PATENT LAW AND NANOTECHNOLOGY: EXAMINING THE PATENT LANDSCAPE IN THE MINIATURE WORLD

- Pallavi Kishore[*]

ABSTRACT

1. INTRODUCTION

The term 'nano' has been derived from the Greek word 'nannos' which means a dwarf.[1] It denotes one billionth of the basic unit.[2] The conceptual underpinnings of nanotechnology were laid down by Richard Feynman in 1959.[3] However the term 'nanotechnology' was not used until 1974. The term 'Nanotechnology' was coined by Noris Taniguchi in 1974 in order to describe the ability of engineers to manipulate

---

[*] Student, 5th Year, B.A LL.B (Hons.), West Bengal Natioanl University of Juridical Sciences, Kolkata.

[1] Fritz Allhoff, Patrick Lin and Daniel Moore, *What Is Nanotechnology And Why Does It Matter?*, Wiley-Blackwell, available at http://www.kacst.edu.sa/en/research/nt/Documents/r9.pdf, last seen on 31/10/2015.

[2] Ibid.

[3] Richard Feynman, *There is plenty of room at the bottom*, The Royal Society & The Royal Academy of Engineering, Nanoscience & Nanotechnologies, available at http://www.raeng.org.uk/publications/reports/nanoscience-and-nanotechnologies-opportunities, last seen on 31/10/2015.

materials at the nano scale.[4] Nanotechnology refers to the three fold elements of research at the spectrum ranging from one to hundred nanometres, creation using structures that have size induced novel characteristics and the ability to manipulate matter at dimensions below hundred nanometres.[5] Owing to the unique properties exhibited by matter at the nano scale, nanotechnology has cross-industry application as a result of which it has immense potential across varied industries like medicine, energy, information technology, food, defence etc.[6] Some applications of nanotechnology that have already been commercialised are stain-resistant cloth and transparent sunscreen.[7] This field is still in its infancy and the trajectory of its future growth will be influenced by the patent landscape since the patent regime provides an incentive for invention and investment in such new fields of technology. Against this backdrop, the author seeks to examine the way in which the patent regime has adapted itself to technological advancements in the field of nanotechnology. Further, the author seeks to analyse the problem of patent thickets that holds the potential to stifle the nanotechnology industry at its infancy and to suggest solutions for the same.

2. EXAMINING THE NEED FOR PATENTS IN THE NANO WORLD

Nanotechnology has been projected to be a 'transformative technology'[8] that has the potential to revolutionise varied

---

[4] Ibid.

[5] Raj Bawa, *Patents, Nanotechnology & the US Patent Office*, IPR in Nanotechnology-Lessons from experiences Worldwide, available at ftp://ftp.cordis.europa.eu/pub/nanotechnology/docs/iprworkshop_bawa_en.pdf, last seen on 31/10/2015.

[6] Indrani Barpujari, *The Patent Regime & Nanotechnology: Issues & Challenges*, 15 Journal of Intellectual Property Rights 207 (2010).

[7] Andrew Wasson, *Protecting the next small thing: Nanotechnology and the reverse doctrine of equivalents*, 10 Duke Law & Technology Law Review, 2 (2004).

[8] Graham Reynolds, *Nanotechnology and the Tragedy of Anticommons: Towards a Strict Utility Requirement*, University of Ottawa Law & Technology Journal, 81 (2009); Also see Ted Sabety, *Nanotechnology Innovation and the Patent Thicket : Which IP Policies Promote Growth*?, 15 Alb. L. J. Sci & Tech. 479 (2004-2005)

industries such as health, information technology, energy, food, defence etc.[9] This is because a single nanotechnology invention has applications across varied industries.[10] Further, nanotechnology deals with the understanding and control of matter at the sub-atomic level whereby matter exhibits unexpected properties that are different from the properties exhibited by bulk material.[11] For instance, carbon, which is a good conductor, turns into a bad conductor, at the nano scale.[12] Manipulation of matter at the nano scale maybe useful across varied industries since matter at the nano scale forms the basic building unit of all products in all industries. By being able to control the properties of matter at the sub-atomic level, one will be able to control the properties of all products across all industries. Cross-industry application of nanotechnology highlights the immense potential that this field holds.[13] It has been estimated that nanotechnology has the potential to grow into a one trillion dollar industry in the next few decades.[14]

In light of the immense potential that the burgeoning field of nanotechnology holds, it is imperative for the patent regime to respond favourably to this new technology.[15] This is because patents incentivise innovation and investment and play a crucial role in determining the growth trajectory of a particular field of technology.[16] Against the backdrop of a global

---

[9] Ibid.

