The Intersection of 3D Printing and Trademark Law

by **Nina Natalia Baranowska***

Abstract: The paper discusses the possible impact of 3D printing technology on a trademark protection system and argues that, despite some obstacles, selling certificated 3D-printable files by companies can be a reasonable new approach in order to face up to the changes brought about by this new technology. 3D printing (three-dimensional printing, counter crafting), perceived by some as a disruptive technology, is an additive manufacturing technique to create objects by joining or printing layer upon layer of material based on digital models. Certain features of this technology such as democratization and dissemination of manufacturing process, participation of hobbyists, the role of CAD files, the possibility of introducing modifications into a file, and the worldwide scope of 3D printing based on the Internet connectivity may have an impact on trademark protection to a certain extent. The paper analyzes the cases of this impact and suggests possible solutions: selling 3D-printable certificated files by trademark owners; price regulation; and better educational programs on counterfeit goods. From the hard law perspective, the solution may lie in establishing clear rules of liability for intermediary online platforms.

Keywords: 3D printing; trademark law; trademark protection; disruptive technology; counterfeiting; registration of shapes; platforms; certificated files

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A. Introduction

1 "If you are not excited by 3-D printing it is because you are not thinking big enough".[1] 3D printing is perceived by many authors as a cause of "A Third Industrial Revolution" or at least a significant factor in revolutionizing the world around us.[2] But what makes this technology powerful enough to compare it with the impact of a steam engine and the Industrial Revolution in the XIX century, or the Internet and Digital Revolution? One may say that 3D printing is *just* an additive manufacturing technique to create objects by printing layers of material based on digital models. Although some predictions about 3D printing seem to be exaggerated, this technology is clearly a new phase of technological development, which is transforming our thinking of home printers and putting the manufacturing process onto a more advanced level.

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1 Linda Federico-O'Murchu, "How 3-D printing will radically change the world", (11 May 2014), online: *CNBC* <http://www.cnbc.com/2014/05/09/will-3-d-technology-radically-change-the-world.html>.

2 See among others: Christopher Barnatt, "3D Printing: The Next Industrial Revolution", online: *Explain Future* <http://explainingthefuture.com/3dprinting.html>; Kent Roberts, "The Rise of the 3D Printer: Hype or Revolution?", (25 September 2014), online: *AtlanticNet* <https://www.atlantic.net/blog/the-rise-of-the-3d-printer-hype-or-revolution/>; Filemon Schoffer, "Is 3D Printing The Next Industrial Revolution?" in *TechCrunch* (2016); Sam Rega, "How 3D Printing Will Revolutionize Our World", online: *Bus Insid* <http://www.businessinsider.com/the-next-industrial-revolution-is-here-3d-printing-2014-8>; "3D printing: not yet a new industrial revolution, but its impact will be huge", *The Guardian* (10 December 2013), online: <https://www.theguardian.com/commentisfree/2013/dec/11/3d-printing-not-yet-a-new-industrial-revolution-but-its-impact-will-be-huge>; "A third industrial revolution", *The Economist* (21 April 2012), online: <http://www.economist.com/node/21552901>.

2 It has to be emphasized that no technology exists in a vacuum. Quite the contrary, almost each new technological advance has a significant impact on society, market and, what is important for this paper – legal regulations. 3D printing is not an exception here. As many commentators observe, 3D printing will force legal scholars and also policy-makers to rethink existing legal concepts within contract law (e.g. the role of prosumers and online platforms, the definition of a "producer", etc.)[3] and tort law (e.g. defining a liable person, proving a causal link, etc.).[4]

3 This paper focuses on the intersection of 3D printing and trademark law and examines the boundaries of the impact of 3D printing on the existing trademark law system. As the starting point (Section B), 3D printing is presented as a disruptive technology, which could change the way people currently produce and use products, and which characteristic features could have an impact on trademark law. Among those features are: freedom, easiness, and low cost of designing and printing objects. They lead to democratization and facilitation of the production process and in fact may change or even eliminate the role of the brand as an "intermediary" between a producer and a consumer.

