

Understanding 'Patenting of Nano-technology' in India

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Abstract

Nano-technology, a 21st century technology, became an inevitable ingredient in all walks of life. Industries producing goods for human consumption majorly in various sectors are the main users of the nanotechnology. By virtue of increasing number of inventions in Nano-technology field, the patent offices across the world is filled with applications involving the same. USPTO, EPO and JPO are the main beneficiaries of the upcoming technology. The increasing grant of patents for nanotechnology is the evidence for their effectiveness in catching the upcoming field. Indian patent statistics relevant to nanotechnology is showing poor numbers compared to USPTO, EPO and JPO. This article keenly examines the nano regime in India and comparison of IPO with USPTO, EPO and JPO in grant of nano patents.

Keywords: Nano-technology, patent, USPTO, EPO, JPO

Introduction

"In world where the powers are determined by the Share of the world's knowledge, reflected by patents, papers and so on.... It is important For India to pull all her acts together to become a continuous innovator and creator of science and technology intensive products"

-Dr. A.P.J. Abdul Kalam

As per the Census 1921, India has a population of 31, 89, 42, and 489 and by 2012 it reached to 1,22,02,00,000 [2]. India's total area of land is 32,87,240 Square Kilometer and the forest covered maximum land [3]. According to the 2013 census, India's Population is multiplied by four times (1,25,21,40,000 [4]), but the total area of the land is constant. The forest area was reduced by industrialization and urbanization in last century. In particular, arable and barren land is improved with the help of Science and Technologies (S&Ts) and met the daily needs of the people of India. In 21st century, India attained the self-sufficiency and reached to the credible incline target in export (Apple to Arsenal) to rest of the World.

India off late realized that, an abundance of traditional factors of production (raw materials, energy & unskilled labors) is not enough to guarantee for long-term success. According to India's industrial policy, *national competitive advantage is not inherited but it has to be created*, and as most of the innovative activity takes place in private enterprises at majority, focus has been laid down on the development of industrialization. India's global competitiveness is still a question of thrust for *research and development (R&D) in Science & Technology (S&T), development of fair competitive environment in trade and best performance in World market*.

Globally, firms in developed countries and increasingly in some developing countries are being driven to take advantage of worldwide S&T resources. These factors have spurred the growth of S&T development in those nations, which have

contributory environments. The Ireland, Israel, Singapore, South Korea, and Taiwan have made substantial progress in upgrading their innovative capacity and, as a result, have become beneficiaries of foreign investments in S&T ventures. The fast developing south Asian countries (China, India and Malaysia) have increased their investments in the areas of science, technology, and innovation at New Science, Technology and Innovation developments [5]. The technologies have always been beneficial for the mankind and developed to help the human race to make the best use and become advantageous in the name of sustainable development for present and future.

Nanotechnology revolution, famously known as 'a tsunami technology', the interdisciplinary of S&T is virtually throwing its impact on the entire human race (especially, the Indians are utilizing the benefits of this emerging technology at full length in 21st century) by the way of using the automobiles to aerospace, from cosmetics to medicine, and energy to robotics [6].

Compared with the western, India put its first step into Nanotechnology very earlier, e.g., clear evidence that Carbon Nanotechnology (CNT) existed centuries before in the southern part of India and exported from the first century AD to all over the World [7]. This technology is definitely bringing in new methods and procedures to make better use of the products as well as make them more efficient. More than the 100 global companies have come to India to set up Research & development Centers, confirming the intellectual capital of the Indian scientific and engineering community.

The science must grapple with the key challenges (The pressures of population increase, health risks, changing demographics, natural resource degradation, and dwindling farmlands) facing the India today. The India needs new science and technologies, new priorities and paradigms to address these fundamental challenges. In India, the Innovators and Investors are practicing new Physics, and Chemistry to

make the new materials / products. In that way the India have link to the Millennium Development Goals (MDG) of the United Nations [8]. India is the one of the top utilizer of the ten applications of Nanotechnology and the United Nations MDGs towards sustainable development [9].

Within 2050 AD, the Nanotech improvement at every field will *makes march of the peace India towards the prosperity for the entire Universe*. The history of Nanotechnology is fully relied upon the definitions of science and technology, without which the understanding of the Nanotechnology, an advocate cannot enter into the legal arena and won the case for his client, one who hold multi national company. It is quite equivalent to the work of the four visually challenged persons described about the elephant. The research work put focus on the definitions on science, technology engineering and the way of enabling technology commercialization trend. It is necessary to understand these basic matters leads to understand the latest developments in Nanotechnology.

