

# 3D PRINTING: A NEW DIMENSIONAL PITFALL FOR COPYRIGHT & PATENT OWNERS

- Vaibhav Latiyan\*

## ***Abstract***

*In the era of digitalization, where the competition is shifting from tangible objects to IP, there is a need to protect the IP rights of the owners. In India, the journey started with the enactment of the Copyright Act, 1957 and the Patents Act, 1970, but as these lagged behind the technological advancements, some conflicts arose. After an intense battle, the situation of copyright and patent, with regard to conventional matters became a bit clear, just to engage us in another issue; 3D printing. The 3D printing, also known as additive manufacturing, is a process used to make three-dimensional objects by laying down successive layers of specific material. The process requires a CAD file for printing. But being outside the purview of many laws, its deceitful use infringes the rights of the owners. In this note, the author has covered the effect of 3D printing on copyright and patent law, by throwing light on the concept of 3D printing, the problems created by the 3D printer for copyright and patent owners and the possible solutions, along with its worldwide adaptability. It is indisputable that IP rights, being in its nascent stage in India, not by the timeline but by the advancement of clarity with the help of issues, faces much more trouble than in some of the developed countries. The problem arises with keeping the CAD (Computer Aided Design) files, using them for the printing purpose, whether for personal consumption or for sale, or directly selling the CAD files. And more troublesome is keeping a track on such activities. So, in order to curtail such practices, there can be active participation from the Government in regulating the printers and targeting those facilitating the infringement. Intervention by the executive and judiciary can also contribute in its own way.*

## **Introduction**

*“3D printing away from control, and away from the law, may become*

---

\* 4<sup>th</sup> year, BA.L.L.B, Army Institute of Law.

*the new normal and IP protection may go the way of the dinosaur.”*

-John Hornick

As a result of the invention of the printing press by Gutenberg in 1436, the level of copying and publishing worldwide increased markedly. Prior to the printing press, book-sellers copied author's manuscripts by hand, a lengthy process whose speed was only slightly increased through the use of slaves. After the invention of the printing press, however, booksellers could copy author's manuscripts at a much faster rate.<sup>1</sup>At that time it looked like an achievement. But who would have thought that the whole system would change so drastically that one day even the printing press would evolve into machines that would be able to “3 Dimensional print” something? With all the technological developments and the allied field advancements made by humankind, the whole floor has changed. And the emergence of 3D printing is one big leap in that journey.

As Jeremy Rifkin pointed out in his work *The Third Industrial Revolution*, if we put steam engine as the symbol of the first industrial revolution and heavy industry and manufacturing industry like steel, electricity, automobile as the symbols of the second industrial revolution, 3D printing, internet and green power technologies would be treated as the symbols and pillars of the third industrial revolution which is taking place right now, globally.<sup>2</sup> The book, *Makers: The New Industrial Revolution*<sup>3</sup> reconfirms Jeremy Rifkin's viewpoint and makes it clear that 3D printing will become the leading technology of the third industrial revolution by way of digitalizing and intelligentizing the manufacturing industry.<sup>4</sup>

## **What is 3D Printing?**

Additive Manufacturing (AM), commonly referred by the term 3D printing in the present time, has a long journey of its evolution since 1983. The earliest incarnation of this technology was ‘stereolithography’ (SLA) which

---

<sup>1</sup>A. SUBBIAN, *INTELLECTUAL PROPERTY RIGHTS: HERITAGE SCIENCE AND SOCIETY UNDER INTERNATIONAL TREATIES* 287 (Deep & Deep Publications, Delhi, 2007).

<sup>2</sup>JEREMY R., *THE THIRD INDUSTRIAL REVOLUTION* 2 (Palgrave MacMillan, UK, 2011).

<sup>3</sup>CHRIS A., *MAKERS: THE NEW INDUSTRIAL REVOLUTION* 3 (Crown Business, NY, 2011).

<sup>4</sup>LIU Xin & YU Xiang, *Potential Challenges of 3D Printing Technology on Patent Enforcement and Considerations for Countermeasures in China*, 20 *JOURNAL OF INTELLECTUAL PROPERTY RIGHTS* 155 (2015).

“sliced” CAD (Computer Aided Design) file into two-dimensional cross-sections and used an ultraviolet laser to print the cross sections layer by layer in a photosensitive resin.<sup>5</sup> After more than 20 years of development, 3D printing processes have evolved from the previous technologies such as SLA and Fused Deposition Manufacture (FDM) into various advanced technologies like Selective Heating Sintering (SHS), Electron Beam Freeform Fabrication (EBF), Direct Metal Laser Sintering (DMLS), Laminated Objected Manufacturing (LOM), Digital Light Processing (DLP) and so on.<sup>6</sup> Additive Manufacturing (AM) is the suite of computer-automated processes used to make three-dimensional objects by laying down successive layers of specific materials like metal, plastic, ceramic, composite or biological materials.<sup>7</sup> The process starts with a virtual design of the object, needed to be manufactured and is generally available as a CAD file. This CAD file is created either by a 3D scanner or by virtually designing the object on the computer. AM’s synonyms include rapid prototyping, additive fabrication, additive processes, additive techniques, additive layer manufacturing, layer manufacturing, freeform fabrication, solid freeform fabrication, and direct digital manufacturing<sup>8</sup> The ASTM International Committee F42 on AM technologies defines AM as the process of joining materials to make objects from CAD model data, usually layer upon layer, as opposed to subtractive manufacturing methods.<sup>9</sup>The current steps in AM are developing a 3D model using a computer modeling software and converting the model into a standard AM file format, changing the size, location, or other properties of the model using AM software, then building the part in layers using the AMdevice.<sup>10</sup>