[10] ETC Group Report, *Nanotech's "Second Nature" Patents: Implications for the Global South*, ETC Group Special Report – Communiqués No. 87 and 88, available at http://www.nanowerk.com/nanotechnology/reports/reportpdf/report7.pdf, last seen on 31/10/2015.

[11] Stefan Huebner, *The validity of European Patents in Germany*, Nanotechnology Law and Business (2008), available at https://srhuebner.com/uploads/media/nanotechnology_validity_huebner_nlb.pdf, last seen on 31/10/2015.

[12] Ibid.

[13] H. Shand & K. Wetter, *Trends in Intellectual Property and Nanotechnology: Implications for the Global South*, 17 Journal of Intellectual Property Rights, 111 (2007).

[14] Supra 7.

[15] Ibid.

[16] *Intellectual Property And Emerging Technologies*, 25 (M. Rimmer & Alison McLennan, 2012).

knowledge marketplace,[17] it is crucial for technology developers to use the tool of patent law in order to ensure that the gap between the laboratory and the marketplace is bridged. From the sovereign's perspective this bridging is important as it would provide the sovereign an edge over other competitors.[18] Consequently, it is crucial to examine whether the existing patent landscape is well equipped to keep pace with the rapid technological advancement that is colouring the field of nanotechnology. The author will delve into this issue in the following chapter.

[17] *Patent Markets In The Global Knowledge Economy*, 96 (Madies & Prager, 2014).

[18] High Level Expert Group, *Mastering and Deploying Key Enabling Technologies*, European Commission, available at http://ec.europa.eu/enterprise/sectors/ict/files/kets/hlgworkingdocument_en.pdf, last seen on 31/10/2015.

3. MOULDING PATENT LAW TO ACCOMMODATE THE NEWLY DEVELOPING TECHNOLOGICAL TERRAIN

3.1. Tweaking the Requirements of Novelty and Non-Obviosness

As per Trade Related Aspects of Intellectual Property Rights (TRIPS) the patent system is geared towards providing a technology neutral protection to all kinds of innovations.[19] Patent protection is provided to inventions that fulfil the three pronged criteria of novelty, non-obviousness and usefulness. In USA, the requirements are novelty, non-obviousness and usefulness and in UK these requirements are referred to as novelty, realisation of inventive step and industrial application.[20] Sometimes, the existing principles of patent law might not fit well with technological advancements, resulting in the need for tweaking the existing principles in order to bring new technological innovations within the net of patent protection.

For instance, as per the general principle, a mere miniaturisation of a product does not clear the hurdles of novelty and non-obviousness.[21] As observed by the US court, "*an invention may not be patentable where the sole element of novelty is a difference in size.*"[22] If we use this general principle related to downsizing of traditional products, a majority of nanotechnology inventions[23] would not be able to satisfy novelty and non-obviousness. As a result of this, the requirements of novelty and non-obviousness have been diluted to a certain extent in order to bring nanotechnology inventions within the umbrella of patent protection. Departing from the general rule, a nano scale miniaturisation is

---

[19] Supra 6.

[20] Luca Escoffier, *Nanotechnology under the Magnifying Lens, from a European and US perspective*, TTLF Working Papers, available at http://www.law.stanford.edu/sites/default/files/publication/205107/doc/slspublic/escoffier_wp3.pdf , last seen on 31/10/2015.

[21] Supra 6.

[22] Supra 6.