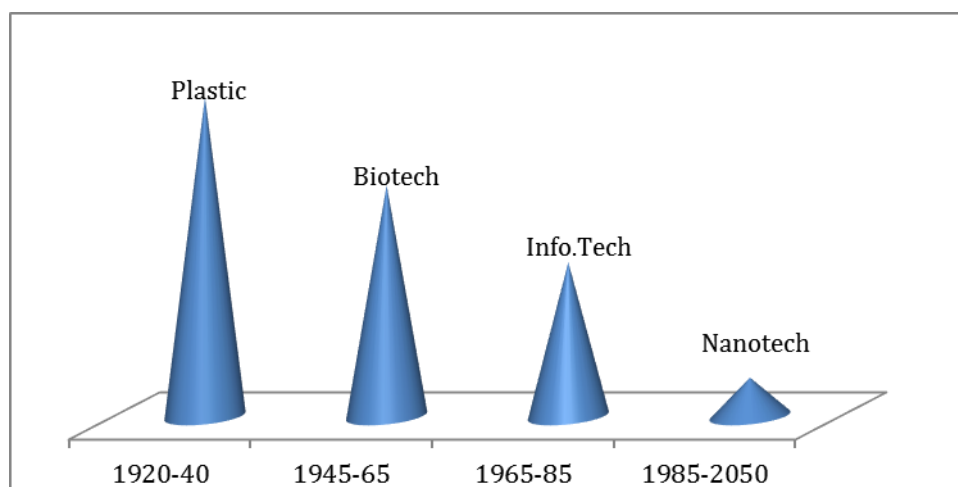
Understanding Nanotechnology

It is the manipulation and manufacturing of materials and devices on the atomic scale. The 'Nano scale' is typically measured in Nano metrics or billionth meter or ten rose to the power minus nine and materials built at this scale often exhibit distinctive physical and chemical properties due to quantum materials, where unique phenomena enable novel application. Encompassing the Nano scale science, engineering and technology, it involves imaging, measuring, modeling and manipulating the matter at this scale of length. Present materials produced with the help of Nanotechnology are used in two ways of approach that is bottom up and top down approach. Techniques for working at the Nano scale are becoming increasingly necessary, however, for further miniaturization of integrated circuit components, Nano engineered materials have begun to appear in Fabric,

Sunscreen, and Bandages, the consumer products containing Nano particles have been marketed so as to coming to the public that they resist stains, block ultraviolet light and kill bacteria.

In the 21st century, *Nanotechnology, Biotechnology, Information technology and Cognitive science* (NBIC [10]) leads the technological side of the entire world. Within the NBIC, presently Nanotechnology holds the lead role due to inter disciplinary nature. The technology's history speaks lot about the eminent person 'the father of Nanotechnology', Alfred Cho and John Arthm and it enabled the controlled deposition of single atomic layers. The next brake through came in 1981 with Scanning tunneling Microscope (STM) at IBM's laboratories in Switzerland. This tool provided a revolutionary radiance by enabling scientists not only to image the position of individual atoms by scanning a sharp probe tip over a surface but it also allowed atoms to be posted around on the surface. In 1982, researchers at IBM were able to display individual atoms of gold using a scanning tunneling microscope. In 1986, STM earned its inventions, Gerd Binnig and Heinrich Rohrer, a Noble prize and spawned a wide variety of scanning probe tools for Nano scale observations [11].

The Nanotechnology is positioned to enable advances in scientific and technological fields. Unique and novel properties at the Nano scale have powered innovations in medicine and health care, environment, electronics, mechanics, energy, optics, information technology, industrial manufacturing and the marketed consumer goods. However, as this technologies advance, so do a barrage of familiar question that have vexed past technologies (biotechnology, genetics and stem cell research): how should knowledge and applications of the science and technology be integrated into marketed products [12].



Source [13]

Fig 1: Enabling technology commercialization trend

The limitations of Nanotechnology

1. The excess rise of Nano science and technology with its development in all spheres would put the result towards loss of jobs in agricultural sectors in a full swing and industry's manufacturing sector also.
2. In near future, crush of few markets business is inevitable due to the lowering value of *oil* and *diamonds*. Because this technology assists rapidly to developing alternative sources of energy that are more efficient and won't require the use of fossil fuels. Smart people now develop

products at the molecular level, so that natural diamonds lost its value since its production at large (ex. American Diamond).