There are several systems to classify the AM processes. One such widely followed system is the one proposed by the ASTM International Committee F42, which classifies the AM processes into seven areas, namely Vat Photo

---

<sup>5</sup>*Id* at 155.

<sup>6</sup>*Types of 3D printers or 3D printing technologies overview*, 3D Printing from Scratch, <http://3dprintingfromscratch.com/common/types-of-3d-printers-or-3d-printing-technologies-overview/>.

<sup>7</sup>Yong Huang *et. al.*, *Additive Manufacturing: Current State, Future Potential, Gaps and Needs, and Recommendations*, 1 *JMSE* 1 (2015).

<sup>8</sup>*Id* at 1.

<sup>9</sup>The ASTM International Committee F42 on Additive Manufacturing Technologies., <http://www.astm.org/COMMITTEE/F42.htm>.

<sup>10</sup>S. Huang *et. al.*, *Additive Manufacturing And Its Societal Impact: A Literature Review*, 67 (5) *INTERNATIONAL JOURNAL OF ADVANCED MANUFACTURING TECHNOLOGY* 1191 (2013).

Polymerization, Material jetting, Binder jetting, Material extrusion, Powder bed fusion, Sheet lamination and Directed energy deposition. All of these have been defined in the Standard Terminology for Additive Manufacturing Technologies, ASTM.<sup>11</sup> These processes use the various technologies as has been mentioned before. These new techniques, while still evolving, are projected to exert a profound impact on manufacturing. They can give industry new design flexibility, reduce energy use, and shorten time required to market products.<sup>12</sup>

The AM technology has two generic advantages over other manufacturing processes. First, AM allows the manufacture of designs without many of the geometric constraints limiting the complexity of shapes that are associated with other processes and treated in the literature on design for manufacturability.<sup>13</sup> Second, AM enables the manufacture of customized products in small volumes at a relatively low average cost.<sup>14</sup>

Combining advantages of previous production approaches, such as craft and large-scale manufacturing, as well as mass customization production, AM has the potential to change contemporary manufacturing process chains, business models, as well as product-user relationships while producing unique, personalized products. To some extent, the ability to create prototypes almost immediately and manufacture custom designs in a cost-effective manner may well revolutionize modern industry.<sup>15</sup> It is also substantiated by the fact that global market for 3D printing has expanded exponentially, with a lot more scope for the future. The industry which was worth \$ 4 billion in 2013, is estimated to reach \$ 6 billion in 2017, and by 2021, it is projected to reach

---

<sup>11</sup>*Standard Terminology for Additive Manufacturing Technologies*, Designation: F2792 – 12a, <http://web.mit.edu/2.810/www/files/readings/AdditiveManufacturingTerminology.pdf>.

<sup>12</sup>Wohlers Report 2014, *3D Printing and Additive Manufacturing State of the Industry, Annual Worldwide Progress Report*, Wohlers Associates, 2014. See also, Wohlers Report 2019, *3D Printing and Additive Manufacturing State of the Industry, Annual Worldwide Progress Report*, Wohlers Associates, 2019.

<sup>13</sup>C. J. Tuck *et. al.* *Rapid Manufacturing Facilitated Customization*, 21 (3) INTERNATIONAL JOURNAL OF COMPUTER INTEGRATED MANUFACTURING 245 (2008).

<sup>14</sup>BOOTHROY *Det.al.*, *PRODUCT DESIGN FOR MANUFACTURE AND ASSEMBLY* (Marcel Dekker, New York, 1994); J. BRALLA, *GENERAL DESIGN PRINCIPLES FOR MANUFACTURABILITY IN DESIGN FOR MANUFACTURABILITY HANDBOOK* (J.Bralla ed., McGraw Hill, New York, 1998).

<sup>15</sup>Barry Berman, *3D Printing: The New Industrial Revolution*, 55 (2) BUSINESS HORIZONS 155 (2012).

\$10.8billion.<sup>16</sup>

## Emerging Issues with 3D Printing: Legal Murkiness

Although, 3D technology is not new, it gained worldwide popularity only after the expiration of the patent of Stratasys and 3D Systems.<sup>17</sup> The expiration of these patents made it possible for others to research and further develop the technology, making it readily available at reduced cost. This made printers handy and emerged as the dawn of 3D printing revolution. But with the boon, comes the bane also. The industry, whose growth averaged 346% each year from 2008 through 2011, cooled significantly to an estimated 46.3% in 2012.<sup>18</sup> With its rapid production, there arose many issues ranging from environmental concerns to IP right's infringement. And the most affected areas are copyright and patents.

