OIL AND GAS PATENTS: DO MULTINATIONAL CORPORATIONS IMPEDE THE GROWTH OF TECHNOLOGY IN DEVELOPING COUNTRIES?

Harini Varadarajan*

Abstract: 82% of the world's proven oil reserves are in the members of the Organization of Petroleum Exporting Countries which are predominantly developing countries. The international oil corporations (IOCs) otherwise known as the O&G (Oil and Gas) multinational corporations (MNCs) of the advanced nations develop the technology for extracting the hydrocarbons from the reserves and assist the developing oil-rich states in doing so. In exchange for the technology, developed nations have obtained access to the O&G resources that they lack. Because the technology required to extract oil is highly sophisticated and requires substantial research and development (R&D), the MNCs have secured them using patents. However, some of the strategic patenting practices and supplementary offensive methods employed by the MNCs of technologically superior countries over the past century have been criticised as being anticompetitive. Though these methods were employed to secure their own investments, they have inadvertently hindered technological development of some developing oil-rich nations and created a large technology gap between the Global North and South which I will present through the course of this paper. I conclude that oil-rich nations that lacked capital and technological infrastructure due to weak governmental support for Research & Development have been the ones to suffer in contrast to those oil-rich nations whose governments were committed to technology and advancement. Therefore, to overcome the technology gap, I urge host countries to have the political will and take proactive measures to develop their own technology. Reformation of International Intellectual Property Laws must also be considered if developed nations are indeed committed to helping the developing countries succeed, as encouraging innovation in all countries is indeed the very foundation of IP Law.

Keywords: Patents; Anti-Competitive; Anti-Trust; Oil and Gas; International Intellectual Property Law; Developing Countries; Multinational Corporations; Innovation; Technology

* University of Edinburgh, United Kingdom.

Table of Contents

INTRODUCTION

82% of the world's proven oil reserves are in the members of the Organization of Petroleum Exporting Countries who are predominantly developing countries. [1] The international oil corporations (IOCs) otherwise known as the O&G (Oil and Gas) multinational corporations (MNCs) of the advanced nations develop the technology for extracting the hydrocarbons from the reserves and assist the developing oil-rich states in doing so. In exchange for the technology, developed nations have obtained access to the O&G resources that they lack. Because the technology required to extract oil is highly sophisticated and requires substantial research and development (R&D), the MNCs have secured them using patents. However, some of the patenting practices and supplementary methods employed by the MNCs to secure their technology has at times been criticised as being anticompetitive and curtailing the innovation of the oil-producing states. Although the impact of petroleum operations conducted by IOCs to the environment and human rights of these states has been a highly debated issue for many years, their impact on their technological growth particularly from the patenting standpoint has not been a thoroughly explored subject. The situation thus begs the question 'Oil and Gas Patents: Do MNCs impede the growth of technology in developing countries?'

Though proponents of the patent system believe that patents are a vehicle of technology transfer, intended to facilitate technical exchange among users with common purposes,[2] this has not always been the case. Particularly in the oil industry, there have been instances in which oil-rich states have suffered a setback to their technology growth because of the strategic manner in which patents owned by the oil corporations have been wielded. And other than a handful, most oil-producing nations continue to be technologically deficient. Therefore, rather than limiting myself to a single jurisdiction, I focus on their general use in the international O&G industry. I examine oil-rich nations that have experienced technological growth as well as those who have experienced technological stagnation, explore the reasons for these and consequently determine what role if any, the patents owned by the O&G MNCs played in them. Because it is my intention that this paper be of use to oil-producing nations who wish to close the technology gap, my analysis culminates in a set of recommendations to develop suitable domestic and international reforms.

This paper is organized as follows. In chapter 2, I present the rationale behind Patent Law, the role of Antitrust Law and enumerate the corporate practices that affect the balance between these laws. In chapter 3, I demonstrate the presence of a technology gap between the advanced states who develop the oil technology and the oil-producing developing states. I will use country examples to demonstrate the usage of anticompetitive practices such as patent strategizing and restrictive patent licensing by MNCs and also present the adverse effects resulting from their use. In chapter 4, I present the counter argument by citing examples of oil-producing nations who have not only managed to escape the adverse effects of O&G MNC patenting, but in fact benefited from them and increased their technological level through technology initiatives, transfers, and collaborations. Having analysed both sides of the issue I suggest reforms to enable the technology deficient nations to increase their technological capability in chapter 5. Here I also detail the Shale technology revolution of the United States

[1] Organization of Petroleum Exporting Countries, https://www.opec.org/opec_web/en/data_graphs/330.htm (last visited 19 May 2023).

[2] Louis M. Lubango, *When can strong patent regimes boost countries' stocks of inventions and related trade? An analytical model tested in Brazil, Egypt, Nigeria and South Africa in the energy, environment and pharmaceuticals and related sectors* 42 TECH. in SOC'Y 150, 150 (2015).

as the ideal manner in which patents can be used to increase innovation. Because patenting is a good indicator of technology growth,[3] I will present patent statistics to illustrate my point throughout the course of this paper. Chapter 6 concludes this paper by summarizing both sides of the argument and presenting my position on the topic.

I. THE PATENT-ANTITRUST BALANCE AND RELATED ISSUES OF THE O&G INDUSTRY

A. The Rationale Behind Patent Law

Patents are a type of intellectual property rights (IPRs). A patent confers upon the inventor exclusive rights to commercialize the invention and obtain revenue from its sales during the duration of its validity. It also guarantees the inventor protection from another's exploitation of his invention through claims established in the patent application. Patent rights are typically territorial i.e. valid only in the country they are granted and can be renewed periodically[4] for about 20 years[5] allowing the inventor a temporary monopoly over that technology. The Patent Convention Treaty system allows an inventor to obtain patent rights in all its member states by filing a single application.[6] Currently 152 states are party to the PCT making it the main international patent granting authority.

In their current form, most patents are owned by companies that develop them for commercial applications through investment in R&D activities. In addition to securing protection for and exclusive use of the technology, the availability of a patent also allows firms to earn royalty income through licensing of that technology. Patents are thus closely linked with trade and commerce. Because patent rights are typically territorial, to enable smoother cross-border trade while ensuring adequate protection for them, the World Trade Organization has defined regulations in the Trade-Related Aspects of Intellectual Property Rights.[7] TRIPS provides a means of harmonizing the different national IP systems and allows developing nations with nascent IP laws to learn from those of the developed countries. However, TRIPS has received much criticism for being tilted towards the developed nations because it requires developing nations to guarantee minimum standards of protection for foreign patents by adopting a system that is predominantly western in nature. This has been attributed to the WTO being dominated by MNCs of developed countries who want to ensure that their technology is protected during trade with the developing world. Because 80% of the R&D takes place within the private MNCs of only ten of the advanced nations of the world, they have a greater say.[8]

Though proponents of patents consider them as a means for technology exchange unlike trade secrets where technology is undisclosed, they can sometimes be a "barrier to entry"[9] for other inventors, restrict competition and create a monopoly which ultimately leads to reduced innovativeness. This naturally defeats the purpose of Patent Law and hence in order to maintain

---

[3] Kyungpyo Lee & Sungjoo Lee, *Patterns of Technological Innovation and Evolution in the Energy Sector: A Patent-Based Approach*, 59 ENERGY POL'Y 415, 415 (2013).
[4] Corinne Langinier, *Are patents strategic barriers to entry?* 56 J. ECON. & BUS. 349, 351 (2004).
[5] World Intellectual Property Organization, *Patents* (last visited 17 May 2023), https://www.wipo.int/patents/en/
[6] Patent Convention Treaty PCT available at: http://www.wipo.int/pct/en/ (last visited 15 May 2023).
[7] Trade-Related Aspects of Intellectual Property Rights available at: https://www.wto.org/english/docs_e/legal_e/27-trips_01_e.htm (last visited 17 May 2023).
[8] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 21 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.
[9] Nuno Pires De Carvalho, *The Primary Function of Patents*, 1 J. L., TECH. & POL'Y 63 (2001).

the balance between patent protection and healthy competition and to stimulate innovation, Antitrust Law has been developed.

B. The Role of Antitrust Law

Antitrust law is intended to regulate the conduct of business corporations and to promote fair competition in any market for the benefit of the consumers. But although international patent regulations and harmonization exists, antitrust issues have been largely left to national legislations.[10] To comprehend how antitrust law functions, the anticompetitive legislative provisions of a few countries are examined below.

In the United States, the Sherman Act,[11] the Clayton Act[12] and the Federal Trade Commission Act (FTC)[13] are the main means of antitrust control. The US verbiage for anticompetition is antitrust.[14] The Sherman Act of 1890 is the federal statute which authorizes the Department of Justice to bring suits against anticompetitive agreements or for market monopoly. The FTC Act of 1914 focuses on detecting and banning all unfair methods of restricting competition including but not limited to the Sherman Act. The Clayton Act of 1914 focuses on joint ventures, mergers and acquisitions which may unfairly create monopolies or reduce competition. These laws are limited to the jurisdiction of the US only and courts are usually reluctant to adjudicate foreign patent claims or interfere in antitrust issues outside its territory unless American consumers are affected.[15]

In Europe, antitrust control is established through two main regulations in the Treaty on the Functioning of the European Union and is enforced by the European Commission.[16] The first regulation is defined in article 101[17] of the Treaty which bans contractual agreements that restrain competition, and the second regulation is defined in article 102[18] which prohibits market abuse by corporations holding dominant positions. The EC requires these to be applied in conjunction with the national antitrust controls.[19]

In Australia, the welfare of the Australian consumer is ensured through the Competition and Consumer Act[20] which promotes competition and encourages fair-trade practices.

[10]Stephen Yelderman, *International Cooperation and the Patent-Antitrust Intersection* 19 TEX. INTELL. PROP. L.J. 193, 195 (2011).
[11] Sherman Antitrust Act, 15 U.S.C. §§ 1-7.
[12] Clayton Act 15 U.S.C. §§ 12-27.
[13] Federal Trade Commission Act 15 U.S.C. §§ 41-58.
[14] Raju KD, *Interface between Competition law and Intellectual Property Rights: A Comparative Study of the US, EU and India,* 2 INDIAN SOC'Y INT'L. L. 115 (2014).
[15] Kendra Robins, *Extraterritorial patent enforcement and multinational patent litigation: Proposed guidelines for US Courts,* 93 VIRGINIA L. REV. 1264 (2007).
[16] Treaty on the Functioning of the European Union (TFEU), 2010 O.J. (C 83) 47.
[17] Consolidated Version of the Treaty on European Union [2008] OJ C115/88.
[18] Consolidated Version of the Treaty on European Union [2008] OJ C115/89.
[19] European Commission, http://ec.europa.eu/competition/antitrust/nca.html (last visited May 2018).
[20] Australian Competition and Consumer Act 2010 (Cth), available at: http://www.australiancompetitionlaw.org/legislation/2010cca.html (last visited 16 May 2023).