[23] *Nanotechnology: The Industrial Revolution of the 21st Century*, Accenture Foundation- Future Trends Forum, available at https://www.fundacionbankinter.org/documents/11036/16211/Publicacion+PDF+IN+FTF_Nanotecnologia/03fd2b3c-0807-4cb3-a1fe-d2b2af21aed9, last seen on 31/10/2015.

considered to fulfil the requirements of novelty and non-obviousness. The primary reason for this is that the laws of physics that apply at the nano scale are fundamentally different.[24] The laws of quantum physics take over as a result of which nano scale particles exhibit unexpected properties, different from their macro scale counterparts.[25] These unexpected changes in properties are called 'quantum effects'.[26] Ergo, by their very nature, nanotech inventions exhibit properties that are not witnessed at the macro scale.[27] With respect to nanotechnology, patent claims based on new unexpected properties due to downsizing are considered to cross the novelty barrier as was seen in *BASF v. Orica Australia BO Appeal* whereby the difference in properties between polymer particles larger than hundred and eleven nanometres and smaller than hundred nanometres was held to be sufficient in order to establish novelty.[28]

Further, a mere change in dimensions is not obvious if it leads to unexpected outcomes;[29] or if it overcomes technical problems relating to prior art.[30] It is pertinent to note that a nanotech invention crosses the inventive step barrier despite being a miniaturised version of a traditional product because for a person skilled in the art it is not obviously derivable from the

---

[24] Supra 7.

[25] *Patenting Nanotechnology: Exploring the Challenges*, WIPO Magazine, 2011 available at http://www.wipo.int/wipo_magazine/en/2011/02/article_0009.html, last seen on 31/10/2015; Also See ETC Group, *Commodity Markets: The Implications for Commodity Dependent Developing Countries*, Trade-Related Agenda, Development And Equity, available at http://www.etcgroup.org/files/publication/45/01/southcentre.commodities.pdf, last seen on 31/10/2015.

[26] *A Tiny Little Primer on Nano-Scale Technology and the Little Bang Theory*, ETC Group, 2009, available at http://www.etcgroup.org/content/tiny-little-primer-nano-scale-technology-and-little-bang-theory, last seen on 31/10/2015.

[27] Jordan Paradise, Claiming *Nanotechnology: Improving USPTO efforts at classification of emerging nano enabled pharmaceutical technologies*, Northwestern 10 Journal of Technology and Intellectual Property, 175 (2012).

[28] Supra 27.

[29] Scott Roe, *Nanotechnology: When Making Something Smaller is Non obvious*, 12 B.U. J. Sci. & Tech. L, 175 (2006).

[30] European Law and New Health Technologies, 164 (Mark L. Flear, 2013).

existing prior art due to the different properties exhibited by the invention;[31] and due to the non-obvious technical considerations that are at work while making a nanotech counterpart of a product.[32]

3.2. Analysing the Stretch of the Patent Net in case of Traditional Products

Another crucial question that arises with respect to patenting nanotechnology inventions which are miniaturised versions of their macro-sized traditional counterparts is that whether the patent rights given on a traditional product without specifying any size could be regarded as being infringed by its miniaturised nanotech invention.[33]

The reverse doctrine of equivalents[34] which states that "*where a device is so far changed in principle from a patented article that it performs the same or a similar function in a substantially different way but nevertheless falls within the literal words of the claim the reverse doctrine of equivalents maybe used to restrict the claim and defeat the patentee's action for infringement*"[35] maybe used in order to excuse the literal infringement of traditional product patents by nanotech inventions. Further, the author will put forth a two pronged

---

[31] Lisa Abe, *Nanotechnology Law : The legal issues*, ICE Technology Conference 2005, available at, http://www.fasken.com/files/Publication/1db6f3c3-a757-4067-af7c-901a5498ecd8/Presentation/PublicationAttachment/da755b60-42ff-44e8-9e57-582e2a83b8f7/NANOTECHNOLOGY.PDF, last seen on 31/10/2015; Also see Marko Schauwecker, *Nanotechnology Inventions in US Patent Law*, TTLF Working Papers, available at http://www.law.stanford.edu/sites/default/files/publication/205786/doc/slspublic/schauwecker_wp_nanotech.pdf, last seen on 31/10/2015.