4 Next, Section C briefly describes the traditional role of trademark, which is the protection of the products' identification with a particular quality source by using recognizable signs or expressions. For further deliberations, it is important to highlight two purposes of trademark protection – "consumer protection" and "company incentives". Those remarks will help to understand the impact of 3D printing on the trademark law system.

5 Section D indicates two major areas where the relation between 3D printing and trademark law collides. First of all, the problem whether three-dimensional objects can be registered as trademarks. The greater possibilities of 3D printing will also raise several questions regarding registering three-dimensional objects (shapes) as a trademark, including the role of the trademark law system, the growing scope of registrable subject matter, the reasons for registration of shapes, the enforcement of trademark protection, if the 3D printing would become the norm. Secondly, the problem of whether and to what extent the certain elements of 3D printing such as democratization and dissemination of manufacturing process, participation of hobbyists, the role of CAD file, the possibility of introducing modifications into a CAD file, and the worldwide scope of 3D printing based on the Internet access could possibly interfere with the trademark law system. In that section, it is stressed that the private reproduction of a trademark is generally not an infringement, which means that the essence of 3D printing, embodied in a homemade production, will not directly and radically affect the core of trademark protection. The current scope of trademark law thus excludes from trademark protection many potential threats to a company's brand due to a commercially-oriented approach and a blurred line between commercial and non-commercial uses. The section also indicates how realistic it is for 3D printing to become a serious risk for companies from the product sectors. It is explained that the series production is still a cheaper way to produce goods and that the technical and practical limits caused by 3D printing will not play important role in many categories of counterfeited goods. Therefore, the problem of using 3D printing for counterfeiting purposes is currently limited to the certain number of products – mainly luxury goods, which are relatively easily accessible through 3D printing and profitable for counterfeiters. Even if the trademark protection may only apply when commercial uses take place and to only some categories of items, 3D printing opens up further possibilities of counterfeiting goods and enables anyone to become a counterfeiter at his/her home and to take commercial advantages of 3D prints. The section also discusses the cases of printing only the trademark, printing the whole item, to which the trademark is attached, and printing the whole item without the trademark, as well as the blurred line between a producer and a user and the line between commercial and non-commercial activities. Next, the role of a CAD file is explained and based on that the section makes a prediction that in the counterfeiting process the files would be offered online by professional counterfeiters, rather than produced by each individual. Finally, the section presents further problems including the status of a CAD file as a product, enforcing companies' rights, and territorial limitations of trademarks.

6 Section E proposes some solutions including a new approach of companies in order to face up to the changes brought about by this new technology, taking as a reference point the Lessig's concept of modalities consisting of hard law regulations, market regulations, social norms and "architecture". I claim that in the area of trademark law, hard law regulation might not be an adequate response to problems presented by 3D printing, mainly because of limited abilities of enforcing rights and high litigation costs. Therefore, the idea of selling 3D printed certificated files by trademark owners will be discussed. Although this idea has some disadvantages (such as losing control over a product and its quality,

3 See for example: Thierry Rayna, Ludmila Striukova & John Darlington, "Co-creation and user innovation: The role of online 3D printing platforms" (2015) 37 J Eng Technol Manag 90.

4 See for example: Patrick J Comerford & Erik P Belt, "3DP, AM, 3DS and product liability.(3D printing, additive manufacturing)" (2015) 55:4 St Clara Law Rev 821.

increasing potential liability for products, confusing consumers, etc.), this solution seems a reasonable and more flexible approach to adjust companies to a new 3D printing reality. Next, I show that the price regulation will be of key importance. I also comment on the necessity of education - a society which is well-informed about detrimental effects of using counterfeit goods can make a wise and conscious decision and even generate social norms regarding whether it wants to contribute to the counterfeit industry. The last solution will be to establish clear rules of liability for intermediary online platforms where it is possible to upload and download unauthorized designs of a trademarked good or trademark itself.

7 The following deliberations are not based on a specific legal system, so that the general problems of trademark law as a system of protection companies (and to some extent consumers) can be presented in a model approach. The discussion is, however, supported by references to EU law, the *Agreement on Trade-Related Aspects of Intellectual Property Rights* (*TRIPS*), and some examples from the U.S. system.