The Competition Act[21] of Canada provides small and medium enterprises in Canada equal opportunities by regulating the competition in its economy while at the same time aiming to provide consumers with "competitive prices and product choices."[22]

Most of the advanced nations possess similar national antitrust legislation but in contrast, most developing nations only possess nascent antitrust laws having only recently acknowledged the need for anticompetitive control and enforcement. What we can gather from the antitrust laws of the advanced countries described above is that they are territorial, and their main focus is on the impact to the consumers in their own market. There is no international antitrust governing body for international activities. And because of this gap in the international antitrust regulation, many anticompetitive activities of O&G MNCs, who were often tougher than their developing state counterparts have continued unchecked for a long time. These are detailed in the next section.

C. Patent Usage in the O&G Industry

Patents are extensively used by firms in the O&G industry for two main reasons. The first reason is to acquire a competitive advantage[23] over other firms through the ownership of highly essential and sophisticated technology. The second reason for patent usage in the oil industry is that innovation is capital-intensive and commercializing a concept takes about 16 years.[24] Therefore in order to guarantee returns, patents are essential. With "easy oil"[25] having been used up, the need to secure technology to extract the maximum value of the reserves is imperative to the survival of MNCs and hence many of them have drastically increased their R&D budget and accumulated large patent portfolios.[26] O&G patents are not simply a means to safeguard proprietary technology, but are in fact a commodity for revenue generation from licensing technology.[27, 28] An increase in global patent litigation when oil prices started to drop is also indicative of the value of patents as revenue generators.[29] Patent settlements as high as C$52 million in Varco Canada v. Pason Systems[30] in 2013 confirms the importance of patent

[21] Canadian Competition Act, R.S.C., 1985, c. C-34, available at: https://laws.justice.gc.ca/eng/acts/C-34/PITIndex.html. (last visited 16 May 2023).
[22] Ibid 1.1.
[23] Brett Slaney & Dalton W. McGrath, *From Windfalls to Pitfalls: Intellectual Property in the Oil and Gas Industry*, Blakes (Nov. 5, 2013), https://www.lexology.com/library/detail.aspx?g=454d5e28-2894-4b94-9cf4-2f13a4130c20.
[24] *Facing the Hard Truths About Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas*, National Petroleum Council (July 18, 2007), https://www.npchardtruthsreport.org/pdf/NPC_Facing_Hard_Truths.pdf.
[25] Robert K. Perrons, *How innovation and R&D happen in the Oil and Gas Industry: Insights from a global survey,* 124 J. PETROLEUM SCI. & ENGG. 301, 301 (2014).
[26] *The Increased Importance of Patents for Big Oil*, Intellectual Property Expert Group (July 10, 2007), https://www.ipeg.com/the-increased-importance-of-patents-for-big-oil/
[27] Benjamin S. Fernandez & John V. Hobgood, *Energy Sector Alert Series: As Oil Prices Descend, Patent Enforcement Litigation Increases Within Energy Industry*, Wilmer Hale (Mar. 3, 2016), https://www.wilmerhale.com/en/insights/client-alerts/2016-03-03-energy-sector-alert-series-as-oil-prices-descend-patent-enforcement-litigation-increases-within-energy-industry.
[28] Mark Prinsley, *Give It Some Gas*, Intellectual Property Magazine (May 2015), https://w Mark Prinsley, *Give It Some Gas*, Intellectual Property Magazine (May 2015), https://www.mayerbrown.com/-/media/files/news/2015/06/give-it-some-gas/files/art_prinsley_jun15_give-it-some-gas/fileattachment/art_prinsley_jun15_give-it-some-gas.pdf.
[29] Rashid Khan, *What is an Intellectual Property Strategy for Oil and Gas Industry?* 52 J. LICENSING EXECUTIVES SOC'Y 45, 45 (2017).
[30] Varco Canada Ltd. et al. v. Pason Systems Corp. et al., (2013) 437 F.T.R. 243 (FC).

litigation in the oil and gas industry, making it more lucrative than pharmaceutical litigation in Canada.[31]

Despite the many advantages of patents, the manner in which they have been wielded can sometimes be regarded as anticompetitive. For example, the use of wide claims in the patent application, blocking patents,[32] non-essential patents and claims of infringement are mainly intended to deter competition but can instead hinder innovation. Strategic practices like patent aggregation[33] both through development and acquisition of technology allows firms to accumulate large patent portfolios making them a "formidable adversary".[34] Because the cost of defending a patent infringement suit averaged around 2.2 million USD[35] in 2015, fear of such high costs from patent litigation can discourage smaller companies from innovating.[36] In the petroleum industry this has resulted in an inadvertent technological oligopoly by major oil corporations and created barriers to entries[37] for new entrants.

Another manner in which O&G MNCs have been known to deter competition is by 'patent pooling' in which firms form patent pools and cross-license when the rights of several patents are needed to develop a certain product or when they hold blocking patents.[38] Although patent pooling can have cost benefits for the consumer, it can also reduce competition and in the long term is not beneficial. The case of Standard Oil[39] described in the next section is one such instance.

Multinational oil corporations often hold patents for the same invention in multiple jurisdictions which makes it safe to license out their oil technology to the national oil companies (NOCs) of different oil-producing nations. However, they have at times used practices such as restricted licensing and non-compete clauses to stifle innovation and eliminate local competition in the host countries. Restricted licensing occurs using clauses when licensing technology to NOCs. Conditions like patent grant-backs require the licensee to grant back any improvements made to the licensed technology to the licensor.[40] Some clauses even

---

[31] Brett Slaney & Dalton W. McGrath, *From Windfalls to Pitfalls: Intellectual Property in the Oil and Gas Industry*, Blakes (Nov. 5, 2013) https://www.lexology.com/library/detail.aspx?g=454d5e28-2894-4b94-9cf4-2f13a4130c20.

[32] Yibai Yang, *On the optimality of IPR protection with blocking patents,* 27 REV. ECON. DYNAMICS 205, 205 (2018).

[33] Oleg Milchenko, *Contemporary Anti-competitive Practices of Patents Usage* 8 J. INT'L COM. L. & TECH. 190, 194 (2013).

[34] Barry Barnett, *Antitrust Lessons for Patent Cases*, The Contingency (July 20, 2015), https://www.thecontingency.com/2015/07/antitrust-lessons-for-patent-cases/.

[35] Rashid Khan, *What is an Intellectual Property Strategy for Oil and Gas Industry?* 52 J. LICENSING EXECUTIVES SOC'Y 45, 46 (2017).

[36] Andreas Exarheas, *Teaming-Up in 2015: Collaboration Agreements by European Oil, Gas Firms*, Rigzone (Jan. 26, 2016), https://www.rigzone.com/news/oil_gas/a/142659/teamingup_in_2015_collaboration_agreements_by_european_oil_gas_firms/.

[37] Maryam Rashtchi et. al, *Patent Analysis in Research Institutes of Developing Countries*, Conference Paper (May 2005), https://www.researchgate.net/publication/267926517_Patent_Analysis_in_Research_Institutes_of_Developing_Countries.

[38] Joel E. Lutzker & Darren M. Franklin, *Patent Pools*, Sheppard Mullin (Apr. 21, 2008), https://www.sheppardmullin.com/media/article/532_Patent%20Pools.pdf.

[39] Standard Oil Co. v. United States, (1931).

[40] Srijit Mukherjee & Sudipta Bhattacharjee, *Technology Transfer and the Intellectual Property Issues Emerging from It – An Analysis from a Developing Country Perspective* 9 J. INTELL. PROP. RTS. 270 (2004).

outrightly ban the licensee from conducting any R&D.[41] Patent extensions through which the life of the patent is extended by patenting the improvements so that the technology is never free are also often used. In some cases, the receiver of the technology may be required to return all technical information and stop using the technology once the agreement has expired.[42] Non-compete agreements prevent NOCs from conducting research that might compete with the technology of the MNC partner. Because patenting can be a luxury[43] for some due to its high cost and because local firms and inventors are less familiar with and wary of the western patenting systems, many developing nations have been slow to adopt it.

Having developing states heavily reliant on their technology has allowed MNCs to charge large amounts in licensing and royalty fees. In 2002, the royalties earned from licensing patents internationally by the US alone was about 80 billion USD.[44] With the United States being the largest developer of oil technology,[45] it is no surprise that nearly 60% O&G patents produced in the US are deployed abroad.[46] MNCs also build defensive patent portfolios and accumulate patents through mergers and acquisitions. These are detailed in section 3.3.

D. Significant Antitrust Cases involving Patents in the O&G Industry

Despite the alleged use of patents as "anticompetitive weapons"[47] in the oil industry, only a few cases have been processed. This is because of the difficulty in detecting and classifying any of these acts as anticompetitive and due to jurisdictional limitations. Nonetheless, the cases described below will help us understand some of the antitrust issues within the oil industry.

The 1910 case of Standard Oil Co v United States[48] was the first antitrust case of the US oil industry. Standard Oil was known for developing and patenting a superior refining technology which was highly beneficial to the American consumer. However, over several years it went on to obtain monopoly in that sector by conducting a series of unfair anticompetitive acts through the use of 37 subsidiaries. These acts included but were not limited to the acquisition, use, sale, and grant of patent licenses across the world. Standard Oil was charged guilty under the Sherman Act for price fixing by restraining competition which increased cost to consumers and was subsequently dissolved.

A similar allegation of price fixing by Atlantic Richfield Company alleged by USA Petroleum Company was not held illegal because the act was actually advantageous to

---

[41] Howard A. Kwon, *Patent Protection and Technology Transfer in the Developing World: The Thailand Experience*, 28 GEO. WASH. J. INT'K L. & ECON. 567, 575 (1995).
[42] Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L. 301, 310 (1989).
[43] Rashid Khan, *What is an Intellectual Property Strategy for Oil and Gas Industry?* 52 J. LICENSING EXECUTIVES SOC'Y 45, 47 (2017).
[44] Ashish Arora, *Intellectual Property Rights and the International Transfer of Technology: Setting Out an Agenda for Empirical Research in Developing Countries*, World Intellectual Property Organization, http://www.wipo.int/edocs/pubdocs/en/wipo_pub_1012-chapter2.pdf (last visited May 17, 2023).
[45] Hanne Berg Cortesi & Marianne Skanseng, *Subsea production and processing technology*, Norwegian Industrial Property Office Patent Landscaping Report (September 2017), https://www.patentstyret.no/globalassets/patent/filer/subseaproduction_and_processingtechnology.pdf.
[46] Robert K. Perrons, *How innovation and R&D happen in the Oil and Gas Industry: Insights from a global survey,* 124 J. PETROLEUM SCI. & ENGG. 301, 308 (2014).
[47] *The Increased Importance of Patents for Big Oil*, Intellectual Property Expert Group (July 10, 2007), https://www.ipeg.com/the-increased-importance-of-patents-for-big-oil/.
[48] Standard Oil Co. of N.J. v. United States, (1910).

consumers.[49] Likewise, in Kinnear-weed v. Humble Oil & Refining Co,[50] the court found that patent infringement even wilfully committed did not constitute a crime because it did not actually restrain commerce and because the public benefit. As we can see, benefit to the consumer is key in antitrust allegations.