[32] Supra 7; Also see Kirthi Jayakumar, *Patenting Nanotechnology: The challenges posed to the Indian Patent Regime*, India Law Journal, available at http://www.indialawjournal.com/volume3/issue_2/article_by_kirhti.html, last seen on 31/10/2015.

[33] *Nanotechnology and Patents*, WIPO, available at http://www.wipo.int/patent-law/en/developments/nanotechnology.html, last seen on 31/10/2015.

[34] Graver Tank & Manufacturing Company v. Linde Air Products Company, 339 U.S. 605 (1950, Supreme Court of the United States).

[35] Supra 7.

argument to suggest that the net of patent protection granted to a traditional product without any size specification does not extend to its nanotech counterpart. Firstly, the traditional product and the nanotech counterpart are fundamentally very different not only in terms of size but also in terms of properties. The patent holder of a macro scale product could neither have envisaged the properties that a nano scale version of his product would have exhibited nor the technical issues that would be involved in actually bringing the nanotech counterpart into existence. Secondly, until the inventor of a macro scale product comes up with a technical solution to apply the laws of quantum physics and come up with a nano scale counterpart, the idea of making a miniaturised version of the macro scale product, exhibiting different properties would in fact just be an abstract idea which is not covered by the net of patent protection.[36]

Thus, the requirements of novelty and non-obviousness have been diluted in order to aid patent law adapt to new technological advancements. Further, the rights of a patent holder on a traditional product with no size specification cannot be regarded as infringed by its miniaturised nanotech counterpart. Against this backdrop, the author will now discuss the way in which nanotech patents have been granted by patent offices.

4. HAS FEYNMAN'S 'BOTTOM' BECOME OVERCROWDED WITH PATENTS?

4.1. The Patent Land Grab and Formation of Patent Thickets

Over the last couple of years, nanotechnology patents have been obtained in a way, resembling a 'gold rush' or a 'land grab.[37] This gold rush has particularly targeted nano materials.[38]

---

[36] Supra 31.

[37] Amber Rose Stiles, *Hacking through the thicket: A proposed patent pooling solution to the nanotechnology building block patent thicket problem*, 4 Drexel Law Review, 558 (2012); Also see Simon Hadlington, *Nanotech Patent Jungle Set To Become Thicker In 2013*, Chemistry World,

Nano materials are "*arrangements of matter that exhibit unique characteristics and properties as a result of their size*."[39] Nano materials have been covered by the net of patents as they are a result of technological innovation at the nano scale. Just as bricks, wood and cement are basic building blocks of a house, nano materials[40] like nanotubes (which are "*large molecules of pure carbon that are long and thin and shaped like tubes and are usually about 1-3 nanometres in diameter*"[41]), quantum dots (which are "t*hree dimensionally constrained semi-conductor nanostructures typically between 1-100 nanometres in diameter*")[42] etc. form the basic building blocks using which complex materials and devices can be made.[43] Nano materials may thus be described as the bedrock upon which future advances in the field nanotechnology would take place. It is pertinent to note that nanotechnology is the first field to have its basic research material patented.[44] Further, granting of patents on building blocks has been supported by the development oriented model of patents which states that granting patents in initial stages of innovation would incentivise channelling of resources and investment towards innovation.[45]

The author will delineate two main reasons behind this nano material's patent arms race.[46] Firstly, patents on the basic building blocks of a field like nanotechnology which is still in its infancy and which holds a lot of potential would enable the patentee to wield control over the future development of this field. The patentee would be in a position to fence off portions of basic research in this field. Secondly, nano-technological inventions and nano materials have cross-sectoral application

---

available at http://www.rsc.org/chemistryworld/2013/01/nanotechnology-patent-thicket-jungle-graphene-nanotubes, last seen on 31/10/2015.

[38] Supra 5.

[39] Supra 8.

[40] Ibid.

[41] Supra 10.

[42] Supra 31.

[43] Supra 41.

[44] J.Miller & D.Harris, *Nanoech May Face Patent Problems*, *Innovation*, 5 America's Journal of Technology Commercialisation, 18 (2007).

[45] Arti Kaur Rai, *Regulating Scientific Research: IPRs and the Norms of Science*, 94 Northwestern University Law Review, 44 (1999; Also see Supra 45.