### i) Copyright

Copyright is the exclusive right granted by law for a certain number of years to make and dispose of, and otherwise to control copies of a literary, musical or artistic work.<sup>19</sup> Under the Copyright Act, 1957, the works in which copyright subsists include artistic works.<sup>20</sup> Artistic work means a painting, a sculpture, a drawing (including a diagram, map, chart or plan), an engraving or a photograph, whether or not any such work possesses artistic quality, a work of architecture, or any other work of artistic craftsmanship.<sup>21</sup> In

---

<sup>16</sup>Rose Brooke, Wohlers Report 2013: 3D printing continues to expand, TCT Magazine (June 4th, 2013, 10:30 AM), <https://www.tctmagazine.com/3d-printing-news/wohlers-report-2013-3d-printing-continues-to-expand/>. See also, TJ McCue, Significant 3D Printing Forecast Surges To \$35.6 Billion, Forbes (March 29th, 2019), <https://www.forbes.com/sites/tjmccue/2019/03/27/wohlers-report-2019-forecasts-35-6-billion-in-3d-printing-industry-growth-by-2024/#38f3aef97d8a>

<sup>17</sup>Stratasys is a manufacture of 3D printers and 3D production systems, especially Fused Deposition Modeling (FDM) printer; an additive manufacturing technology commonly used for modeling, prototyping, and production applications. 3D Systems describes the technology of Selective Laser Sintering (SLS); a powder based printing technique, where a powerful laser is used to locally sinter powder into a solid part.

<sup>18</sup>*Growth of Personal Printers*, TCT MAG, <https://www.tctmagazine.com/blogs/industry-snapshot/growth-of-personal-printers/>.

<sup>19</sup>Webster's Encyclopedia Unabridged Edition.

<sup>20</sup>Section 13(1) (a), Copyright Act, 1957.

<sup>21</sup>Section 2(c), Copyright Act, 1957.

respect to such artistic work, copyright means the exclusive right “to reproduce the work in any material form including depiction in three-dimensions of a two-dimensional work or depiction in two-dimensions of a three-dimensional work.”<sup>22</sup> Some types of work are treated as artistic only if they bear a distinctive element of aesthetic creativity, others gain protection simply because labor and capital ought not to be freely appropriable.<sup>23</sup> It is the particular expression making up a work which is protected, rather than the idea behind it.<sup>24</sup>

In case of 3D printed objects, the copyright protection would exist not only to the actual printed object but also to the CAD file. A CAD file is generally protected by copyright as an artistic work under the Copyright Act, 1957.<sup>25</sup> It is considered more as an artistic work than a mere computer program as it is intrinsically a model, design or diagram of some article or object. Now, there can be infringement of copyright in two ways

I. CAD File: As CAD files are covered under the protection of copyright as an artistic work, any infringement of the exclusive rights of the owner would amount to infringement of copyright. In case a CAD file is generated by someone by scanning an object, then the actual copyright would lie in the object, and not the file, as the originality aspect would not be fulfilled.

II. 3D Printed Object: Even the 3D printed objects enjoy the cover of copyright protection. But this protection is only limited to the artistic design and not the whole object.

Since the Copyright Act, 1957, protects even the conversion of a 2D work into 3D form and *vice-versa*, there would be an infringement of the right of copyright holder if someone scans the already protected object or uses the CAD file to print one. The copyright comprises two main sets of rights- economic rights and moral rights. Economic rights are the rights of reproduction, adaptation, public performance etc. Moral rights include the owner/author’s right to object to any distortion, mutilation or other modification of his/her work that might be prejudicial to the author’s honor or reputation.<sup>26</sup> Nowadays, due to

<sup>22</sup>Section 14(c) (i), Copyright Act, 1957.

<sup>23</sup>W. R. CORNISH, *INTELLECTUAL PROPERTY: PATENTS, COPYRIGHT, TRADEMARKS AND ALLIED RIGHTS* 8 (Sweet & Maxwell, UK, 2003).

<sup>24</sup>*Id* at 337.

<sup>25</sup>Vikram Gupta, *3D Printing: An Emerging Issue in Copyright Law*, 53 (1) SCIENCE REPORTER 29 (January 2016). See also, Saahil Damaand Amulya Chinmaye, *Printing A Revolution: The Challenges of 3D Printing on Copyright*. 84 GEORGE WASHINGTON LAW REVIEW ARGUENDO 68 (2016).

the rapid growth of the use of 3D printing technology, there is infringement of both of these rights. It has become difficult for the law enforcing authorities to keep a check on the activities involving the printing of objects using CAD files or scanning of objects. What one has to do is to just arrange for a CAD file. After that what someone does with the file or how someone uses it, is totally in oblivion. Due to this loophole, the copyright owners, and indirectly, the economy suffer a huge loss.