The 1931 case of Standard Oil Co v United States[51] is the classic example of anticompetition through patent pooling. Four petroleum firms created a patent pool by cross-licensing 46 patents creating a market dominance. The acts displayed an intent of monopoly through the division of royalties and were held as violating the Sherman Act.[52]

The use of wide claims in patents is commonly used to foil competitors requiring them to invent around the patent or to charge infringement. But in Oil States Energy v Greene's Energy,[53] infringement of Oil States' patent by Greene's was dismissed and the patent was invalidated because its claims were found to be weak and lacking in novelty. The court wanted patent monopolies to be kept within their legitimate scope.

In a similar issue, misrepresentation of its patent claims by Unocal[54] harmed competition and lead to unfair monopoly. The FTC came down hard against Unocal for attempting to earn huge royalties for the use of its technology after making a fraudulent claim to California Air Resources Board. Unocal was subsequently found guilty.

Despite a handful of lawsuits in the US, the antitrust sensitivity of the oil industry is low.[55] In many jurisdictions, patent protection has priority over anticompetition. For example, in Korea patent abuse is extremely hard to prove because of the occurrence of "sham" litigations and in Brazil and Spain the burden of proof for anticompetitive acts falls on the claimant who can be held liable if the claim is determined to be in bad faith.[56]

II. THE CASE AGAINST O&G MNC PATENTS – EVIDENCE OF THE TECHNOLOGY GAP

Petroleum operations are divided into three portions: upstream, midstream and the downstream sectors. The midstream sector focuses on the storage and transport of oil and gas, whilst the downstream sector includes oil refineries and distribution plants. The upstream sector where the exploration and production (E&P) occurs is the most innovative sector. Here, technologies to extract oil efficiently and maximise production using conventional and unconventional methods are developed and patented by O&G corporations. But in order to increase the competitiveness among themselves, the petroleum industry has resorted to closed

[49] Richfield v. Petroleum, (1990).
[50] Corp v. Humble Oil & Ref. Co, (5th Cir. 1954).
[51] Standard Oil Co. v. United States, (1931).
[52] Joel E. Lutzker & Darren M. Franklin, *Patent Pools*, Sheppard Mullin (Apr. 21, 2008), https://www.sheppardmullin.com/media/article/532_Patent%20Pools.pdf.
[53] Oil States Energy Servs. LLC v. Greene's Energy Grp. LLC, (2017).
[54] Union Oil Co. of Cal. v. CHEVRON U.S.A., INC., Exxon Corp., Mobil Oil, Shell Oil Prods. Co. & Texaco Ref. & Mktg., Inc. Defendants., (C.D. Cal. 1998).
[55] Ronald W Davis, *Antitrust Analysis of Mergers, Acquisitions, and Joint Ventures in the 1908s: A Pragmatic Guide to Evaluation of Legal Risks*, 11 DEL. J. CORP. L. 25, 44 (1986).
[56] World Intellectual Property Organization, *Study on the Anti-Competitive Enforcement of Intellectual Property (IP) Rights: Sham Litigation*, Committee on Development and Intellectual Property (CDIP) Meeting Report (May 7-11, 2012), http://www.wipo.int/edocs/mdocs/mdocs/en/cdip_9/cdip_9_inf_6_rev.pdf.

innovation methods[57] and patent strategizing which have morphed into their use as an "offensive competitive weapon"[58] with repercussions beyond borders. This can be clearly observed in the technology dichotomy between the developed countries like US, Europe and Japan which possess the oil technology and the developing oil-producing countries.

A. The Technology Gap[59]

An ideal and balanced scenario of the petroleum industry would have comprised of MNCs of advanced states sharing their technology with developing host states in exchange for petroleum for use in their home state. But, because many O&G MNCs were often stronger than the developing countries and were motivated purely by commercial gains, they closely safeguarded their technology and used it as leverage to obtain access to the reserves and in some instances completely exploited the nations and damaged their environments.[60, 61] The MNCs felt justified in guarding the technology they licensed to the host state NOCs because they spent considerable time and resources to develop them and the NOCs did not take initiatives to innovate. In fact, prior to the 1980s more than 80% of R&D expenditure was borne by only eleven of the main oil companies.[62]

However, patent protectionism took an ugly turn when MNCs started to place restrictions on the users of their technology such as patent grant-backs,[63] non-compete clauses and restricting innovation of the licensee including outright bans on their R&D. These restrictive clauses were included in the licensing or technology agreements between the IOC and the NOC and have previously been described in section 2.3. I refer to these clauses as anticompetitive practices because they would not have met the standards of the US antitrust laws had they been within its jurisdiction.[64] Because the oil industry is mainly a process-based industry,[65] a large part of the proprietary technology is retained in the "know-how"[66] of the personnel. Therefore, to prevent technology leakage, MNCs employed expatriate technical personnel in crucial technical areas and limited the local workforces' access to them. Some MNCs also "colluded" with corrupt host governments "against the best interests of the local population".[67] Often two foreign firms engage in a competition to gain market share through their patented technology, which creates a sort of duopoly deterring the local firms.[68] These

---

[57] Kyungpyo Lee & Sungjoo Lee, *Patterns of Technological Innovation and Evolution in the Energy Sector: A Patent-Based Approach*, 59 ENERGY POL'Y 415, 425 (2013).
[58] *The Increased Importance of Patents for Big Oil*, Intellectual Property Expert Group (July 10, 2007), https://www.ipeg.com/the-increased-importance-of-patents-for-big-oil/
[59] Daniel Benoliel, *The International Patent Propensity Divide*, 15 NC J. L. & TECH., 49, 49 (2013).
[60] Elisa Giuliani, *Multinational Corporations, Technology Spillovers and Human Rights Impacts on Developing Countries*, LEM Paper Series (2010), https://www.ec.unipi.it/documents/Ricerca/papers/2013-158.pdf.
[61] The example of Nigeria to prove this point will be discussed in the next section.
[62] Economides M, Oligney R, *The Color of Oil: The History, the Money, and the Politics of the World's Biggest Business* (Round Oak Publishing Company, 2000).
Cited in Robert K. Perrons, *How innovation and R&D happen in the Oil and Gas Industry: Insights from a global survey,* 124 J. PETROLEUM SCI. & ENGG. 302 (2014).
[63] Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L. 301, 311 (1989).
[64] Daniel R. McGlynn, *Technology Transfer and Industrial Property Law in Developing Countries*, 8(2) U. MIA INTER-AM. L. REV. 394, 396 (1976).
[65] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 143 (2019).
[66] Srijit Mukherjee & Sudipta Bhattacharjee, *Technology Transfer and the Intellectual Property Issues Emerging from It – An Analysis from a Developing Country Perspective* 9 J. INTELL. PROP. RTS. 263 (2004).
[67] John M. Kline, 'MNCs and Surrogate Sovereignty' (2006) 13 Brown Journal of World Affairs 123, 128.
[68] Corinne Langinier, *Are patents strategic barriers to entry?* 56 J. ECON. & BUS. 349, 349 (2004).

acts have collectively reduced the technology transfer into the host state, created barriers for new entrants, reduced competition, effectively constrained domestic innovation and created 'foreign dependency'.

Much pressure has been applied on developing states keen to receive Foreign Direct Investment (FDI) to adopt certain "good policies"[69] to guarantee the minimum standards of protection for developed countries' technologies defined by TRIPS. TRIPS has thus resulted in large implementation costs[70] for the developing countries and also led to higher royalty payments for licensing patented foreign technology.[71] TRIPS was also not easily assimilated by inventors in the developing states because of its high cost and a lack of trust in the patent system leading them to conduct their research in secret to avoid being copied. This unfamiliarity with the western patent system, a "culture of secrecy" and the high cost of patenting deterred many inventors in Africa.[72] TRIPS's main flaw was in assuming that MNCs would freely transfer their patented technology and assist in the capacity building of the host states in exchange for patent protection.[73] Though art.7[74] did outline these requirements on the part of the developed nations, they have not been enforced. Other intrinsic limitations of the oil-producing states such as poor legislation, enforcement, corruption, lack of innovative capability and poor technological absorption worked to the advantage of the O&G MNCs and resulted in the creation of a substantial technology gap. By prioritizing international IP protection over endogenous economic and technology transfer incentives, TRIPS failed the developing countries![75]

For several decades, the NOCs of developing countries have consistently shown lower patent growth than the IOCs of developed states evidencing the technology gap. In recent years there has been an increase in the number of filings from NOCs of China, Brazil and Norway.[76] However, many NOCs still lag behind their IOC counterparts. Another way to ascertain the internal technological capability of a country is to analyse the number of resident patent filings. By examining the patent filings in WIPO in 2017 we can see that in developed countries like the US, Japan and Europe, resident filings are high whereas in developing oil-producing nations like Brazil, South Africa, Malaysia and Mexico, the non-resident filings account for more than half of the patent applications.[77] In addition to showing evidence of the technology gap, what this tells us is that foreign MNCs in those countries still hold a monopoly.