[46] G.Hunt & M. Mehta, *Nanotechnology: Risks, Ethics and Law*, 232 (2013).

owing to their unique properties.[47] For instance, carbon nano tubes have application in multiple industries ranging from the electronics and materials industries to the life sciences and energy industries.[48] This has encouraged the patent gold rush mentality[49] since patentees having control over the basic research tools of nanotechnology would gain influence in various other industries.

The euphoria of patenting basic building blocks of nanotechnology has not been handled efficiently by patent offices. This is because of the complexities attached to granting patents in a field which is at its infancy and which has prior art scattered across the patent classification system owing to its 'multidisciplinary nature'.[50] The problem of searching for prior art related to nanotechnology was solved to a certain extent by the introduction of subclass 977[51] and Y01N[52] (specifically dealing with nanotechnology patents) by the United States Patent & Trademark Office (USPTO) and the European Patent Office (EPO) respectively. Despite this, it is very difficult to search for nanotechnology prior art due to lack of standard nanotechnology terminology which impedes identification of nano patents.[53] Further, nano-inventions are difficult to describe by using the terminology which is used to describe traditional inventions.[54] This problem is compounded by lack of qualified people in the patent office;[55] who would be in a position to understand nanotech patent applications, most of which use self-coined terms due to lack of any standard terminology. All this has resulted in the grant of broad, fragmented and overlapping patents in the field of nanotechnology.[56]

---

[47] Supra 6.
[48] Ibid.
[49] Supra 10.
[50] Supra 6.
[51] Charles Eloshway, *Nanotechnology Related Issues at the USPTO*, United States Patent and Trademark Office, available at ftp://ftp.cordis.europa.eu/pub/nanotechnology/docs/iprworkshop_eloshway_en.pdf, last seen on 31/10/2015.
[52] Supra 27.
[53] Supra 39.
[54] Supra 53.
[55] Ibid.
[56] Supra 13.

Due to the grant of broad and overlapping patents on the basic building blocks of nanotechnology, patentees are now in a position to lock up the use of large areas of basic research tools in the field of nanotechnology, resulting in the formation of patent thickets.[57] A patent thicket is a web of overlapping patent rights requiring those who want to use the patented subject matter to obtain the permission of multiple patent holders.[58]

4.2. Hurdles that might stifle the growth of Nanotechnology

The creation of patent thickets has resulted in a chaotic nanotechnology patent landscape. The author will analyse the ways in which patent thickets hold the potential to stifle the growth of nanotechnology

4.2.1. Tragedy of Anti-Commons

Tragedy of anti-commons results when a large number of individuals are given the rights of exclusion vis-a-vis a scarce resource as a result of which the resource remains underutilised.[59] For instance, if a large number of individuals are given exclusionary rights over parts of a metaphorical pie (scare resource) and if these exclusionary rights are not bundled together, no one will be able to utilise the pie and the pie would be wasted.

This concept maybe extrapolated to the realm patent thickets. The creation of patent thickets in the field of nanotechnology has led to the requirement of obtaining licenses from multiple patentees in order to be able to make use of patented nano materials, the building blocks of nanotechnology. If the patentees holding overlapping patents refuse to grant such

---

[57] G.Clarkson & D. Dekorte, *The Problem of Patent Thickets in Convergent Technologies*, University of Michigan, available at http://ipeg.eu/wp-content/uploads/2011/05/Keunen_Unraveling-the-Patent-Thicket-an-economic-analysis-of-an-intangible-reality-2008.pdf, last seen on 31/10/2015.

[58] Carl Shapiro, *Navigating the Patent Thicket: Cross Licenses, Patent Pools and Standard Setting* Innovation Policy and Economy, Volume 1, available at http://www.nber.org/chapters/c10778.pdf, last seen on 31/10/2015.

[59] Supra 41; Also see Michael Heller, *The Tragedy of Anti-Commons: Property in Transition from Marx to Markets*, 111 Harvard Law Review, 2 (1997).

licenses, the basic building blocks of nanotechnology would remain locked leading to their underutilisation. This would lead to tragedy of anti-commons at the basic building block level which in turn would stifle the growth of nanotechnology.