However, due to its numerous industrial benefits, the scope of this protection to artistic works has been made limited and now, after the recent amendment to the Copyright Act in 2012, (with the inclusion of S. 52(1) (w)): “*the making of a three-dimensional object from a two-dimensional artistic work, such as a technical drawing, for the purposes of industrial application of any purely functional part of a useful device*” does not constitute an infringement of copyright, when used with prior permission of the copyright owner. This has done in order to help various industries to harness the benefits of 3D printing like increased productivity with reduced cost.

## ii) Patent

Under the Patents Act, 1970, patent is an invention granted under the Act.<sup>27</sup> Patent is a set of exclusive IP rights, provided by a sovereign state to an inventor for his/ her invention, usually for a period of 20 years. This means that the inventor or patent holder enjoys exclusive rights over that invention and it cannot be produced or sold by any other entity, without patentee’s consent till the patent is valid. The patentee also has certain rights as mentioned in the Patents Act 1970. The patentee has the exclusive rights by himself, his agents or licensees to make, use exercise, sell or distribute the invention in India, be it the subject matter of the patent a product or a process.<sup>28</sup> The effect of grant of patent is *quid pro quo*.<sup>29</sup> It has to be appreciated that undoubtedly patent creates a statutory monopoly protecting the patentee against any unlicensed use of the patented device.

<sup>26</sup>S. K. SINGH, INTELLECTUAL PROPERTY RIGHTS LAW(Central Law Agency, Allahabad, 2009).

<sup>27</sup>Section 2(1) (m), Patents Act, 1970.

<sup>28</sup>Section 48, Patents Act, 1970.

<sup>29</sup>Raj Prakash v. Mangat Ram, AIR 1978 Del. 1.

<sup>30</sup>Telemecanique& Control (I) Ltd. v. Schneider Electric Industries, (2002) 24 PTC 632 (Delhi).

<sup>31</sup>Imperial Chemical Industries v. Controller General, AIR 1978 Cal 77.



A monopoly of the patent is the reward of the inventor.<sup>30</sup> Also, the patent must be granted for an invention and not a discovery,<sup>31</sup> and an invention is not a property unless it has been patented.<sup>32</sup> So the importance and significance of patents are quite clear in the industrial and economic sectors. History has witnessed the unpredictable use of the technology and also now, in the case of 3D printing.

Nowadays, 3D printers are often used in deceitful ways to obtain the tangible copies of patented products. This can be achieved by simply scanning the patented object, converting it into a digital file or blueprint and then using the printer to get it in a tangible version. This process very easily sidesteps the patent system of a country; infringing the patent owner's rights. The object of any patent law is to encourage scientific research, new technology and industrial progress. Grant of exclusive privilege to own, use or sell the method or the product patented for a limited period stimulates new inventions of commercial utility.<sup>33</sup> But even this objective stands defeated in circumstances when the infringing object is just a press of a button away from coming to reality. The greatest impediment in overcoming this problem is the impracticality of knowing the probable illegal users of the patented object. It is impossible for the patent owners to know about every printer widely dispersed across thousands of households and businesses. Each printed copy of an invention is a lost potential sale to the patent holder. The Gartner Group predicts that "By 2018, 3D printing will result in the loss of at least \$100 billion per year in intellectual property globally"<sup>34</sup>. Hence the need to take steps and protect the destruction of patents worth billions.

## Remedies against Infringement

At the core of the IP theory lies the basic observation that information has economic value- both to individuals who possess it and to society as a whole,<sup>35</sup> and that an infringement is a loss of that value. The Copyright Act, 1957, deals with three kinds of remedies to the owner of the copyright against infringement of copyright. These remedies are as follows:

---

<sup>32</sup>Shining Industries v. Shri Krishna, AIR 1975 All. 231.

<sup>33</sup>Bishwanath Prasad RadheyShyam v. H.M. Industries, AIR 1982 SC 1444.

<sup>34</sup>Janessa Rivera, *Gartner Reveals Top Predictions for IT Organizations and Users for 2014 and Beyond* (October 8<sup>th</sup>, 2013), <https://www.gartner.com/newsroom/id/2603215>.

<sup>35</sup>Mark C. Suchman, *Invention and Ritual: Notes on the Interrelation of Magic and Intellectual Property in Preliterate Societies*, 89 (6) COLUMBIA LAW REVIEW 1264(1989).