---

[69] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 58 (2014).
Clete D Johnson, *A Barren Harvest for the Developing World? Presidential "Trade Promotion Authority" and the Unfulfilled Promise of Agriculture Negotiations in the Doha Round*, 32 GA. J. INT'L & COMP. L. 437, 464 (2004).
[71] Daniel Benoliel, *The International Patent Propensity Divide*, 15 NC J. L. & TECH., 49, 61 (2013).
[72] Helen Nyambura-Mwaura, *Inventors Struggle to Protect Patents in Africa*, REUTERS (July 17, 2014, 1:25 AM), https://www.reuters.com/article/us-africa-investment/inventors-struggle-to-protect-patents-in-africa-idUSKBN0FM0HQ20140717.
[73] Rod Falvey & Neil Foster, *The Role of Intellectual Property Rights in Technology Transfer and Economic Growth: Theory and Evidence,* 10 REV. DEV. ECON. 700, 719 (2006).
[74] TRIPS Article 7, available at: https://www.wto.org/english/docs_e/legal_e/27-trips_03_e.htm (last visited 17 August 2018).
[75] Daniel Benoliel, *The International Patent Propensity Divide*, 15 NC J. L. & TECH. 49, 62 (2013).
[76] Osvaldo, Amaral*, Energy Reform Promises Tech Transfer and Patent Boom*, Managing IP (Aug. 31, 2014), https://www.managingip.com/article/2a5cjj2edmcwlstcb7u9s/energy-reform-promises-tech-transfer-and-patent-boom.
[77] World Intellectual Property Organization, *World Intellectual Property Indicators 2017*, http://www.wipo.int/edocs/pubdocs/en/wipo_pub_941_2017-chapter2.pdf (last visited 17 May 2023).

Nigeria is one such oil-producing state whose resident patent filings for several years was as low as 1%.[78] Nigeria and the other country examples presented below will demonstrate the incidence of anticompetitive patent practices by O&G MNCs and their adverse impact on the technology growth of the host nation.

B. Nigeria and Other Countries that did not Sustain Technology Growth

Foreign MNCs that brought their technology to extract oil in Nigeria have not only destroyed the ecosystem of the Niger Delta[79] but may have also impeded its technology growth. During the 1970s and 80s, a large volume of foreign technology was brought into Nigeria through FDI, contracts and licensing. But growth of domestic technology did not occur as a consequence of extrinsic and intrinsic factors and for several years, the ownership of patents in the Nigerian patent office by Nigerians was consistently only about 1%. Intrinsic factors included a lack of capital, poor technological infrastructure, lack of government support for R&D, lack of trust in the patent system, and other political and economic reasons. But the main extrinsic reasons were the private foreign companies that operated in Nigeria. Although the Nigerian patent office was created with the primary intention of enabling an inflow of foreign technology from MNCs which would lead to knowledge 'spillovers'[80] to their subsidiaries or links which in turn would kindle local inventiveness, the reality was far from it.[81] The MNCs in Nigeria which conducted the petroleum operations, actively patented their technology in the Nigerian patent office to obtain market share. Because of their considerably high resources and experience in comparison to the local inventors, they dominated not only the patent office but also the market effectively eliminating local competition.[82] Often, a mismatch between the technology being transferred and the domestic capability also hindered technology absorption. During this period, the foreign MNCs also used a few anticompetitive means to restrict local innovation. 43.7% of the license agreements included clauses for patent grant backs and 64.3% of the contracts banned R&D of the domestic licensee.[83] Although Nigeria did make changes to its legislation such as the "local content development programme" which required inclusion of Nigerians in technology transfers, the ultimate outcome was merely the production of good Nigerian "workers in a process tightly controlled by foreign expertise, without any transfer of technology".[84] Even after 50 years of oil industry operations Nigeria could not overcome its

[78] Owen T. Adikibi, *The multinational corporation and monopoly of patents in Nigeria*, 16 WORLD DEV., 511, 513 (1988).
[79] Elisa Giuliani, *Multinational Corporations, Technology Spillovers and Human Rights Impacts on Developing Countries*, LEM Paper Series (2010), https://www.ec.unipi.it/documents/Ricerca/papers/2013-158.pdf.
[80] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 21 (1st ed. 2013).
[81] Owen T. Adikibi, *The multinational corporation and monopoly of patents in Nigeria*, 16 WORLD DEV., 511, 516 (1988).
[82] Femi Aribisala, *Nigeria and the Multinationals*, Financial Nigeria (Aug. 28, 2013), http://www.financialnigeria.com/nigeria-and-the-multinationals-blog-5.html.
[83] Owen T. Adikibi, *The multinational corporation and monopoly of patents in Nigeria*, 16 WORLD DEV., 511, 519 (1988).
[84] Femi Aribisala, *Nigeria and the Multinationals*, Financial Nigeria (Aug. 28, 2013), http://www.financialnigeria.com/nigeria-and-the-multinationals-blog-5.html.

intrinsic limitations[85] and has consequently been technologically stunted. The anticompetitive patenting practices of 'resource-seeking'[86] oil corporations have been partly to blame.

Brazil is another nation whose oil technology was under foreign dominance for a long time. Foreign MNCs in Brazil had significant freedom in conducting petroleum operations and actively used anticompetitive methods to eliminate the domestic competition.[87] Despite being aware of the abusive market dominance by the foreign MNCs, Brazil's NOC Petrobras[88] did not intervene because it needed them to conduct its operations. Instead, it focussed on developing its internal innovative potential by remaining close to the MNCs and learning from them. This strategy paid off when Brazil's oil reserves were discovered in 2007 allowing Petrobras to grow into a self-sufficient technology producer.[89] Petrobras's success story is detailed in section 4.3 as a nation whose technology growth was not stifled by the O&G MNC patenting practices.

However, this has not been the case in African nations like Ghana. Ghana's non-development can be attributed to a corrupt and dysfunctional political system that conducted petroleum operations through agreements with foreign MNCs, some under the table, with the state always at the losing end.[90] Ghana has since made changes to its policies, mandated "local content" inclusion in petroleum agreements with foreign companies and also undertaken technology collaborations with them. It has also chosen to form a partnership with Norway in an effort to emulate the success of Norway's oil industry in developing its technology.[91] Whether Ghana will be successful in breaking free of foreign technological domination is yet to be seen.

Many Less Developed Countries (LDCs) in Africa such as Zimbabwe, suffered a fate like that of Ghana and Nigeria. Even in Asia and South America despite the presence of large FDI, technology spill over was actually found to be negative.[92] These cases illustrate how the anticompetitive practices of MNCs in an oil-rich state already rife with internal limitations, can technologically cripple it.

Another manner in which IOCs have continued to maintain their technology dominance in the oil industry is through mergers and acquisitions (M&As). These are described in the next section.

C. M&As in the O&G Industry

---

[85] Offiong I. Akpanika, *Technology transfer and the challenges of local content development in the Nigerian Oil Industry*, 11 GLOBAL J. ENGG. RES. 123, 129 (2013).
[86] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 33 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.
[87] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 148 (2019).
[88] Petróleo Brasileiro S.A., http://www.petrobras.com.br/en/ (last visited 19 May 2023).
[89] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 148 (2019).
[90] Kow Kwegya & Amissah Abraham, *Contractual Agreements in Ghana's Oil and Gas Industry: In Whose Interest?* 8 MCGILL INT. J. SUSTAINABLE DEV. L & Policy, 186, 202 (2017).
[91] *Ghana to Emulate Norwegian's Management of Oil and Gas*, Ghana Web (Apr. 12, 2011), https://www.ghanaweb.com/GhanaHomePage/economy/Ghana-to-emulate-Norwegian-s-management-of-oil-and-gas-206805.
[92] Elisa Giuliani, *Multinational Corporations, Technology Spillovers and Human Rights Impacts on Developing Countries*, LEM PAPER SERIES (2010), https://www.ec.unipi.it/documents/Ricerca/papers/2013-158.pdf.

Mergers or "amalgamation of undertakings"[93] among corporations are common in the oil industry due to their many benefits predominantly cost savings. The 1999 merger between Exxon and Mobil resulted in cost savings of over 7 Billion USD and the ConocoPhillips merger of 2004 resulted in a saving of 1.9 Billion USD within sixteen months.[94] Mergers also enable firms to undertake large scale projects and capacity expansions, manage the risks associated with E&P and improve their efficiency.[95] Some mergers are conducted in order to increase the scope of R&D and to enable better management of innovation capabilities in a larger scale.[96] Mergers are one way through which oil corporations gain monopoly or market share.

Acquisitions on the other hand take place when O&G corporations purchase or acquire smaller firms who possess key technology in order to increase their business portfolio. This can be advantageous to obtain market share in a specific sector, and even lead to cost savings for the consumer. Because the O&G industry is a conservative industry, the buyers of technology have preference for well-known names and newer firms struggle to get market acceptance. In such instances, the new technology companies prefer to be acquired by larger better-known firms.[97]

But although the benefits of M&As are many, they possess another side. Sometimes O&G corporations acquire smaller firms who are their competitors and or to build a large defensive patent portfolio. Nowadays even small oil MNCs from developed states have started to develop defensive patent portfolios to deter competition and to become more attractive for acquisition.[98] Such M&As reduce competition and allow for the concentration of technology in a few hands.[99]

Hence, governments of developed nations closely scrutinize M&As for antitrust issues that might adversely affect the consumers within their market. For example, the merger of Halliburton and Baker Hughes in 2016 that would have allowed greater than 50% ownership in 3 markets[100] and led to monopoly was challenged by the U.S. Department of Justice on antitrust grounds. Mobil Corporation's intended hostile takeover of Marathon Oil Co in 1981 raised anticompetitive concerns due to concentration of power and ownership of oil reserves.[101] Although mergers in the oil industry are challenged more often than those in other industries particularly in the US,[102] many anticompetitive issues remain because the IP issues are often

---

[93] Adebayo G. Adaralegbe, *Mergers in the international petroleum industry: Legal aspects on the operations of Petroleum Development Companies in Nigeria*, 21 J. ENERGY & NAT. RESOURCES L. 325, 327 (2003).
[94] Timothy J. Muris & Richard G. Parker, *A Dozen facts you should know about antitrust and the oil industry,* US Chamber of Commerce (2007), https://www.uschamber.com/sites/default/files/legacy/reports/070625oilreport.pdf.
[95] ibid 62.
[96] ibid 79.
[97] Sam Veasna, *Patents and Competitive Advantage in the Oil & Gas Industry*, the Case of Oil Country Tubular Goods (OCTG) (2016) (Master's Thesis) (on file with https://hdl.handle.net/20.500.12380/237479).
[98] Benjamin S. Fernandez & John V. Hobgood, *Energy Sector Alert Series: As Oil Prices Descend, Patent Enforcement Litigation Increases Within Energy Industry*, Wilmer Hale (Mar. 3, 2016), https://www.wilmerhale.com/en/insights/client-alerts/2016-03-03-energy-sector-alert-series-as-oil-prices-descend-patent-enforcement-litigation-increases-within-energy-industry
[99] Mergers are discussed in detail in section 3.3
[100] *Antitrust Update*, PATTERSON BELKNAP (Apr. 15, 2016), https://www.pbwt.com/antitrust-update-blog/antitrust-lessons-oil-giants-proposed-merger.
[101] Ron Scherer, Mobil-Marathon Outcome May Shape Oil Industry Future, The Christian Science Monitor (Dec. 3, 1981), https://www.csmonitor.com/1981/1203/120340.html.
[102] Timothy J. Muris & Richard G. Parker, *A Dozen facts you should know about antitrust and the oil industry,* US Chamber of Commerce (2007), https://www.uschamber.com/sites/default/files/legacy/reports/070625oilreport.pdf.

overlooked. In my opinion, cost savings resulting from mergers that are ultimately passed on to the consumer are often prioritized over patent aggregation.