3. The powerful and destructive defense equipment including atomic weapons are more accessible (to the private groups) in large quantities by this technology. It can cause a reason to collection of weapon of mass destruction (WMD) to destroy the valuable lives in and around the world and there are concerns that invisible Nanotechnology based monitoring tools could pose a threat to national security and personnel privacy.
4. The Nano particles are very small, problems can arise from the inhalation of these minute particles (ex. Chanel’s perfume, named Coco Mademoiselle Fresh Moisture Mist that uses Nano particles to ensure prolong fragrance is a Nano product that falls under the inhalants category), much like the problems from minute asbestos particles, which cause different medical problems.
5. These technology products are very pretty hard to produce in large quantity. So that the usage of an expensive and adventure as developing it can cost very high to consumers.
6. For some extent, the products of this technology harm to all organisms (ex. GMO Corn poisoned all insects).
7. Nano pollution (generic name) is created by the all waste generated by Nano devices or during the Nano materials

in a manufacturing process. It may be very dangerous due its size in minute. It can float in the air and might easily penetrate animal & plant cells causing unknown effects. The impact on the environment or human may vary at different stages of the life style. It is not possible to “precisely predict or control the ecological impacts of the release (Nano pollution) of these Nano products in to the environment [14].

8. From the Indian perspective, the life cycle analysis on Nano enabled end products is not yet calculated.

Global Nano-patenting Scenario

The global Nano patent race has emerged from the United States of America (granted Nano patents, R&D funding and publications), the Europe (the German take lead), the Japan, the Republic of China and the South Korea. At the global level, key tribute to the Nano patent race is fixed with the role of Universities (‘Locus of Innovation’). The status of Nanotechnology around the World is increased in the past 30 years. The research work focused it through the following tables and it gives the position of granted Nano patents under heading of the *international patents on Nanotechnology* (from the year 1976 to 2014) and *Current status of Nano patents in the India, as on 23 June 2014* (from the year 1997 to mid of 2014).

Table 1: The International patents on Nanotechnology

Year	USPTO	EPO	JPO	IPO	Asia	Rest
1976	9	0	0	-	-	-
1977	18	0	0	-	-	-
1978	23	0	0	-	-	-
1979	11	0	1	-	-	-
1980	15	3	1	-	-	-
1981	25	3	0	-	-	-
1982	25	5	1	-	-	-
1983	24	6	1	-	-	-
1984	25	7	4	-	-	-
1985	33	7	1	-	-	-
1986	27	9	8	-	-	-
1987	46	10	0	-	-	-
1988	39	23	8	-	-	-
1989	65	24	6	-	-	-
1990	57	47	13	-	-	-
1991	85	35	29	-	-	-
1992	121	28	46	-	-	-
1993	123	42	45	-	-	-
1994	128	67	70	-	-	-
1995	160	73	65	-	-	-
1996	205	71	66	-	-	-
1997	238	93	51	-	15	8
1998	297	112	54	1	15	16
1999	367	127	78	-	27	19
2000	422	141	87	1	34	27
2001	524	235	85	1	47	48
2002	582	308	143	2	95	50
2003	739	364	143	7	144	60
2004	931	408	126	4	226	82

2005	886	601	43	29	244	86
2006	1,156	679	3	26	349	140
2007				4		
2008				12		
2009				17		
2010				21		
2011				27		
2012				30		
2013				14		
2014				7		
Total	7,406	3,596	1,150	203	1,196	536

Source: ^[15]

The sustainable development and Nanotechnology

The ecological sciences have developed more sustainable ways of production and consumption. It is obtained through the Nanotechnologies improvement and it is paved the essential way to achieving the sustained economic growth and sustainable development in the India. It encompasses a total systems which includes know how, procedures, goods and services. The agenda 21 emphasizes the need for access to and the transfer of environmentally sound Nanotechnology to developing countries (includes the India) on favorable and preferential terms as mutually agreed. This would take into account the need to protect intellectual property rights (IPRs) as well as the special needs of developing countries for the implementation of agenda 21. The commitments of implementation in the transfer of this technology and technical knowhow have been staying at improving position in the India. The United Nations was decided to establish an "inclusive and transparent intergovernmental process open to all stakeholders, with a view to developing global sustainable development goals to be agreed by the General Assembly"^[16]. The achievement of sustainable development and profitable growth requires the integration of its economic, environmental and social components at all levels. This is facilitated by the continuous dialogue and action in the eleventh meeting of the finance ministers of the Asia Europe (ASEM) in the Italian city of Milan ^[17] and suggestions are welcomed by the United Nations for 13th session of the open working group on the sustainable development goals On 14-18 July 2014 ^[18].