## i) Civil Remedies

Section 55 of the Copyright Act, 1957, provides “*that where copyright in any work has been infringed, the owner of the copyright shall, except as otherwise provided by this Act, be entitled to all such remedies by way of injunction, damages, accounts and otherwise as are or may be conferred by law for the infringement of a right.*” This provision enables the copyright owner to ensure some remedial actions. The civil remedies against the infringement are also of different types. The first one is an injunction. An injunction looks to the future. It is an order of the court directing a party in litigation to do or refrain from doing an act. In IP, an injunction is almost always prohibitory since it enjoins the threatened commission or commission of wrongful acts.<sup>36</sup> But in granting an injunction for infringement of copyright, three factors contemplated under Order 39, Rule 1 of the Code of Civil Procedure must be kept in mind. These three factors are the establishment of *prima facie* case; the balance of convenience between the parties; and irreparable injury to the applicant<sup>37</sup> If a *prima facie* case is established, the court then considers whether the balance of convenience lies in favour of restraining the defendant until the trial, or in leaving the plaintiff to recover damages at the trial for any infringement by the defendant in the intervening period.<sup>38</sup>

Then there can be an Anton Piller order,<sup>39</sup> an order issued by the court which provides for the right to search premises and seize evidence without prior warning. This is usually used in order to prevent the destruction of incriminating evidence, and is issued under exceptional circumstances. There can also be a claim for damages. As copyright is a right to property, any injury caused to such right is a potential loss for the owner. So there arises a claim by the owner for the damages, in order to be compensated for the harm caused by the legal injury.

Account of Profit, another form of remedy is an alternative remedy to damages. If payment of damages is not feasible, then the court can also order the person committing the infringement to transfer the profit earned by him/ her by the said copyright to the owner of the copyright. Damages for conversion is another form of remedy whereby the infringing copies and the devices held by the person committing the infringement are deemed to be the

<sup>36</sup>*Supra* note 26, at 117.

<sup>37</sup>*Bharat Law House v. Wadhwa & Co. Pvt. Ltd.*, AIR 1988 Del 88.

<sup>38</sup>*Supra* note 26, at 118.

<sup>39</sup>*Action Piller K.G. v. Manufacturing Processes*, (1976) 1 All ER 779.

property of the owner of copyright. The copyright owner is put in the position that he owns the infringing copies of the material.

## ii) Criminal Prosecution

Along with the civil remedies, the owner of copyright can also initiate criminal proceedings against the person committing the infringement, distinctly and simultaneously with the civil suit. Section 63 of the Copyright Act, 1957, provides for the offense as well as the adequate punishment. It states that “*any person who knowingly infringes or abets the infringement of the copyright in a work, or any other right conferred by this Act shall be punishable with imprisonment for a term which shall not be less than six months but which may extend to three years and with fine which shall not be less than fifty thousand rupees but which may extend to two lakh rupees.*” This punishment was enhanced in the case of second and subsequent offenses by the insertion of Section 63-A by the Amendment Act, 1994, making it to a term which shall not be less than one year but which may extend to three years and with fine which shall not be less than one lakh rupees but which may extend to two lakh rupees. Even companies are under the purview of the punishment for the offenses committed by the directors or any other persons.<sup>40</sup> And like a company, a firm is criminally liable in its own name apart from the partnersthereof.<sup>41</sup>

## Administrative remedy

Section 53 provides a remedy for the prevention of import into India of copies of a copyrighted work made outside India, which if made in India would amount to infringement. This section is an additional remedy. The nature of this remedy provided under the section is of *quasi-judicial* nature. The Registrar of Copyrights is bound to make a *quasi-judicial* inquiry as to the context of the infringement.<sup>42</sup>

In case of patents, the remedies are similar. Chapter XVIII of the Patents Act, 1970, provides for the suits concerning infringement of patents. The patent owner has the right to move to the court in case of any infringement of his/her rights,<sup>43</sup> where the court may grant relief in the form of an injunction,

<sup>40</sup>Section 69, Copyright Act 1957.

<sup>41</sup>J.N. Bagga v. All India Reporter Ltd., AIR 1969 Bom 302.

<sup>42</sup>Gramophone Co. of India v. Birendra Bahadur Pandey, AIR 1985 SC 667.

<sup>43</sup>Section 104, Patents Act, 1970.

and at the option of the plaintiff, either damages or an account of profits.<sup>44</sup>

But even these remedies are not enough to curb the infringement in case of 3D printing. These remedies will come into play only when the culprits are caught and that is where the biggest challenge lies- to be aware of the incidence of infringement. Inadequate protection of IP in developing countries occurs at both the substantive law and enforcement levels.<sup>45</sup> Also, there arise new dimensions of threat involved with it, backed by the information technology sector. Like, in USA, a man designed, printed and successfully fired a 3D printed gun and soon uploaded its STL file on his website, accessible by everyone for free.<sup>46</sup> There has emerged a new pitfall for the copyright and patent owner which needs to be addressed properly else the bright future of the manufacturing industry can fall deep into the dark.

Developing countries often lack strong technological infrastructure, i.e. the “support system” that is necessary for the specific technology to function effectively. These support systems include hardware, technological education, the level of process technologies in the receiving firms, the capability to perform R&D work, and the ability to maintain technology and organizational infrastructure.<sup>47</sup>

## Worldwide Adaptation of 3D Printing

3D printing technology has witnessed a boom in its demand throughout the world. The scope of its usability has widened a lot since its inception with many households now having inducted this technology in their day to day life. If we consider its expansion, then credit can be given to two facts - the wide scope of its use and the support given by the governments of various countries. If we consider the Indian subcontinent, we have realized that in order to achieve the goal of the growth target for the manufacturing sector from 16% of GDP to reach 25% of GDP by 2025, under the ‘Make in India’ campaign, we need to rely on the fast developing 3D technology.<sup>48</sup> The National Policy for Advanced Manufacturing is designed to advance India’s

---

<sup>45</sup> *Supra* note 1 at 39.