In the international level M&As are not regulated and developing nations have been impacted by mergers which may result in cost savings for consumers in the home country of the MNC but creates technology monopoly in the host state. The Baker-GE merger significantly increased its technology portfolio, and Schlumberger-Cameron merger increased its market share by 45% in 25 international markets.[103] The sheer size of these corporations and their substantial patent portfolio can deter new and smaller entrants into the market. International mergers have so many far-reaching consequences that improved regulation and stringent enforcement is essential.[104] Hence, some African nations such as Nigeria have put into place committees and measures to regularize mergers.[105]

In chapters 2 and 3, I presented my case against the manner in which patents are wielded by O&G MNCs and how they impeded the technological growth of some countries. In the next chapter, I present the counterargument.

III. THE CASE SUPPORTING O&G MNC PATENTS

A. Evidence of Technology Transfers and Collaborations

In this chapter, I examine the technological growth of a few oil-producing states and analyse what role if any the MNC patents played in them. I will pay particular attention to the technology transfers and technology collaborations between MNCs and host states as these provide evidence of MNC facilitating their technological growth. But before launching into these examples, it is important to understand how the ownership of technology among the O&G MNC has evolved over time.

1. Evolution of Technology Ownership in the Oil Industry

Through the many geo-political upheavals and oil crises, major oil corporations have recognised the importance of continuous innovation in the oil industry. By substantial investments in R&D, oil corporations accumulated large patent portfolios in order to maintain their competitive advantage. But the oil crisis of the 1980s was worse than the previous ones and caused oil corporations to reduce innovation expenditure and divest their R&D segments.[106] It was during this window that the NOCs of developing nations and the oilfield service companies gained a technology foothold in the industry.[107] The newly formed oil service companies' main business was the development of oil technology. During this period and since then oilfield service companies invested heavily in R&D and have consequently

---

[103] *Will Schlumberger Continue to Be an Industry Leader in 2017?* Forbes (Jan. 4, 2017), https://www.forbes.com/sites/greatspeculations/2017/01/04/will-schlumberger-continue-to-be-an-industry-leader-in-2017/#3f6a8c7e7bc5.

[104] Timothy J. Muris & Richard G. Parker, *A Dozen facts you should know about antitrust and the oil industry,* US Chamber of Commerce (2007), https://www.uschamber.com/sites/default/files/legacy/reports/070625oilreport.pdf.

[105] Adebayo G. Adaralegbe, 'Mergers in the International Petroleum Industry: Legal Aspects on the Operations of Petroleum Development Companies in Nigeria' (2003) 21 Journal of Energy and Natural Resource Law 325, 325.

[106] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 138 (2019).

[107] ibid.

grown to become the new technology MNCs. The 2014 global survey of oil and gas patents clearly shows the oilfield service companies as the leaders.[108] These oilfield service companies[109] have also assisted several NOCs in building their technological competence.[110] Having ceded technology control to the oil service companies in the 1980s, the oil majors over time needed new partners to share R&D costs and subsequently opened up to collaborations.[111] Despite previously preferring to conduct R&D activities in their home country, factors like reduced cost and the improved technical capability of some host states have led MNCs to also internationalise their R&D.[112] Technology transfers have also become important to the oil corporations due to the benefits of higher returns resulting due to the effective use of technology,[113] and reduced costs due to use of local workforce.[114] Despite the advantages of collaborations and technology transfers, many intrinsic factors of the host state influence the attitude of the MNC in adopting these methods. These are described in the next section.

B. Technology Transfers and Collaborations among MNCs and Host States

Petroleum operations are normally conducted using concession contracts, joint ventures, production sharing contracts or service contracts.[115] Knowledge of petroleum operation is especially important to oil-producing states because foreign firms might exit the oil fields and future operations need to be addressed.[116] But in most petroleum operations only the importation of high-technology tools and expatriate personnel results without any real technology transfer. Real technology transfer involves not merely the exchange of explicit information stored in patents, manuals, procedures and blueprints, but also exchange of tacit know-how through training and collaboration.[117] The basic factors which affect whether and what technology the O&G MNC transfers into the state are strength of its patent regime, the technical capacity of its oil industry, and other government incentives for the MNC.

The first factor affecting MNC technology policy is the strength of the host state's patent regime. In evaluating the strength of a patent regime, the features that MNCs look for are, membership in an international treaty, sufficient duration of patent protection and strong enforcement for patent infringement.[118] Therefore, nations keen to benefit from technology exchange and transfer tend to comply with the TRIPS regulations and provide a reasonably

---

[108] ibid 142.
[109] By Oilfield service companies I refer to the oil technology service providers including but not limited to Schlumberger, Weatherford, Baker Hughes, Petrofac, Geophysical and Weatherford.
[110] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 138 (2019).
[111] ibid 139.
[112] Floortje Alkemade et al., *Tracking the internationalization of multinational corporate inventive activity: National and sectoral characteristics*, 44 RES. POL'Y 1763, 1764 (2015).
[113] Tony Wood, *The Natural Wealth of Nations: Transformation of Oil- and Gas-Producing Economies*, Cisco, https://www.cisco.com/c/dam/en_us/about/ac79/docs/wp/Transforming_Energy_0629b.pdf, (last visited May 17, 2023).
[114] Harrie Vredenburg H & Percy Garcia, *Technology transfer in international business: the role of the multinational corporation in building capacity in developing countries,* 7 INT'L.J. BUS. STRATEGY (2007).
[115] Kow Kwegya & Amissah Abraham, *Contractual Agreements in Ghana's Oil and Gas Industry: In Whose Interest?,* 8 MCGILL INT. J. SUSTAINABLE DEV. L & Policy, 186, 189 (2017)..
[116] Reginald I. Chima et al., *Technology Transfer and Acquisition in the Oil Sector and Government Policy in Nigeria*, Africa Portal (Jan. 1, 2002), https://www.africaportal.org/publications/technology-transfer-and-acquisition-in-the-oil-sector-and-government-policy-in-nigeria/.
[117] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 135 (2019).
[118] Andréanne Léger, 'Intellectual Property Rights and Innovation in Developing Countries: Evidence from Panel Data' (International Association of Agricultural Economists Conference, Australia, August 2006) 1, 6.

strong patent protection and enforcement schemes for foreign-owned patents. In states with strong IP regime, foreign MNCs do not hesitate to license their patents,[119] transfer technology and collaborate because they have no reason to fear imitation. Norway is the perfect example of such a nation which as a result of its internal initiatives circumvented restrictive patenting practices and grew technologically. I will discuss Norway in detail in section 4.4.

In nations with weak IP regimes, only indirect technology spill overs are possible because MNCs prefer to conduct their activities through their direct subsidiaries, use expat personnel in key technical areas and avoid licensing their patents in order to restrict the flow of knowledge.[120] Weak patent rights also lead to reduced exports or FDI[121] from countries like the US.[122] Countries with weak IP regimes and weak imitative capabilities like the African countries, continue to be technologically monopolised by foreign MNCs.[123] Countries that have weak IP regimes but have high absorptive capability such as China, have a high risk of imitation. Although imitation played a large part in the manner in which the United States built its technological competence, it is less tolerant of its own technology being copied. Nonetheless, using this imitative strategy China has surpassed Japan and closed in on the US in the number of international patents filed.[124]

The United Nations has acknowledged that technology collaborations are the best way to transfer or exchange technology[125] and the sharing and exchange of patents is known to increase global innovation and technology.[126]

But aside from the strength of its patent regime, the technical capability of a country determines whether MNCs undertake technology transfers and collaborations with it. Studies show that steps taken by the developing countries towards building internal technical competence were taken as a positive sign by MNCs.[127] Building internal competence within a state increases competitiveness among local firms, which in turn induces MNCs to transfer

---

[119] Ashish Arora, *Intellectual Property Rights and the International Transfer of Technology: Setting Out an Agenda for Empirical Research in Developing Countries*, WORLD INTELLECTUAL PROPERTY ORGANIZATION, http://www.wipo.int/edocs/pubdocs/en/wipo_pub_1012-chapter2.pdf (last visited May 17, 2023).
[120] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 24 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.
[121] Ashish Arora, *Intellectual Property Rights and the International Transfer of Technology: Setting Out an Agenda for Empirical Research in Developing Countries*, WORLD INTELLECTUAL PROPERTY ORGANIZATION, http://www.wipo.int/edocs/pubdocs/en/wipo_pub_1012-chapter2.pdf (last visited May 17, 2023).
[122] Pamela J. Smith, *Are weak patent rights a barrier to U.S. expor*ts*?* 48 J. INT'L ECON. 151, 151 (1999).
[123] ibid.
[124] World Intellectual Property Organization, *China Drives International Patent Applications to Record Heights; Demand Rising for Trademark and Industrial Design Protection* (Mar. 21, 2018), https://www.wipo.int/pressroom/en/articles/2018/article_0002.html.
[125] United Nations Department of Economic and Social Affairs, *Climate change: Technology development and technology transfer*, Conference Report (Nov. 7-8, 2008), https://sdgs.un.org/sites/default/files/publications/tec_technology_dev.pdf.
[126] Tomoya Yanagisawa & Dominique Guellec, *The Emerging Patent Marketplace*, OECD Science, Technology and Industry Working Papers (22 Dec 2009), https://doi.org/10.1787/21841315225.
[127] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 16 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.

high quality technology to their subsidiaries.[128] When host states increased their technology level independently, MNCs were even open to conducting R&D operations with them.

The examples given below show evidence of the above. These oil-producing states successfully engaged in technology collaborations with MNCs and benefited from increased technology transfers once they strengthened their patent regime and improved their internal technological competence. The exchange of patented information and absence of patent strategizing in these collaborative efforts proves that O&G MNCs did not stifle the technology growth in these instances.