4.2.2. Impeding Cumulative innovation

Cumulative innovation refers to using an already patented invention in order to develop a second-generation invention.[60] Broad and overlapping patents granted to the original inventor on a nano material would delay or prohibit the activity of the second generation inventor since his activity would be contingent on obtaining licenses for the use of such nano material.[61] Further, if the second generation inventor fails to accumulate the required bundle of licenses, he would not be able to come up with a cumulative innovation, leading to the stagnation of the nanotechnology industry.

This problem may also be viewed from the prism of Hegel's Personality theory as per which an invention is the extension of the inventor's personality.[62] Fencing off basic research material by using the web of a patent thicket, would deny the second generation inventor an opportunity to come up with a product by way of extension of his personality. Further, a person's brainchild may serve as a vehicle for self-actualisation.[63] An inventor might be recognised by his invention leading to self-validation. The creation of a patent thicket might deny this opportunity of self-actualisation to the second-generation inventor. Further, in the market place of ideas where everyone is jostling for space, it is crucial that second generation inventors must get an opportunity to come up with cumulative innovations which in turn might hold the potential for technological advancement. The second generation invention might have the potential to not only serve as a vehicle for self-

---

[60] Tur Sinai, *Cumulative Innovation in Patent Law: Making Sense of Incentives*, 50 The Intellectual Property Law Review, 731 (2010).

[61] Supra 41.

[62] Supra 61; Kanu Priya, *Intellectual Property and Hegelian Justification*, 1 N.U.J.S. Law Review, 360 (2008).

[63] *Intellectual Property*, Stanford Encyclopaedia of Philosophy, available at http://plato.stanford.edu/entries/intellectual-property/, last seen on 31/10/2015.

actualisation for the second generation inventor but it might also be viewed as currency in the knowledge market.[64] Consequently, by acting as roadblocks to second generation innovation, patent thickets might impede the development of inventions embodying the twin elements of self-actualisation and currency.

4.2.3. Royalty stacking and transaction costs

Due to the existence of a patent thicket, an individual wishing to use a nano material to build improvements in order to take nanotechnology from the laboratory to commercial viability, must bundle all overlapping and fragmented rights with regard to the nano material.[65] The transaction costs involved in identifying the patentees of overlapping nano material patents and negotiating with them might be enormous.[66] Further, even if the patentees agree to grant licenses for the use of the nano material , the total amount of royalty that an individual might have to pay to varied overlapping patent holders might be astronomical. This excessive burden of royalties on an individual seeking patent licenses is known as royalty stacking.[67] This would increase the cost of the cumulative innovation which might be passed on to the consumers leading to double marginalisation. "*The double marginalization problem refers to a vertical sequence of monopolists in which a mark-up is charged on a mark-up.*"[68] In case of intellectual property rights, a subsequent inventor is a downstream monopolist who is required to get licenses from upstream monopolists (that is the owners of existing patents upon which the subsequent

---

[64] Ibid.

[65] *IPRs, Nanotechnology: Issues, Trends and Challenges for India*, Teri, available at http://www.teriin.org/events/Nano-IPR_Note.pdf, last seen on 31/10/2015.

[66] Damien Geradin & Others, *Royalty Stacking in High Tech Industries: Separating Myth from Reality*, CEMFI, available at ftp://ftp.cemfi.es/wp/07/0701.pdf, last seen on 31/10/2015.

[67] Ibid; Also see Thorsten Kaseberg, *Intellectual Property, Antitrust & Cumulative Innovation*, The Eu & The US, 212 (2012).

[68] Mahdiyeh Entezarkheir, *Essays on Innovation, Patents and Econometrics*, Waterloo Library, available at https://uwspace.uwaterloo.ca/bitstream/handle/10012/5320/entezarkheir_mahdiyeh.pdf?sequence=1, last seen on 31/10/2015.

inventor's own invention is built upon).[69] This leads to a double mark-up and enhances the licensing fee for the subsequent inventor.[70] Further, even if the individual manages to cross these 'patent tollbooths',[71] there is always a risk of being sued for patent infringement by an unidentified patent holder since it is very difficult to keep track of overlapping and fragmented patents in a complex web of patent thickets existing at the basic research level.