<sup>46</sup> Lyndsey Gilpin, *3D printing: 10 Factors still Holding it Back*, Tech Republic (January 19<sup>th</sup>, 2014), <https://www.techrepublic.com/article/3d-printing-10-factors-still-holding-it-back/>.

<sup>47</sup> *Supra* note 1 at 5.

<sup>48</sup> *Advanced Manufacturing Technologies (AMT)*, Department of Science & Technology, Government of India, <http://dst.gov.in/advanced-manufacturing-technologies-amt>.

position as global competitor in terms of manufacturing.<sup>49</sup> With this, there has been a lot of investment, not only by the government but also by foreign companies. In an interview, on the occasion of UAE's Strata partnership with Reliance Defence Ltd, Rajesh K. Dhingra, President of Reliance Defence & Aerospace said, "3D printing enables us to produce assembly and machining fixtures in one-quarter the time and at one-half the cost as conventional machining,"<sup>50</sup> and this is the case with most of the manufacturing companies. According to 6Wresearch, the 3D printer market in India is projected to cross \$79 million by 2021.<sup>51</sup> So it is now up to us as to how much we can realize from these situations. Not only the Indian government, but various other governments have also extended their hand to this technology. In Singapore, a 3D printer called the Buccaneer has drawn so much interest on Kicks tarter that it attracted over 3,500 people who pledged more than US\$1.4 million to the project, more than 14 times its original target.<sup>52</sup> The Singapore government has also announced that it will invest US\$500 million in 3D printing advanced manufacturing technologies.<sup>53</sup> In South Korea, the Ministry of Science, Information and Communication Technology and Future Planning has announced that it will invest around \$37 million in 2017 to accelerate the development of 3D printing across the country, in the sectors ranging from the military to medical industries.<sup>54</sup> One among the many steps taken by the government in order to ensure its wide adaptation is offering tax exemptions for companies who take up 3D printing. Even IDA Ireland, the agency responsible for the attraction and development of foreign direct investment in Ireland, the government branch, is supporting Henkel's (3D printing company) establishment of the additive manufacturing department.<sup>55</sup>

<sup>49</sup>Anshul Dhamija, *UAE's Strata Partners with Anil Ambani's Reliance Defence Ltd.*, Forbes India (February 15<sup>th</sup>, 2017), <http://www.forbesindia.com/printcontent/45959>.

<sup>51</sup>Pradeep Nair, *3D Printing Moving to Mainstream*, The Hindu (July 26<sup>th</sup>, 2015), <http://www.thehindu.com/business/Industry/3d-printing-moving-to-mainstream/article7467217.ece>.

<sup>52</sup>Ryan Huang, *Pirate3D Building Success as Singapore Hardware Startup*, ZD Net (October 10<sup>th</sup>, 2013), <http://www.zdnet.com/article/pirate3d-building-success-as-singapore-hardware-startup/>.

<sup>53</sup>Bryan Tan, *3D Printing Surfaces Interesting Legal Issues*, ZD Net (October 11<sup>th</sup>, 2013), <http://www.zdnet.com/article/3d-printing-surfaces-interesting-legal-issues/>.

<sup>54</sup>Sam Davies, *South Korea to invest \$37 million into 3D Printing this Year*, TCT Magazine (April 4<sup>th</sup>, 2017), <https://www.tctmagazine.com/3d-printing-news/south-korea-invest-37-million-3d-printing-2017/>.

<sup>55</sup>Sam Davies, *Henkel Receives Government Support for Additive Manufacturing Operation in Ireland*, TCT Magazine (October 23<sup>rd</sup>, 2017), <https://www.tctmagazine.com/3d-printing-news/henkel-government-support-additive-manufacturing-ireland/>.

Also, the Chinese government has pledged to invest 1.5 billion yuan (\$245 million, £160 million) in a seven-year project that will boost development of AM.<sup>56</sup>

The investments by various governments are in different sectors, ranging from health & food to manufacturing. Moreover, the private companies have shown a keen interest in investing in this technology. The viability of 3D printing in space has also taken a new turn. A company called Made in Space made a total of 25 parts in a total of 28 hours on its initial Zero-Gravity 3D Printer on board the International Space Station.<sup>57</sup> Even the National Aeronautics and Space Administration has focused on the option of 3D printing of food in space, which is better than the freeze-dried food astronauts usually eat.<sup>58</sup> McLaren has also used 3D printing to print prototypes and built parts<sup>59</sup>. Even Volkswagen (Autoeuropa) has taken help of Ultimaker, a 3D printing company to design and print around 1000 parts, and this is estimated to have saved \$160,000 in 2016 with \$200,000 expected in 2017.<sup>60</sup>