C. The case of Petrobras

Brazil had for the longest time imported oil to meet its energy needs. But all that changed with the discovery of the oil and gas reserves in the country's South-eastern coast in 2007. The discovery of this ultra-Deepwater reserves by its NOC Petrobras created the possibility of turning Brazil into a substantial oil producer.[129] Having worked closely with MNCs over the previous decades and tolerated their anticompetitive behaviour, Petrobras had quietly developed its internal technological capability. But, despite having the technical knowledge in Deepwater exploration, the harsh environment of its ultra-Deepwater reservoirs could not be conquered without substantial R&D, because the technology to do so simply did not exist.[130] Therefore, Brazil's federal government put together new long-term development goals prioritizing R&D for a dynamic and strong technology-based oil industry.[131] The country focussed on independently increasing its technological level in the oil sector by using an open-innovation method and collaborating with universities, vendors and other industry counterparts.[132] Petrobras also collaborated with other O&G MNCs and formed strategic alliances with those possessing relevant technology.[133] As a result, it has grown into a highly regarded technology NOC self-sufficient in the area of ultra-Deepwater exploration.[134] Petrobras has also gained access to resources of other countries through operating licenses and become a competitor to other O&G MNCs.[135]

A noteworthy increase in its patent filings at the Brazilian patent office between 2001 and 2010 is evidence of its technological growth.[136] A corresponding increase in O&G patent

---

[128] Elisa Giuliani, *Multinational Corporations, Technology Spillovers and Human Rights Impacts on Developing Countries*, LEM Paper Series (2010), https://www.ec.unipi.it/documents/Ricerca/papers/2013-158.pdf.
[129] Eduardo Haddad et al., *Economic impacts of pre-salt on a regional economy: the case of Espírito Santo, Brazil,* ERSA conference papers (2014), available at: RePEc:wiw:wiwrsa:ersa10p156.
Cited in Gabriel Marcuzzo do Canto Cavalheiro, *Examining the influence of the pre-salt on patent applications related to drilling fluids in Brazil*, 10 RECENT PAT. IN ENGG. 3, 11 (2016).
[130] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION 127, 147 (2019).
[131] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 60 (2014).
[132] Christopher E Gay , *Why Is Patent Production So Comparatively Low at Petrobras* 5 (2014) (Master's Thesis) (on file with http://hdl.handle.net/10438/13312).
[133] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION 127, 148 (2019).
[134] Christopher E Gay , *Why Is Patent Production So Comparatively Low at Petrobras* 5 (2014) (Master's Thesis) (on file with http://hdl.handle.net/10438/13312).
[135] Seyed K. Bagheri & Alberto Di Minin, *The changing competitive landscape of the global upstream petroleum industry*, 8 J. WORLD ENERGY L. & BUS. 1, 14 (2015).
[136] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 61 (2014).

filings at the USPTO[137] support the technological significance of these patents.[138] Although the technological growth of Brazil was at one time impeded by the anticompetitive practices of O&G MNCs, it broke free of foreign domination in two phases. The first phase consisted of it improving its intrinsic technical capabilities through domestic initiatives, and the second phase involved it making strategic alliances and collaborations with O&G partners to advance to the next level of technological self-sufficiency. Although not all oil-rich states who increased their technology followed the same path, many similarities can be seen. These are presented in the next section.

D. Other NOCs and their Technology Growth Path

Norway has already been highlighted as the shining example of an oil-producing nation that transformed itself into a competitive oil technology producer within 20 years.[139] By examining the steps Norway undertook to build its technical competence, we can develop a path for other oil-producing states that hope to do the same. When oil was discovered in Norway in the 1950s, the tremendous impact it would make on its economy was not expected.[140] The Norwegian personnel had no experience in operating and managing petroleum operations and for that reason, foreign MNCs were allowed to carry out these operations under the precondition of training the Norwegian counterparts. Subsequent collaborations with foreign companies caused a transfer of knowledge into the country and resulted in the ultimate strengthening of its intrinsic technical capabilities. Norway's story supports the theory that O&G MNCs did not impede its technology growth but instead enabled them to share their technology when assured of patent protection.

The Malaysian NOC Petroliam Nasional Berhad[141] did not exist when oil was discovered in the country and foreign IOCs were the ones who developed its oil industry.[142] However, two decades later the production rates started to decline and the country had to take control.[143] Malaysia's newly formed NOC Petronas achieved this by moving its technical operations abroad in order to avoid governmental interference, focussed on innovation and subsequently developed enhanced oil recovery methods for the wells back home.[144] Petronas also adopted new policies and formed strategic alliances with MNCs in order to increase domestic innovation and has subsequently built itself into a technology superpower.[145]

Venezuela's NOC Petróleos de Venezuela, S.A.[146] had also broken free of foreign dominance and built itself up to be a technology leader similar to the path of Petrobras. However, the recent political upheavals have allowed its technical competence to deteriorate.

---

[137] United States Patent and Trademark Office, https://www.uspto.gov/ (last visited 19 May 2023).
[138] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 61 (2014).
[139] Mahdi Asghari & Mohammad Ali Rakhshanikia, *Technology transfer in oil industry, significance and challenges*, 75 PROCEDIA – SOC. & BEHAV. SCI. 264, 271 (2013).
[140] *Norway's Petroleum History*, Norwegian Petroleum, https://www.norskpetroleum.no/en/framework/norways-petroleum-history/ (last updated May 11, 2023).
[141] Petroliam Nasional Berhad, http://www.petronas.com.my/Pages/default.aspx (last visited 19 May 2023).
[142] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION 127, 150 (2019).
[143] ibid.
[144] ibid.
[145] ibid.
[146] Petróleos de Venezuela, S.A, http://www.pdvsa.com/index.php?option=com_content&view=article&id=6541&Itemid=888&lang=en (last visited 19 May 2023).

Venezuela's story highlights the need to continuously prioritise innovation or else short-sighted governmental polices could result in technological setbacks.[147]

Other reasons for the poor technology growth of NOCs from certain oil-rich nations are the availability of easy oil and the reliance on their "monopolistic position"[148] leaving little need to innovate. A prime example of this is the Kingdom of Saudi Arabia.[149] For decades, the Saudi Arabian NOC Saudi Aramco[150] did not aggressively accumulate patents allowing foreign oil companies to have a technology monopoly. But in recent years, the country has prioritized innovation with autonomous Saudi Aramco at its forefront and drastically increased its patent filings.[151] By adoption of an open innovation model,[152] the creation of strategic alliances with foreign countries advanced in oil technology, collaborations with educational institutions, oil service companies and other technology providers, increased investment in R&D and funding of start-up ventures, Saudi Arabia has attempted to emulate the Western innovation and patenting model.[153] As a result of these initiatives, the ownership of patents by Saudi Aramco in the Saudi Arabian patent office has grown to the level of the super majors.[154] The forward citation of patents owned by Saudi Aramco is further proof of its technological advancement.[155]

The technology growth path of Brazil, Norway, Malaysia, and Saudi Arabia show that O&G MNCs share their patents through collaborations, licensing and technology transfer so long as they are protected from infringement and provided the states take initiatives to increase their technology independently. As a result, these countries are technologically self-sufficient and among the leaders of oil technology. Among state-owned firms, Equinor and Petrobras are among the largest patent producers of today.[156]

The factors which led to the technological growth of these countries and those that led to the absence of it in others have been identified in the last two chapters. Based on these, I suggest reforms for other nations to adopt and attain technological independence in the next chapter.

IV. THE FUTURE OF THE O&G INDUSTRY AND WAYS TO DECREASE THE TECHNOLOGY GAP

Prior to launching into the recommended reforms, I touch upon the subject of patenting within the Shale operations because it will have a significant impact on the future of the O&G industry.

---

[147] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION 127, 151 (2019).
[148] ibid 130.
[149] ibid 148.
[150] Saudi Aramco, http://www.saudiaramco.com/en/home.html (last visited 19 May 2023).
[151] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 148 (2019).
[152] Saudi Aramco, http://www.saudiaramco.com/en/home.html (last visited 19 May 2023.
[153] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION, 127, 149 (2019).
[154] ibid 141.
[155] ibid 149.
[156] Osvaldo, Amaral*, Energy Reform Promises Tech Transfer and Patent Boom*, Managing IP (Aug. 31, 2014), https://www.managingip.com/article/2a5cjj2edmcwlstcb7u9s/energy-reform-promises-tech-transfer-and-patent-boom.

A. The Shale Technology Revolution

The presence of hydrocarbon in earth's shale formations has been known to man for a long time. But tapping into the formation to extract the oil and gas had been a technological challenge for many years. The extraordinary way in which this was achieved in the US illustrates the proper way to foster innovation.[157] Although many factors contributed to the shale revolution, most of it has been credited to the unwavering effort of George Mitchell. Mitchell collaborated with the US government and other industry counterparts using an open innovation method. By risking millions of dollars over two decades synthesised a new method of 'fracking' the shale formations by combining the technology of horizontal drilling and 'slickwater' fracturing and adapting it for shale gas extraction.[158] These efforts paid off in the late 1990's resulting in the Shale Boom of 2001. During the course of its development Mitchell and his successor Devon Energy did not patent any of their technology, which enabled others in the industry to use it freely. Despite not patenting their technology or gaining any royalty payments, the company made significant profits. The story of the US shale fracking revolution is the perfect instance where "restraint in patenting"[159] and use of open innovation and collaboration enabled a technological transformation. As a result, the US has grown to be one of the largest producers of hydrocarbons and a world leader in shale gas technology.

The socio-economic impact of shale technology to the developing world will be minimal because nearly 43% of the world reserves are in highly developed countries, 33% in the MDCs and only 3% in the LDCs.[160] For developing countries like Algeria, South Africa and Bulgaria which possess a few shale gas reserves, the technology may possibly even be detrimental due to weak regulatory systems leading to environmental consequences from fracking.[161] The US and China are the top two applicants for patents in shale technology, the only difference being that private companies own the technology in the US which is already in the commercial domain, but in the case of China, the patents are not yet close to commercialization.[162] Despite the technical ingenuity of Chinese innovators in exploring for oil abroad,[163] they lack the cutting edge technologies to tap their own shale formations which are more complex than those present in the US.[164] And though China has larger reserves than the US,[165] without collaboration with US companies and technology transfer from the US they cannot tap their reserves because much of the tried and tested shale gas technology is held captive in patents owned by the major oil corporations in the United States.[166] But US firms

---

[157] John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy*, 64 EMORY L. J. 955, 958 (2015).
[158] For definition of the terminology used in Shale technology refer to: Luca Gandossi, *An overview of hydraulic fracturing and other formation stimulation technologies for shale gas production*, European Commission Technical Report, (December 19, 2013), https://publications.jrc.ec.europa.eu/repository/handle/JRC86065.
[159] John M. Golden & Hannah J. Wiseman, *The Fracking Revolution: Shale Gas as a Case Study in Innovation Policy*, 64 EMORY L. J. 955, 1022 (2015).
[160] Adrian Paylor, *The social–economic impact of shale gas extraction: a global perspective* 38 THIRD WORLD Q. 340, 343 (2017).
[161] ibid 341.
[162] Woo Jin Lee, & So Young Sohn, *Patent analysis to identify shale gas development in China and the United States*, 74 ENERGY POL'Y. 111, 112 (2014).
[163] Danelle Gagliardi, *Made in America: Why the Shale Revolution in America is Not Replicable in China and Argentina*, 14 WASH. U. GLOBAL STUD. L. Rev. 181, 190 (2015).
[164] Woo Jin Lee, & So Young Sohn, *Patent analysis to identify shale gas development in China and the United States*, 74 ENERGY POL'Y. 111, 114 (2014).
[165] Danelle Gagliardi, *Made in America: Why the Shale Revolution in America is Not Replicable in China and Argentina*, 14 WASH. U. GLOBAL STUD. L. Rev. 181, 182 (2015).
[166] Woo Jin Lee, & So Young Sohn, *Patent analysis to identify shale gas development in China and the United States*, 74 ENERGY POL'Y. 111, 114 (2014).

hesitate to collaborate with China because of risk of imitation in a weak IP regime. China has amended its IP laws after the US exerted pressure in the WTO, but there are still concerns.[167] The Chinese "Bamboo Capitalism"[168] which involves operating outside the bounds of legal rules is also a deterrent to importing technology. The Chinese instance highlights the need for a strong patent regime for increased technology transfers and collaborations.