Status of Nanotechnology patenting in India

The deep research efforts and roadmaps for key Nanotechnology sectors are enhance innovation, competitiveness and safety in India. The further development of India's infrastructure and the educational system is consistent with the multidisciplinary character of Nanotechnology. The continuing review of regulation can be engaged wherever possible with international development and adapting as appropriate the implementation instruments. The survey of markets for Nanotechnology products, its safety aspects and developments paved the way for environmentally sound products from India. The improvement of Nanotechnology in India increased the research effort on safety assessment and risk management, including further development and validation of materials characterization and test materials. Since India adopted and inserted all obligations of International Conventions and treaties (including TRIPs) in

the name of agreement relating to patent through the Patent Act, 1970 (amended 2005), it certainly impacts the existing system in all fields of inventions relating to a Nanotechnology. Particularly, the impact and step to be taken for solving the problems for each field are not uniform ^[19]. According to Pandit Jawaharlal Nehru who expressed the inevitability of Intellectual Property and sustainability development regime in India said that, "I hope with Lord Rutherford that in the days to come, the India will again become the home of science, not only as a form of intellectual activity, but also as a means of furthering the progress of her people".

In order to upgrade this technology, Patenting, Funding towards Research & Development (R&D) in government sectors and Public & Private Partnership are an essential part. Through the mechanism of patenting, Government of India gives protection to the inventor or investor, however the same turns futile if it is not properly granted or the patents so granted are overlapping with others. This research work attempt to address the issues and expertise in the in the fields of this technology, by examining the published Nano patent applications for Nanotechnology by Intellectual Property India offices in all over India (Chennai, Mumbai, Delhi and Kolkata) ^[20]. Now it has been an accepted fact that the developments in science and technology is always one step ahead of the law framed to regulate the technology, as a result of which the developments in the absence of a well-defined regulatory frame work acts as enormous potential for good as well as evil. The government of India realized the role of Nano science & Nanotechnology and launched a mission on Nano under the department of science and technology (DST) in May 2007, with an allocation of about US\$ 130 million for five years and gradually reached this fund for Nano mission up to Rupees Six hundred and fifty crores in May 2014. The mission on Nano science and technology of DST (nodal agency) has funded a number of interdisciplinary projects in Indian Institute of Technology and other national institutes of repute by creating centers for Nanotechnology.

The Nano mission's aims

1. Capacity building in research.
2. *Developing India as a global knowledge hub.*
3. Developments of products and processes for national development, especially in the areas of national relevance such as Safe drinking water, Mineral development, Sensors development and Drug delivery.

4. Forging linkages between industry, educational and research institutions and
5. *Promote Public Private Partnership (PPP).*

The India's Nano mission is to improve everyday existing end Nano products and to create products on revolutionary nature in near future to bolster the business of India in global market, in addition try to build a very strong Indian economic and help the world progress in sustainable manner and addresses the need to adopt a proactive approach for the legislation with

regards patenting Nanotechnology in India. So that technology of this kind can be used and gave solutions for maximum benefits to flora, fauna, human and environment in the name of Green and sustainable development to obtain the millennium development goal is set by the United Nations in its agenda 21. This technology upgraded entrepreneurial stewardship, economic efficiency and growth leading towards socio economics; social progress ends with socio environmental for sustainability in the economies ^[21].

Table 2: Current status of Nano patents in the India, as on 23 June 2014

Intellectual Property India	Total published application	Granted patents	Request for examination not filed	Application awaiting for examination	Under examination
Delhi	454	60	1	146	90
Kolkata	205	25	-	64	39
Mumbai	122	21	-	29	24
Chennai	277	26	-	141	27
Total	1,058	132	1	380	180

Source ^[22]

277 Nano patent applications are published in IP India Chennai; within that 26 Nano patents are granted [14 National phase (more gained) + 12 national]. The granted twelve national Nano patents were divided in to two ways: 09 for Academia [IISc & IIT (gained)] and 03 for Individuals (without gain) [published granted patents on Nano, from 2006 to 2013] ^[23].

Conclusion

The growing population in India is in need of a technology, which can cater their needs. Nanotechnology, a technology of hope, emerged like a tsunami, by bringing revolution in all surrounding technologies such as biotechnology, information technology etc., the patent regime also accommodated nanotechnology under its umbrella with a limitation that such technology shall comply with the criterion novelty, non-obviousness and utility. The world patent regime moved towards the new technological revolution by increasing the number of patents granted to this field. India being a developing country also had to face the challenge of accommodating the nanotechnology under its patent regime. Due to lack of technical expertise, understanding over the technology, tender age of technology in the India etc., India yet to show a promising support to the nanotechnology in the field of patents. The commercialization of the technology as interdependent today on intellectual property, the Indian government initiated Nano Mission and also the Indian Patent Office is trying to develop its expertise. According to the supports of nanotechnology, the next decade will hopefully witness the exponential growth of nanotechnology along with the increasing number of nanotechnology patents in India.

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