The education and research sector is also modifying its dimensions. The College of Engineering, University of Miami has opened a Johnson & Johnson 3D Printing Center in Coral Gables, Florida, which will serve as a location for joint research, materials development and the testing of 3D printing technologies and processes.<sup>61</sup>

In the medical and allied fields too, 3D printing has helped in accomplishing the goals which were lagging due to lack of resources and time. Doctors at the

---

<sup>56</sup> As mentioned by Mr. Wohlers said in his keynote speech at the Rapid 2013 Conference & Exposition in Pittsburgh, PA, on June 12<sup>th</sup>, 2015, <https://www.tctmagazine.com/3d-printing-news/china-flexes-muscles-in-3dp-race/>

<sup>57</sup> Daniel O'Connor, *Made in Space*, TCT Magazine (June 22<sup>nd</sup>, 2018), <https://www.tctmagazine.com/3d-printing-news/manufacturing-in-space/>.

<sup>58</sup> Lyndsey Gilpin, *10 Industries 3D Printing will Disrupt or Decimate*, Tech Republic (January 12<sup>th</sup>, 2014), <https://www.techrepublic.com/article/10-industries-3d-printing-will-disrupt-or-decimate/>.

<sup>59</sup> Laura Griffiths, *Stratasys 3D Printing Speeds up Formula 1 Racing*, TCT Magazine (October 4<sup>th</sup>, 2017), <https://www.tctmagazine.com/tct-events/tct-show-uk/stratasys-3d-printing-speeds-up-formula-1-racing/>.

<sup>60</sup> Larry Dignan, *Volkswagen Autoeuropa Nets Parts Savings with Ultimaker 3D Printers*, ZD Net (June 21<sup>st</sup>, 2017), <http://www.zdnet.com/article/volkswagen-autoeuropa-nets-parts-savings-with-ultimaker-3d-printers/>.

<sup>61</sup> Sam Davies, *Johnson & Johnson 3D Printing Centre opens at University of Miami*, TCT Magazine (October 27<sup>th</sup>, 2017), <https://www.tctmagazine.com/3d-printing-news/johnson-johnson-3d-printing-center-university-miami/>.

National University Hospital in Singapore have been using 3D printing since 2008 for treating patients. One wonder of 3D printing is ‘exoskeleton,’ which is a 3D printed artificial arm that helps children with underdeveloped muscles to play, feed themselves and hug.<sup>62</sup> A small technology and innovation company based in Tanzania is working to create a healthier environment and produce more medical tools by re-using plastic waste as 3D printer filament.<sup>63</sup> The technology serves not only the actual aim of medical field but also aids in boosting the economy of nations. In India, the medical device market is worth \$5.5 billion, and huge growth is expected in the next several years. But the catch is that nearly 75% of the market is made up of imported medical devices. But this problem has been addressed by opening an advanced manufacturing facility in the Andhra Pradesh Medical Tech Zone (AMTZ).<sup>64</sup> Now, when it is claimed that humanity’s ecological footprint already far exceeds earth’s capacity, this technology is a step towards sustainability, as its ‘carbon accounting’ is comparatively less than the conventional methods of manufacturing. Furthermore, this technology has also addressed the problem of plastic-pollution to some extent. A company in Pune is using the plastic waste, collected by the waste-pickers, to make low-cost 3D filament and use it for further printing.<sup>65</sup> In the global 3D printing industry, the continued leveraging of the technology is expected to see its market value reach over \$30 billion by 2022 - the annual growth rate between 2016 and 2022 being 28.5%.

## Conclusion

We have realized that the 3D printing itself is not the problem but rather, the blithely made reproductions, made using these printers. If not controlled quickly, then many of the greatest innovations of our time may be consumed by the innovation of 3D printers. Though 3D printing provides an incredible

---

<sup>62</sup> 3D printing moving to mainstream, <http://www.thehindu.com/business/Industry/3d-printing-moving-to-mainstream/article7467217.ece>

<sup>63</sup> Sam Davies, *3D Printing at the Heart of Tanzanian Project to Reduce Plastic Waste and Save Lives*, TCT Magazine (February 20<sup>th</sup>, 2017), <https://www.tctmagazine.com/3d-printing-news/3d-printing-heart-tanzanian-project-reduce-plastic-waste-save-lives/>.

<sup>64</sup> Sarah Saunders, *Think 3D Tapped by Provincial Indian Government to Open 3d Printing and Design Facility in Medical Device Park*, 3DPRINT.COM (June 19<sup>th</sup>, 2017), <https://3dprint.com/178492/think3d-india-3D-printing-facility/>.

