6020	No	Not Available	No specific law	Allowed	Not Available
Grenada	Yes	Upper middle	Yes	Yes No		12%	126,440	15870	No	Not Available	No specific law	No InformationNot Available	
Guatemala	Yes	Upper middle	Yes	Yes No		12%	17,357,890	10610	Yes	Available	No specific law	Allowed	Available
Guinea	Yes	Low income	Yes	Yes No		15%	13,497,237	2540	No	Not Available	No specific law	Allowed	Not Available
Honduras	Yes	Lower middle	Yes	Yes No		14%	10,062,994	5740	Yes	Not Available	Allowed	Allowed	Not Available
India	Yes	Lower middle	Yes	Yes No		13%	1,417,173,170	8210	Yes	Banned/Not Availabl	Banned	No InformationAvailable	
Indonesia	Yes	Lower middle	Yes	Yes No		31%	276,361,788	12560	Yes	Not Available/No spe	Allowed	No InformationAvailable	
Jamaica	Yes	Upper middle	Yes	Yes No		13%	2,827,380	11480	No	Not Available/Allowe	Allowed	No InformationAvailable	
Jordan	Yes	Upper middle	Yes	Yes No		34%	11,285,870	10690	Yes	Not Available/Allowe	Allowed	No InformationAvailable	
Kazakhstan	Yes	Upper middle	Yes	Yes No		25%	19,621,970	27060	Yes	Available	No specific law	Allowed	Available
Kenya	Yes	Lower middle	Yes	Yes No		11%	54,985,702	4950	No	Not Available	No specific law	Allowed	Available
Kyrgyz Republic	Yes	Lower middle	Yes	Yes No	N/A		6,694,200	4840	No	Not Available	No specific law	Allowed	Not Available
Lao PDR	Yes	Lower middle	Yes	Yes No		30%	7,379,358	8150	No	Not Available/No spe	Banned	No InformationNot Available	
Lesotho	Yes	Lower middle	Yes	Yes No		21%	2,159,067	3030	No	Not Available	No specific law	Allowed	No Information
Liberia	Yes	Low income	Yes	Yes No		8%	5,180,208	1450	No	Not Available	No specific law	Allowed	Not Available
Madagascar	Yes	Low income	Yes	Yes No		14%	29,200,000	1600	No	Not Available	No specific law	No InformationAvailable	
Malawi	Yes	Low income	Yes	Yes No		13%	19,647,681	1630	No	Not Available	No specific law	No InformationNot Available	
Malaysia	Yes	Upper middle	Yes	Yes No		22%	33,938,220	32250	Yes	Available/Allowed	Allowed	Allowed	Available
Mauritania	Yes	Lower middle	Yes	Yes No		18%	4,775,110	5530	Modelled	Not Available	No specific law	Allowed	Not Available
Mauritius	Yes	Upper middle	Yes	Yes No		23%	1,262,520	27480	Modelled	Not Available	Banned	Allowed	Available
Mexico	Yes	Upper middle	Yes	Yes No		18%	130,262,220	19540	Yes	Banned/Not Availabl	Banned	Allowed	Available
Moldova	Yes	Upper middle	Yes	Yes No	N/A		2,592,480	15310	No	Available/Allowed	Allowed	No InformationNot Available	
Mongolia	Yes	Lower middle	Yes	Yes No		29%	3,329,282	11090	No	Not Available	No specific law	Allowed	Available
Montenegro	Yes	Upper middle	Yes	Yes No		36%	616,160	27530	No	Not Available	No specific law	Banned	Not Available
Morocco	Yes	Lower middle	Yes	Yes No		12%	37,344,787	8020	Yes	Not Available	No specific law	Allowed	Available
Namibia	Yes	Upper middle	Yes	Yes No		17%	2,567,344	9660	Modelled	Not Available	No specific law	Allowed	Available
Nicaragua	Yes	Lower middle	Yes	Yes No		13%	6,948,390	5380	No	Not Available	Banned	Allowed	Available
North Macedonia	Yes	Upper middle	Yes	Yes No		39%	205,766	19280	Yes	Available/Allowed	Allowed	Banned	Available
Peru	Yes	Upper middle	Yes	Yes No		6%	3,404,959	14080	Yes	Not Available	No specific law	Allowed	Available
Philippines	Yes	Lower middle	Yes	Yes No		25%	111,046,910	9450	Yes	Not Available	Allowed	Allowed	Available
Ruasian Federation	Yes	Upper middle	Yes	Yes No		30%	143,446,060	32000	Yes	Available	Allowed	Banned	Not Available
Rwanda	Yes	Low income	Yes	Yes No		15%	13,276,517	2440	No	Not Available	No specific law	No InformationNot Available	
Samoa	Yes	Lower middle	Yes	Yes No		27%	200,144	6300	No	Not Available	No specific law	No InformationAvailable	