In Europe, the recoverable shale reserves small and are present in complex formations making them difficult to extract.[169] Hence despite the presence of oil corporations like Total,[170] BP[171] and Equinor[172] with decades of technical experience in conventional techniques, the lack of experience in unconventional hydrocarbons makes them dependent on the US.[173] Likewise, most MDCs and LDCs possessing shale reservoirs will also have to rely on US technology. In a sense, there already exists a technology gap between the US and the rest of the world regarding patents in shale technology.[174] Because concentration of technology causes a technological monopoly and can bring up anticompetitive issues, steps must be taken to avoid a repeat of the technology dichotomy of the past oil industry.

B. Recommendations and Reforms to Close the Technology Gap

Despite nearly 100 years of oil industry,[175] MNCs of developed countries still hold most of the advanced technologies through "technical imperialism"[176] as described in the previous chapters. Although NOCs of oil-producing states now have 90% ownership of the hydrocarbons whereas in the 1970s they only controlled 10%, the petroleum technology is still controlled by the MNCs.[177] Only a few oil-producing countries like Norway have closed the technology gap and a few others like Brazil and Malaysia have gained technological independence. But many other oil-producing nations are still technologically deficient. Although this can be attributed to the intrinsic limitations of the state and an inherent lack of absorptive capability,[178] one cannot dismiss the effect of anticompetitive methods practiced by MNCs as being partly to blame.

---

[167] Danelle Gagliardi, *Made in America: Why the Shale Revolution in America is Not Replicable in China and Argentina*, 14 WASH. U. GLOBAL STUD. L. Rev. 181, 190 (2015).
[168] *China's Economy: Bamboo Capitalism*, The Economist (Mar. 10, 2011), http://www.economist.com/node/18332610.
[169] Minh-Thong Le, *An assessment of the potential for the development of the shale gas industry in countries outside of North America*, 4 HELIYON (February 2018), https://doi.org/10.1016/j.heliyon.2018.e00516.
[170] Total, https://www.total.com/en (last visited 19 May 2023).
[171] British Petroleum, https://www.bp.com/ (last visited 19 May 2023).
[172] Equinor, https://www.equinor.com/en.html (last visited 19 May 2023).
[173] Minh-Thong Le, *An assessment of the potential for the development of the shale gas industry in countries outside of North America*, 4 HELIYON (February 2018), https://doi.org/10.1016/j.heliyon.2018.e00516.
[174] Woo Jin Lee, & So Young Sohn, *Patent analysis to identify shale gas development in China and the United States*, 74 ENERGY POL'Y. 111, 114 (2014)
[175] Mahdi Asghari & Mohammad Ali Rakhshanikia, *Technology transfer in oil industry, significance and challenges*, 75 PROCEDIA – SOC. & BEHAV. SCI. 264, 271 (2013).
[176] Offiong I. Akpanika, *Technology transfer and the challenges of local content development in the Nigerian Oil Industry*, 11 GLOBAL J. ENGG. RES. 123, 123 (2013)
[177] Alexey Bereznoy, *Catching-up with the supermajors: the technology factor in building competitive power of national oil companies from developing economies,* INDUSTRY & INNOVATION 127, 127 (2019).
[178] Harrie Vredenburg H & Percy Garcia, *Technology transfer in international business: the role of the multinational corporation in building capacity in developing countries,* 7 INT'L.J. BUS. STRATEGY (2007).

In the past, oil corporations were mainly "resource-seeking" [179] or "efficiency-seeking" [180] and had no compunction for local development. In contrast, the "market-seeking"[181] corporations like the oil service companies of have positively contributed to the technology development in nations like Brazil. But in recent years, even major oil corporations have realised the advantages of teaming up with NOCs to benefit from reduced costs and higher returns.

Innovation is essential for the host state if it wants to take control of its technology, break free of foreign domination, to diversify because oil will run out and also to close the technology gap. This can be achieved by independently developing and patenting technology, through transferring or purchasing technology and through technology collaborations. MNCs play a significant role in the second and third way of bringing developing nations to the standards of developed nations through the sharing of patented technology. This is especially crucial for states whose internal capability is limited and cannot achieve technological growth without significant support from the MNCs. But this requires a convergence of attitudes among developed and developing countries and result in reforms for co-operation, collaboration and technology transfer intended to bring maximum benefit for a larger group of people as opposed to prioritizing economic returns for MNCs. The Newly Industrialized Countries [182] whose NOCs have become the MNCs of today also provide a basis for developing reform to stimulate innovation and technology growth.

Some such reforms are presented below. Although the list of dos and don'ts is not comprehensive, the suggestions made in here should be useful in developing a potential road map for developing nations wishing to close the technology gap. They are grouped under seven subheadings.

1. Strong but Flexible Patent Regime

Evidence of increased technology transfer from the US to countries that pose a limited threat of innovation or possess strong IP regimes was observed in the empirical models evaluated by Smith.[183] The strengthening of IP rights also allowed NOCs from Brazil, Malaysia, Saudi Arabia, and Norway to build their technical competence through collaborations and technology exchanges with the IOCs.[184] Thus, oil-producing nations must improve the strength of their patent laws and comply with TRIPS. However, a more flexible and efficient IP system, or as I like to call it the 'TRIPS-minus' that allows technologically deficient states an opportunity to

[179] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 33 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.
[180] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 34 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2.
[181] Elisa Giuliani, *Multinational Corporations, Technology Spillovers and Human Rights Impacts on Developing Countries*, LEM Paper Series (2010), https://www.ec.unipi.it/documents/Ricerca/papers/2013-158.pdf.
[182] Daniel Benoliel, *The International Patent Propensity Divide*, 15 NC J. L. & TECH., 49, 76 (2013).
[183] Pamela J. Smith, *Are weak patent rights a barrier to U.S. export*s*?* 48 J. INT'L ECON. 151, 151 (1999).
[184] Robert A. James, *Program on Energy and Sustainable Development Stanford, Strategic Alliances Between National and International Oil Companies*, Working Paper #104 (October 2011), https://www.pillsburylaw.com/images/content/1/0/103639.pdf.

"catch-up"[185] like the case of India and Korea[186] is recommended. The patent system should offer foreign and domestic patents sufficient protection from infringement, while at the same time reducing the cost of patent application and term of protection from 20 to fewer years. In many LDCs the cost of patenting is a huge deterrent. Therefore, patenting costs must take into consideration the affordability of the local inventors, in order to encourage the inventiveness of domestic firms and academic institutions. Shorter patent protection term can encourage additional new entrants into a market.

2. Increased Collaborations

Malaysia, Brazil, Saudi Arabia, and Norway have increased their technology through collaborations and strategic alliances with foreign MNCs and other countries. Other oil-rich states must apply the same methods and increase their external collaborations. Because oilfield service companies have been known to make the most technology collaborations,[187] and own the most technology and maximum number of patents,[188] it is recommended that NOCs form partnerships with them. Collaborations are needed to extend the life of the oil-producing wells, enable cost and time savings in production, improve production efficiency, create lesser environmental impact, create a sustainable growth and significantly improve the profit margins.[189] MNCs also benefit from collaborations due to improved efficiency from the effective use of technology,[190] reduced production costs due to use of local workforce and even reduced R&D costs. But although collaborations can be mutually beneficial, MNCs have at times been criticised as desiring to collaborate only if the resulting technology is of benefit to them. For example, 90% of the patents in the upstream sector of the Brazilian oil industry some of which may have resulted from collaborative efforts are owned by private foreign companies.[191] Despite the technical progress achieved by Petrobras, the fewer patents in comparison to the foreign the MNCs could be indicative of the dominance of foreign MNCs in technology collaborations or merely a slow adoption of the Brazilian patent system by the domestic inventors. Nonetheless, it is highly crucial that collaborative agreements between firms clearly capture the non-disclosure terms and the terms of any resulting IP.

3. Mandated Technology Sharing

---

[185] ALPER SÖNMEZ, MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER: THEORETICAL FRAMEWORK. IN: MULTINATIONAL COMPANIES, KNOWLEDGE AND TECHNOLOGY TRANSFER. CONTRIBUTIONS TO MANAGEMENT SCIENCE 17 (1st ed. 2013) available at: https://doi.org/10.1007/978-3-319-02033-4_2

[186] Cheikh Kane, *The Relationship Between Ip, Technology Transfer and Development*, IP Watch, http://www.ip-watch.org/2010/08/30/the-relationship-between-ip-technology-transfer-and-development/ (last visited Aug. 17, 2018).

[187] Hanne Berg Cortesi & Marianne Skanseng, *Subsea production and processing technology*, Norwegian Industrial Property Office Patent Landscaping Report (September 2017), https://www.patentstyret.no/globalassets/patent/filer/subseaproduction_and_processingtechnology.pdf.

[188] Robert K. Perrons, *How innovation and R&D happen in the Oil and Gas Industry: Insights from a global survey,* 124 J. PETROLEUM SCI. & ENGG. 301, 306 (2014).

[189] Hossein Hassani et al., *The role of Innovation and Technology in sustaining the petroleum and Petrochemical Industry*, 119 TECH. FORECASTING & SOC. CHANGE 1, 13 (2017).