<sup>65</sup> Lyndsey Gilpin, *How Recycled Plastic for 3D Printing will Drive Sustainability and Improve Social Consciousness*, Tech Republic, (May 30<sup>th</sup>, 2014), <https://www.techrepublic.com/article/how-recycled-plastic-for-3d-printing-will-drive-sustainability-and-raise-the-social-conscious-of-business/>.

opportunity for nation building and enhancing the economy, it upsets the protection of copyright and patents. In India, IP laws have typically lagged behind new technologies, which is evident from the recently released Intellectual Property Index (IPI) by United States Chamber of Commerce (USCC),<sup>66</sup> where India ranked 37th among the surveyed 38 countries<sup>67</sup>. So, there is an urgent need to protect the copyright and patent owners from incurring losses, and strengthening the economy. The new approach should be able to regulate the illegal 3D printed object instead of controlling the 3D printers, as the growth of the use of printers is inevitable due to its wide-ranging uses. There is a need to address this issue before it causes irreparable damage.

To address this emerging problem, we would have to use a broad approach in which IP owners, stakeholders, legislators; everyone has to contribute. Only IP reforms can save us now. As IBM recommended in its 2013 3D printing study: *“Prepare for IP reform...by protecting businesses, but balance this with enabling innovation by disruptive technologies and open source platforms - start by considering the revision of stifling legacy regulations.”*<sup>68</sup>

Since suing the customers and the infringers is impracticable to a great extent, the IP owners and other concerned authorities can ask the lawmakers to amend the existing laws, and to induct new regulatory provisions. To cap this infringement, the Government can also try to regulate the machines (3D printers) themselves. This will put an instant halt to the process of infringing the patented objects. But, the already over-burdened Government departments with a lot of corruption will create another set of problems. It will further restrict the development of the technology, and will not be a desired remedial step. So, instead of giving the reign in the hands of the Government, it is better to regulate the use of illegal objects that materialize from them. This will make people responsible for their actions and people will refrain from buying these infringed products and even the use of these items in public will be discouraged, owing to the punishments for the infringement. Also, this will not affect the

---

<sup>66</sup>Infinite Possibilities: IP Index, US Chamber of Commerce, GIPC Report, (Feb. 2016), <http://www.theglobalipcenter.com/gipcindex>.

<sup>67</sup>It was started in 2012 and some of its criteria were patent, copyright and trademark protections, enforcement and engagement in international treaties.

<sup>68</sup>Paul Brody & Veena Pureswaran, *The New Software-Defined Supply Chain: Preparing for the Disruptive Transformation of Electronics Design and Manufacturing*, IBM INSTITUTE FOR BUSINESS VALUE 12 (July 2013), <http://www-935.ibm.com/services/us/gbs/thoughtleadership/software-defined-supply-chain/>.



development of the 3D technology, which would have been stalled or slowed down, had we regulated the machines themselves.

Another way out is by targeting those who facilitate the infringement. Those who induce the infringement of the patented products in any way must be punished in order to protect the IP owners from potential loss. Punishment should be awarded to any person who sells the CAD files of the patented device through any platform, the owner of such platforms like website owners and anyone selling the 3D printers for that purpose. Bold steps should be taken against such infringers like in the case of *Grokster*,<sup>69</sup> where USA Supreme Court held that *Grokster*, though it did not make the infringing copies itself, but it likely induced copyright infringement and thus was liable.

Also, there is a need to address some institutional difficulties like the one mentioned by Omer Krieger,<sup>70</sup> that high duty structure on the usage of the technology and close to 40% excise duty (as it has not been defined as a product category) makes it less accessible to Indian customers.<sup>71</sup> IP law throughout the world essentially seeks to ensure that the creator is rewarded for his invention. This principle is being ensured by many international instruments like the Berne Convention,<sup>72</sup> the Universal Copyright Convention etc. But now, as we are past the hyped initial stage of AM and its impact, and have undergone a fundamental conceptual change, there is a need to have specific provisions related to it. Maybe in future, the 3D printing can become in itself a new-fangled issue mentioned in books; an amalgamation of all other IP rights issues. As has been rightfully states: “*3D printing is being promoted as the technology that will lead us into the next industrial revolution. Clothing, electronics, replacement body parts, biological components and even entire functional organs will be able to be built in the near future. Consumers should be aware of and prepared to enter the third industrial revolution governed by mass customization and a lower environmental impact.*”<sup>73</sup>

---

<sup>69</sup>*MGM Studios, Inc. v. Grokster, Ltd.*, 545 U.S. 913 (2005).

<sup>70</sup>General Manager, Asia Pacific and Japan, at Stratasys.

<sup>71</sup>Varun Agarwal, *Make in India: World's Largest 3D Printing Firm sets up Shop in India*, The Economic Times (May 11<sup>th</sup>, 2015), <https://economictimes.indiatimes.com/tech/hardware/make-in-india-worlds-largest-3d-printing-firm-sets-up-shop-in-india/articleshow/47036187.cms>.

<sup>72</sup>Berne Convention for the Protection of Literary and Artistic Works, 1886.

<sup>73</sup>*The Environmental Impact of 3D Printing: A Study Based on Cuboyo's Life Cycle Screening Assessment with Quantis*, CUBOYO (2013), <http://www.cuboyo.com/environmental>.