Senegal	Yes	Lower middle	Yes	Yes No		8%	17,196,308	3690 No	Not Available/Allowe	Allowed	Allowed	Available
Sierra Leone	Yes	Low income	Yes	Yes No		19%	8,141,343	1750 Modelled	Not Available	No specific law	Allowed	Not Available
South Africa	Yes	Upper middle	Yes	Yes No		23%	59,893,890	15570 Yes	Available/Allowed	Allowed	Allowed	Available
Sri Lanka	Yes	Lower middle	Yes	Yes No		15%	22,181,000	14030 No	Banned/Not Availabl	Banned	No InformationNot	Available
St. Lucia	Yes	Upper middle	Yes	Yes No		12%	179,860	17110 No	Not Available	No specific law	No InformationNo	Information
St. Vincent and the Grenadin	Yes	Upper middle	Yes	Yes No		12%	103,950	16510 No	Not Available	No specific law	No InformationNot	Available
Tajikistan	Yes	Lower middle	Yes	Yes No		9%	9,749,625	5180 Modelled	Not Available	Allowed	No InformationNot	Available
Tanzania	Yes	Lower middle	Yes	Yes No		8%	61,498,438	2920 No	Not Available	No specific law	No InformationNot	Available
Thailand	Yes	Upper middle	Yes	Yes No		14%	5,453,566	102450 No	Banned/Not Availabl	Banned	Allowed	Available
Togo	Yes	Low income	Yes	Yes No		8%	8,478,242	2390 Modelled	Not Available	Allowed	No InformationNot	Available
Tunisia	Yes	Lower middle	Yes	Yes No		24%	11,935,764	11270 Yes	Not Available	Allowed	Allowed	Available
Türkiye	Yes	Upper middle	Yes	Yes No		31%	85,042,736	30020 No	Banned/Not Availabl	Banned	Banned	Available
Uganda	Yes	Low income	Yes	Yes No	N/A		47,249,585	2650 No	Not Available	Banned	No InformationAvailable	
Vietnam	Yes	Lower middle	Yes	Yes No	N/A		99,168,829	11040 No	Not Available	Allowed	No InformationAvailable	
Zambia	Yes	Low income	Yes	Yes No		16%	18,920,657	3300 No	Not Available	No specific law	No InformationAvailable	

TABLE 6: KEYWORDS BY TECHNOLOGY SPACE

Heated Tobacco Technology	**Nicotine Vapour Technology**	**Smokeless tobacco technology**
Heat-not-burn AND tobacco	"E-liquid" vapouriser	"Oral delivery" nicotine
"Heat-not-burn tobacco product"	Nicotine vaporiser NOT "no nicotine"	"Free nicotine salt"
"Tobacco heating product"	Nicotine AND atomiser	"Nicotine gum"
"Tobacco heating system"	Cartomizer	"Nicotine patch"
"Tobacco heating device"	"Electronic Nicotine Delivery System"	"Nicotine nasal spray"
Electric OR electronic AND "heated tobacco"	Wicking AND aerosolization	"Nicotine lozenge"
Carbon-based tobacco AND heating AND products	Aerosol nicotine solvent mixture	Nicotine "oral pouch"
Tobacco AND aerosol AND dispenser OR generator OR emitter	Nicotine AND cartridge	Snus
Tobacco AND nicotine AND aerosol AND dispenser OR generator OR emitter	Nicotine pod NOT "non-nicotine"	Snuff tobacco NOT flavour NOT pneumatic NOT "cooling effect" NOT herbal NOT nasal
"Tobacco puffing device"	Flavour cartridge electronic	Nicotine pouch products
Pulse-heated tobacco	Aerosol nicotine generating system	"Nicotine polacrilex"
Tobacco nicotine inhalation products	Liquid nicotine aerosol forming substrate	"Smokeless tobacco products"
"Non-combustible tobacco product"	Electrically AND heated AND smoking AND system	"Chewing tobacco products"
Glycerol tobacco heated	Electrically operated aerosol generating system	"Oral tobacco"
Propylene glycol tobacco heating	Nicotine mouthpiece with a fluid inlet and a fluid outlet	"Nasal snuff"
"Novel tobacco products"	Cigarette permeable vaporizer membrane	"Moist snuff" NOT cannabis NOT nontobacco NOT "non-tobacco"
Heat-not-burn cigarette technology	Smoke-free inhalation of nicotine	"Nicotine pouches"
"Electrically heated smoking system"	"Electronic cigarette"	"Nicotine powder" NOT ginseng NOT insecticides
"Electrical smoking system"	"E-cigarette"	"Nicotine replacement therapy"
Tobacco AND aerosol AND substrate	"E-vapor" apparatus	"Alternative nicotine"

Electrically insulated tobacco substrate	"Vapor precursor compartment"	Rapid AND release AND nicotine AND gum
Thermally insulated tobacco substrate	"Electronic vapor devices"	Nicotine transdermal patch
Volatile tobacco aerosol flavour compounds	"E-vaping device"	Nicotine sublingual tablets NOT pharmaceutical
Tobacco atomizer OR tobacco atomiser	Nicotine "electronic inhaler"	"Nicotine tablets"
Tobacco puff control mechanism	Nicotine "electronic atomizer"	Nicotine vaccine NOT cholera NOT feed
	"Vape pen"	
	Nicotine vaping NOT "non-nicotine"	
	Coil-and-wick atomizer NOT oil	
	Coil-and-wick cigarette NOT oil	