Ergo, although the patent system is geared towards spurring innovation and technological advancement, patent thickets in the field of nanotechnology hold the potential to delay or prohibit cumulative innovation. Further, they make cumulative innovation extremely expensive and risky. This would deter inventors from venturing into coming up with second generation nanotechnology inventions. Further, because of the risk posed by the formation of the nanotechnology patent thicket at the building block level, very few investors would be willing to invest in projects or ventures dealing with second generation nanotechnology inventions. This in turn might stifle the growth of nanotechnology at its infancy.

5. SUGGESTING SOLUTIONS TO HACK THROUGH THE PATENT THICKET

In order to ensure that the nanotechnology industry is not stifled in its early stages of growth due to the reasons highlighted in the previous chapter, it is essential to navigate through the nanotechnology patent thicket. The author will suggest ways of hacking through the patent thicket.

5.1. Development of standard terminology

The development of standard nanotechnology terminology will help the patent office classify nanotechnology patent

---

[69] Ibid.

[70] Mark Lemley, *Patenting Nanotechnology*, 58 Stanford Law Review, 625 (2005).

[71] Raj Bawa & Others, *The Nanotechnology Patent Gold Rush*, 10 Journal of Intellectual Property Rights, 429 (2005).

applications systematically and will make it easier for them to conduct prior art searches.[72] This in turn would reduce the chances of overlapping patents being granted in the future, thus, preventing the patent thicket from getting denser. Thus, the development of standard nanotechnology terminology would help towards ensuring that the growth of nanotechnology is not stifled.

5.2. Formation of patent pools

Patent pools are cooperative agreements whereby two or more parties pool their patent rights into a package which is then licensed to the members of the pool and other third parties for a set fee.[73] Patent pools would reduce transaction costs related to obtaining licenses from multiple overlapping and fragmented patent owners since all overlapping and fragmented patents would be packaged into a bundle. Further, the need to enter into negotiations with multiple patentees would be eliminated and patent pool would also mitigate royalty stacking since the bundle of patent licenses would be obtained by paying a lump-sum amount.[74] Ergo, patent pools facilitate cumulative inventions as they provide a vehicle for second-generation inventors to stand on the shoulders of original inventors;[75] by obtaining licenses to use patented products easily. Also, this would reduce the expenses and risks associated with venturing into projects related to cumulative inventions in the field of nanotechnology, thus incentivising second generation inventors and investors to invest their efforts in the field of nanotechnology.

---

[72] Supra 56.

[73] *Patently Absurd?*, The Economist, available at http://www.economist.com/node/662374, last seen on 31/10/2015.

[74] *Anti-trust Analysis of Portfolio Cross Licensing Agreements and Patent Pools*, The US Department of Justice, available at http://www.justice.gov/atr/public/hearings/ip/chapter_3.htm, last seen on 31/10/2015.

[75] Anna Abdon, *The Patent Systems of Today- At a Cross Road*, Master Thesis, Faculty of Law, University of Lund, available at http://lup.lub.lu.se/luur/download?func=downloadFile&recordOId=1541753&fileOId=1541762, last seen on 31/10/2015.

In the author's opinion, the tension between cooperation and self-interest embodied in the game theory[76] maybe applied to the formation of a patent pool. For instance if X, Y and Z are three companies holding patents that are pooled, the fee obtained for licensing the pooled patents would be divided among them. If X opts out of the pool, it could charge a higher royalty and consequently the licensee would end up paying a higher royalty to X in addition to the fee charged by Y and Z (patent pool fee). All three companies would have a tendency to opt out of the pool and charge a higher royalty. However if all three companies do not cooperate, and charge separate royalties, the total royalty required to be paid by the licensee would be astronomical;[77] and he might end up abandoning his venture of coming up with a second-generation product, resulting in X, Y and Z receiving no royalty for their patents.