B. 3D Printing as a Disruptive Technology

8 3D printing (three-dimensional printing, counter crafting) is perceived as one of the new disruptive technologies. Jeremy Rifkin, an American economic and social theorist, in his book from 1995 titled *"The End of Work: The Decline of the Global Labor Force and the Dawn of the Post-Market Era"*[5] used the ambiguous term "disruptive technologies" to describe new technological phenomena which, on the one hand, have a huge economic potential, and on the other hand replace previous solutions, causing old businesses and professions to disappear. Indeed, new technologies can quickly reorganize the world where we live and work and create a new order with new range of products, services, but also threats. A report by the *McKinsey Global Institute* from May 2013 titled *"Disruptive technologies: Advances that will transform life, business, and the global economy"* indicated 3D printing as one of the twelve new technologies which by 2025 will demonstrate the greatest commercial potential and exert the largest impact on social and economic changes.[6] According to the report, the illustrative pools of economic value that could be impacted by 3D printing include $11 trillion of global manufacturing GDP and $85 billion revenue from global toy sales.[7]

9 3D printing is defined as additive manufacturing techniques to create objects by joining or printing layer upon layer of material based on digital models.[8] Additive manufacturing (AM) covers many specific processes which vary in the materials and machine technologies. A report on Standard Terminology for Additive Manufacturing Technologies, published by the American Society for Testing and Materials (ASTM), initially by the group ASTM F42 – Additive Manufacturing in 2012 and then developed by the Subcommittee: F42.91 in 2015, indicates 7 categories of additive manufacturing, which are: VAT Photopolymerisation, Material Jetting, Binder Jetting, Material Extrusion, Powder Bed Fusion, Sheet Lamination, Directed Energy Deposition.[9]

10 Additive manufacturing was invented in the 1980s and was initially used for "rapid prototyping" of mechanical models in plastic,[10] and for industrial use. Before 3D printing technology, prototypes were usually made in different geographical areas like India or China so that it required the involvement of time and human and financial resources.[11] The base of 3D printing technology is well-known computer aided design programs (CAD), which evolved from the two-dimensional space digital drafting.[12] The

5 Jeremy Rifkin, *The end of work: the decline of the global labor force and the dawn of the post-market era* (New York: GPPutnam's Sons, 1995).

6 McKinsey Global Institute, "Disruptive technologies: Advances that will transform life, business, and the global economy", (May 2013), online: <http://www.mckinsey.com/business-functions/digital-mckinsey/our-insights/disruptive-technologies>. These technologies are: mobile Internet, automation of knowledge work, Internet of Things, cloud, advanced robotics, autonomous and near-autonomous vehicles, next-generation genomics, energy storage, 3D printing, advanced materials, advanced oil and gas exploration and recovery, renewable energy.

7 *Ibid* at 5.

8 See for example: Michael Weinberg, *It Will Be Awesome If They Don't Screw it Up: 3D Printing, Intellectual Property, and the Fight Over the Next Great Disruptive Technology* (Public Knowledge, 2010) at 2; Lisa Harouni, "A primer on 3D printing", (November 2011), online: *TEDTalk* <https://www.ted.com/talks/lisa_harouni_a_primer_on_3d_printing>.

9 American Society for Testing and Materials (ASTM), Group F42 Additive Manufacturing Technologies, developed by Subcommittee F4291, "Standard Terminology for Additive Manufacturing Technologies", (2012), online: <http://www.astm.org/DATABASE.CART/REDLINE_PAGES/F2792.htm>. See more Ben Redwood, "Additive Manufacturing Technologies: An Overview", online: *3D Hubs* <https://www.3dhubs.com/knowledge-base/additive-manufacturing-technologies-overview>; Additive Manufacturing Research Group, Loughborough University, "The 7 categories of Additive Manufacturing", online: <http://www.lboro.ac.uk/research/amrg/about/the7categoriesofadditivemanufacturing/>.

10 Barnatt, *supra* note 2.

11 Juho Vesanto, "Saving Resources by Prototyping with 3D Printing – A Lamplight Case Study", (30 September 2013), online: *3D Print Ind* <https://3dprintingindustry.com/news/saving-resources-prototyping-3d-printing-lamplight-case-study-17629/>.