[190] Tony Wood, *The Natural Wealth of Nations: Transformation of Oil- and Gas-Producing Economies*, Cisco, https://www.cisco.com/c/dam/en_us/about/ac79/docs/wp/Transforming_Energy_0629b.pdf, (last visited May 17, 2023).

[191] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 62 (2014).

In the upstream and the oil refining sector, states can directly purchase technology from technology suppliers, engineering contractors and through licensing.[192] In such contracts and in all petroleum contracts, the NOC must make technology sharing a precondition. Simply requiring inclusion of local personnel in petroleum operations may not help technology transfers as we saw in the instance of Nigeria, therefore the training and technology transfer requirements must be properly defined. Norway mandated the training of Norwegians by the IOCs who conducted its petroleum operations in exchange for patent protection.

4. Independent Technology Initiatives

Opponents of the patent system believe that patents are not means to transfer technology, but only a means to control technology[193] and are not the main way to increase the technology level of a state. Instead, this can be achieved through independent technology growth initiatives such as the creation of high-quality centres of higher education, encouraging start-ups, increasing R&D funding and methods of open innovation. These methods have been known to function better when a solid patent protection regime is in place. But governments can adopt a few additional measures to encourage local innovation. For example, in Brazil, companies are required to consult with the national patent bank before acquiring foreign technology.[194]

5. Open Innovation Models

The development of Shale in the US has been attributed to an open innovation model. Although the O&G industry has traditionally been known as a closed innovation system, some openness must be accepted in order to enable increased collaborations so as to enhance the technological level of the complete industry. Saudi Arabian NOC has adopted this path to enhance its technological competence and has since then shown a substantial increase in its patenting.[195]

6. Anticompetitive Controls

Many LDCs and MDCs[196] have suffered as a result of restrictive licensing practices and patent strategizing. Lack of international antitrust regulation and enforcement has left these issues in the hands of national legislation.[197] This system has been ineffective in weak nations with poor enforcement capabilities and because many MNCs are substantially stronger than the host state counterparts. Requiring MNC subsidiaries to be made into separate entities from their parent can make them answerable to the local government. As mentioned in section 3.2, Nigeria has recently enacted legislation to do so, and this has been useful in regulating MNC activities. However, strong domestic antitrust regulation and enforcement is extremely

[192] Ashish Arora, *Intellectual Property Rights and the International Transfer of Technology: Setting Out an Agenda for Empirical Research in Developing Countries*, WORLD INTELLECTUAL PROPERTY ORGANIZATION, http://www.wipo.int/edocs/pubdocs/en/wipo_pub_1012-chapter2.pdf (last visited May 17, 2023).
[193] Srijit Mukherjee & Sudipta Bhattacharjee, *Technology Transfer and the Intellectual Property Issues Emerging from It – An Analysis from a Developing Country Perspective* 9 J. INTELL. PROP. RTS. 271 (2004).
[194] Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L. 301, 314 (1989).
[195] Discussed previously in section 4.4.
[196] Less Developed Countries LDCs and More Developed Countries MDCs.
[197] Stephen Yelderman, *International Cooperation and the Patent-Antitrust Intersection* 19 TEX. INTELL. PROP. L.J., 195 (2011).

necessary. For example, Mexican anticompetitive laws[198] expressly prohibit the use of clauses restricting local R&D and even prohibits companies from entering into agreements for technology already available in the state.[199] Brazil's antitrust regulation prohibits the use of non-compete clauses, limits the term of a licensing contract to less than 10 years and reduces the obligations of the licensee. Subsequently, the licensee is free to use the technology after having paid 10 years' worth of royalties.[200] The Competition Act[201] of Zimbabwe prevents horizontal and vertical restraints of competition, abuse of dominant position and anticompetitive mergers.

The very need for these acts in these nations is proof that MNCs used anticompetitive practices in the past.

7. International Legislative Reforms

On the international front, though TRIPS[202] and the OECD[203] demand technology benefits for the host nation, there is no regulation or enforcement of these requirements. And though the rights to regulate and supervise the activities of a foreign MNC belong to the sovereign state under international law,[204] these have not been enforced because many MNCs are richer than the countries. The efforts of organizations like the Intergovernmental Commission on Transnational Corporations and the UN Center of Transnational Corporations to regulate the international activities of MNCs have also not succeeded[205] mainly because of the probable harm to the developed countries' economies.[206] Because developed nations such as the US prioritize their strategic needs[207] and the impact to their own commerce above fairness,[208] the international regulation for anticompetition has not developed. The US supreme courts' reluctance to extend illegality into the case of the US being involved in international cartels with the middle east and British participants since 1920[209] serves to prove this point. Thus, in the absence of international regulatory enforcement, the anticompetitive practices of MNCs have continued unchecked. However, moving forward, such international anticompetitive harmonization efforts must be renewed and standards complementary to

---

[198] Mexico: Regulation of the Federal Law of Economic Competition , available at: http://www.diputados.gob.mx/LeyesBiblio/regley/Reg_LFCE.pdf (last visited 17 May 2023).
[199] Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L. 301, 315 (1989).
[200] Normative Act. No. 015 Establishing Basic Principles and Norms for the Registration of Contracts Involving the Transfer of Technology and Related Agreements, September 1975. Cited in Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L. 301, 313 (1989).
[201] Competition Act of Zimbabwe [Chapter 14:28], available at: http://www.wipo.int/wipolex/en/text.jsp?file_id=214717 (last visited 18 May 2023).
[202] TRIPS Article 7, available at: https://www.wto.org/english/docs_e/legal_e/27-trips_03_e.htm (last visited 17 May 2023).
[203] Przemyslaw Kowalsk et al., *International Technology Transfer Measures in an Interconnected World*, O.E.C.D (Nov. 20, 2017), https://www.oecd-ilibrary.org/trade/international-technology-transfer-measures-in-an-interconnected-world_ada51ec0-en.
[204] United Nations General Assembly Resolution, Declaration on the Establishment of a New International Economic Order 3201 (S-VI) (1 May 1974) Part g., available at: http://www.un-documents.net/s6r3201.htm.
[205] CYNTHIA DAY WALLACE, THE MULTINATIONAL ENTERPRISE AND LEGAL CONTROL: HOST STATE SOVEREIGNTY IN AN ERA OF ECONOMIC GLOBALIZATION 1082 (1st ed. 2002).
[206] Paul Kuruk, *Controls on Technology Transfer: an Analysis of the Southern Response to Northern Technological Protectionism*, 13 MD. J. INT'L L., 301, 323 (1989).
[207] Jim Manzi, *Joint Ventures Abroad and United States Antitrust,* 4 FLETCHER F. 49, 57 (1980).
[208] ibid 63.
[209] ibid 57.

TRIPS must be developed.[210] These standards must regularize M&As, ban the use of anticompetitive clauses in international contracts and also provide a means for states to bring forward their grievances against MNCs. In international contracts, MNCs must focus not only on the core business and commercial gains, but on the whole social aspect of the host country which would lead to prospective opportunities.[211] Although the initiatives and reforms proposed in this section can be incredibly useful, states must be aware that it is not merely enough to insert clauses into legislation and agreements, but they must also have methods to enforce them.

CONCLUSION

During the course of this paper, I have analysed two groups of oil-producing countries, one that experienced significant technological advancement and another that experienced no technological growth as a result of dealings with O&G MNCs. Having done so, I have identified the factors leading to both circumstances and also determined whether patents of the O&G MNCs played any role in these. Therefore, my response to the question "***Oil and Gas Patents: Do MNCs impede the growth of technology in developing nations?"*** is ***Yes, in selected instances***. These are the instances in which the host countries did not take proactive measures to improve their technical capabilities, possessed weak regulation and enforcement and were wholly constrained by their internal limitations. Although the states themselves are liable for being unable to overcome their limitations, in having taken advantage of their situations and in being purely driven by commercial gains, sometimes even wielding patents anticompetitively, MNCs have brought a portion of the culpability upon themselves.

It is an absolute fact that resource-rich developing states that lacked the capacity to innovate would not have been able to tap their reserves without the technology from the MNCs of developed nations. However, it is also equally true that not only did oil-rich states have to pay a form of "patent tax"[212] to the MNCs in order to obtain access to this technology, but that they in fact paid a much greater price in some instances. While on one hand, the growth of technology in countries such as Norway, Brazil and Malaysia have been accomplished as a result of collaborations with MNCs and through the licensing and transfer of patented technology. But on the other hand, Nigeria, Ghana and other oil-producing LDCs have been unable to grow their technical competence. This can be equally attributed to intrinsic country specific and extrinsic industry and organization specific factors. Nevertheless, the intent of this paper is to raise awareness of the extrinsic factors such as patent strategizing and restrictive licensing practiced by the O&G MNCs which are at times anticompetitive and have impeded the technology growth and created foreign dependence in some host nations. These have ultimately resulted in the formation of a technology gap between the oil-producing nations and the oil technology producing nations.

Because it is my intent that this paper is of use to those nations wishing to close the technology gap, I have made certain recommendations after having evaluated the reasons for the technology growth and stagnation of different countries. These recommendations will aid the technologically backward countries to independently increase their innovation and technology. Innovation is crucial to the petroleum industry. Despite declining oil prices, firms

---

[210] Stephen Yelderman, *International Cooperation and the Patent-Antitrust Intersection* 19 TEX. INTELL. PROP. L.J. 193, 196 (2011).
[211] Harrie Vredenburg H & Percy Garcia, *Technology transfer in international business: the role of the multinational corporation in building capacity in developing countries,* 7 INT'L.J. BUS. STRATEGY (2007).
[212] Gabriel Marcuzzo Cavalheiro et al., *Strategic patenting in the upstream oil and gas industry: Assessing the impact of the pre-salt discovery on patent applications in Brazil*, 39 WORLD PAT. INFO. 58, 58 (2014).

that have prioritized innovation have managed to maintain their competitive advantage and successfully survive.[213] However, the use of anticompetitive practices must not be tolerated because that defeats the entire foundation of intellectual property law due to its adverse effects on innovation albeit in foreign nations. The benefits of innovation and intellectual property rights belong to everyone and not just the few who know how to practise them! Just as a transformation in the ownership and control of the oil reserves came about through increased awareness of the issue, and culminated in pressure from the OPEC, it is my wish that a transformation in the control of the oil technology will also come about. The suggested international and domestic reforms will regulate the dominant behaviour of O&G MNCs and facilitate the technology catch-up of the developing states.

[213] Hossein Hassani et al., *The role of Innovation and Technology in sustaining the petroleum and Petrochemical Industry*, 119 TECH. FORECASTING & SOC. CHANGE 1,6 (2017).