The formation of patent pools also reflects a utilitarian approach (greatest good of the greatest number)[78] as it would mitigate royalty stacking and the problem of double marginalisation,[79] which in turn would be 'good' for the growth of the nanotechnology industry and the consumers of the second-generation nanotech products.[80]

5.3. Experimental exception

Since the very basic building blocks of nanotechnology have been patented, there is a need for an experimental exception to be recognised by the law in order to enable future inventors

---

[76] Avinash Dixit & Barry Nalebuff, *Game Theory*, The Concise Encyclopaedia of Economics, available at http://www.econlib.org/library/Enc/GameTheory.html, last seen on 31/10/2015.

[77] R. Aoki & S. Nagaoka, *Formation of a Pool with Essential Patents*, (2006), Centre for Intergenerational Studies, available at http://cis.ier.hit-u.ac.jp/Common/pdf/dp/2006/dp326.pdf, lasty seen on 31/10/2015.

[78] Supra 67.

[79] Leveque, *Early Commitments Help In Patent Pool Formation*, Institute for Economic Research, available at http://www.ier.hit-u.ac.jp/pie/stage2/Japanese/d_p/dp2008/dp384/text.pdf, last seen on 31/10/2015.

[80] Steffen Brenner, *Optimal Formation Rules for Patent Pools*, Springer Link, available at http://link.springer.com/article/10.1007%2Fs00199-008-0379-z, last seen on 31/10/2015.

including second-generation inventors to use patented nano materials for further research and invention.[81] This would also ensure that the growth of the nanotechnology industry is not stifled in its infancy.

6. CONCLUSION

Patents play a crucial role in determining the growth trajectory of a particular field of technology. In order to ensure that the patent regime responds favourably to nanotechnology patent claims, the requirements of novelty and non-obviousness have been tweaked whereby a mere nano scale miniaturisation of a product would be considered to cross the hurdles of novelty and non-obviousness. This is because of the unexpected and unique properties exhibited by nano scale matter as a result of the operation of laws of quantum physics at the nano scale. For instance, gold as bulk material is an excellent conductor. However at the nano-level, it turns into a semi-conductor.[82] Further, the patent system is geared towards spurring innovation. However, it might end up having the exact opposite effect of stifling innovation due to the formation of patent thickets which refers to a web of overlapping patent rights requiring those who want to use the patented subject matter to obtain the permission of multiple patent holders. A patent thicket has been formed in the field of nanotechnology due to reasons like the grant of overlapping patent rights over basic building blocks of nanotechnology by patent offices. Patent thickets stifle innovation as they hold the potential to result in tragedy of anti-commons. If the patentees holding overlapping patents refuse to grant such licenses to those who seek them, the basic building blocks of nanotechnology would remain locked from the reach of other inventors, leading to their underutilisation. Patent thickets might also impede second generation innovation and they might provide soil for the germination of problems like royalty stacking and double marginalisation. Ergo, in order to ensure that the field of nanotechnology is not stifled in its infancy, there is a need for

[81] Supra 41.
[82] Supra 11.

all stakeholders to encourage the formation of patent pools and to support the development of standard nanotech terminology. These solutions would mitigate problems related to granting overlapping patents. Further, the suggested solutions would ensure that prior art searches in the field of nanotechnology are streamlined, expenses and risks related to obtaining licenses from multiple patentees are minimised and the burden of litigation related to being sued due to the failure of identifying multiple patentees holding patents over basic building block of nanotechnology, is reduced significantly. In addition to the development of standard nanotechnology terminology by patent offices and formation of patent pools, there is a need for an experimental exception to be recognised by law in the field of nanotechnology in order to enable inventors use patented nanotechnology building blocks for further research and invention. Ergo, the field of nanotechnology holds the key to revolutionise varied industries and in light of the immense potential that the burgeoning field of nanotechnology holds, it is imperative for the patent regime to respond favourably to this new technology. This article highlighted the reasons as to why the existing patent landscape is not well equipped to keep pace with the rapid technological advancement that is colouring the field of nanotechnology and it is important that patent law should be moulded to accommodate the solutions that have been suggested in this article in order to ensure that the tool of patent law helps advance the growth of this burgeoning field of nanotechnology.