12 See "CAD Software", online: <https://www.autodesk.com/

years of research, and continuous improvement of technological processes has transformed the AM from an expensive and inaccessible technology to easier and cheaper to acquire and use.[13] The recent expiry of patent rights over some of the technologies invented in the 1980s, including 3D printing, has sparked consumers' interest in the potential of 3D printing, which is perceived by many as the symbol of the shift towards individualism and creativity.[14]

11 3D printing allows for the production of day-to-day consumer products (furniture, clothes,[15] footwear,[16] sports gear,[17] kitchen implements, office materials, tools, toys, decorative elements),[18] but can also be applied in mass-scale production and professional use (automotive industry, robotics, architecture, construction, etc).[19] 3D printing technology can also be applied in the food industry.[20] This technology is already irreplaceable in medicine, especially in the field of replacement and reconstructive surgery.[21] Alongside printing of dental implants, prosthetics and hearing aids,[22] research is presently focusing on bioprinting. Bioprinting opens up new possibilities in the scope of innovative transplantology methods thanks to the possibility of recreating organs and tissue from human cells using 3D technology.[23]

12 Significantly, 3D printing can be a key factor in future commercial application,[24] but it can also provide individuals with further possibilities to print objects in their own homes and thus become a symbol of the "do-it-yourself" movement ("DIY").[25] Lipson and Kurman point out that 3D printing requires less operator skills which, along with a high production capacity, make "3D printers ideal for home use".[26] Taking into account the current developments of 3D printing, it is probable that 3D printers will one day be used in the majority of private homes, like computers and 2D printers.[27] So far, however, 3D printers intended for home use have not reached the level to print sophisticated forms in materials other than plastic.

solutions/cad-software>.

13 See Gil Laroya, "3D Printing Can Turn You Into a Designer", (16 December 2013), online: *Huffington Post* <http://www.huffingtonpost.com/gil-laroya/3d-printing-design_b_4440463.html>.

14 Hod Lipson & Melba Kurman, *Fabricated: The New World of 3D Printing* (New York: John Wiley & Sons, 2013) at 22, 103; See more: Chris Anderson, *Makers: the new industrial revolution* (London: Random House Business Books, 2013).

15 Rachel Hennessey, "3D Printing Hits The Fashion World", (7 August 2013), online: *Forbes* <http://www.forbes.com/sites/rachelhennessey/2013/08/07/3-d-printed-clothes-could-be-the-next-big-thing-to-hit-fashion/>.

16 Michael Fitzgerald, "With 3-D Printing, the Shoe Really Fits", (15 May 2013), online: *MIT Sloan Manag Rev* <http://sloanreview.mit.edu/article/with-3-d-printing-the-shoe-really-fits/>.

17 Richard Lai, "EADS's Airbike is a 3D-printed nylon bicycle, actually looks rather decent", (3 September 2011), online: *Engadget* <https://www.engadget.com/2011/03/09/eadss-airbike-is-a-3d-printed-nylon-bicycle-actually-looks-rat/>.

18 See for example: Steven Kurutz, "A Factory on Your Kitchen Counter", *N Y Times* (20 February 2013), online: <http://www.nytimes.com/2013/02/21/garden/the-3-d-printer-may-be-the-home-appliance-of-the-future.html>; Dan Nosowitz, "A Smooth, 3-D-Printed, Multicolored, High-Resolution Vase", (19 July 2013), online: *Pop Sci* <http://www.popsci.com/technology/article/2013-07/smooth-3-d-printed-vase-has-four-times-resolution-makerbot>.

19 Michelle Starr, "Dubai unveils world's first 3D-printed office building", (25 May 2016), online: *CNET* <https://www.cnet.com/news/dubai-unveils-worlds-first-3d-printed-office-building/>; Francesca Perry, "Chinese firm creates 'world's tallest 3D-printed building'", *The Guardian* (31 January 2015), online: <https://www.theguardian.com/cities/2015/jan/31/chinese-firm-creates-worlds-tallest-3d-printed-building>; Clare Scott, "Saudi Arabian Government Meets With WinSun to Discuss 3D Printing as Part of a Plan to Build 1.5 Million Homes in Five Years", (3 August 2016), online: *3DPrint.com* <https://3dprint.com/144727/saudi-arabia-winsun-housing/>.

20 Aaron Souppouris, "NASA is funding a 3D food printer, and it'll start with pizza", (21 May 2013), online: *The Verge* <https://www.theverge.com/2013/5/21/4350948/nasa-funding-3d-food-printer-pizza>; Bianca Bosker, "3D Printers Could Actually Make Donuts Healthy", *Huffington Post* (24 April 2013), online: <http://www.huffingtonpost.com/2013/04/24/3d-printed-food_n_3148598.html>.

21 Sean Gallagher, "Doctors save baby's life with 3D-printed tracheal implant", (24 May 2013), online: *Ars Tech* <https://arstechnica.com/information-technology/2013/05/doctors-save-babys-life-with-3d-printed-tracheal-implant/>; Carol Torgan, "3-D Printing of Working Bionic Ears", (13 May 2015), online: *Natl Inst Health NIH* <https://www.nih.gov/news-events/nih-research-matters/3-d-printing-working-bionic-ears>.

22 Ian Birrell, "3D-printed prosthetic limbs: the next revolution in medicine", (19 February 2017), online: *The Guardian* <https://www.theguardian.com/technology/2017/feb/19/3d-printed-prosthetic-limbs-revolution-in-medicine>.

23 Liat Clark, "Bioengineer: the heart is one of the easiest organs to bioprint, we'll do it in a decade", (21 November 2013), online: *WIRED UK* <http://www.wired.co.uk/article/3d-printed-whole-heart>.

24 Kevin Maney, "3-D printing could break China's economic stranglehold and make manufacturing great again", (2 April 2016), online: *Newsweek* <http://www.newsweek.com/2016/04/15/3d-hubs-3-d-printers-manufacturing-china-443350.html>.

25 See for example: Rhys Jones et al, "RepRap - the Replicating Rapid Prototyper" (2011) 29:1 Robotica 177; See also the idea of Maker Movement: "The Maker Movement Manifesto", *PR Newswire* (2013); Amanda Scardamaglia, "Flashpoints in 3D Printing and Trade Mark Law" (2014) 23 J Law Inf Sci 30 at 34.

26 See ten principles indicated by autors in Chapter 2: Lipson & Kurman, *supra* note 14.

27 Compare: Daniel O'Connor, "A 3D Printer in Every Home: Redux", (11 October 2016), online: *TCT Mag* <http://www.tctmagazine.com/api/content/8908b0b0-8fcc-11e6-bee4-0a161eac8f79/>; Lipson & Kurman, *supra* note 14 at 20–22.

13 Nonetheless, the scope of the application of 3D printing technology is expanding, and constant processes of improvement, application of new materials, and a reduction in prices of the materials and printers[28] are facilitating the popularity and accessibility of this technology. 3D printing is also being promoted by the biggest tech companies such as Amazon and Microsoft who are selling 3D printers[29] and creating more efficient working environments with this technology.[30]

14 Many commentators see 3D printing not only as a new manufacturing paradigm of the XXI century, but also as a trigger for the changes in society, the environment, trade, the market, entrepreneurship, and of course law.[31] For example, according to the McKinsey Report, 3D printing technology could be beneficial for small companies by providing them with technological tools so that they can rapidly enter into the market and compete on a more significant scale.[32] On the other hand, as the use of 3D printing technology becomes more common, ethical[33] and legal concerns[34] are increasingly raised.

15 From the legal perspective, 3D printing raises many questions in different areas of law, including contract law (e.g. it challenges the role of prosumers and the definition of a "producer") and tort law (e.g. who, and to what extent, is liable for damages caused by the 3D printed object, if defects can arise from the initial design, the code, the printer, the material, or in the improper use of the printer and/or materials). 3D printing also has an impact on Intellectual Property Law: patent law,[35] copyright law,[36] and trademark law which will be discussed in this paper.

C. The Traditional Role of Trademark Law

16 The trademark law system was created in order to ensure that products or services that are identifiable through particular qualities, would have a recognizable sign or expression attributed to it to protect this identification.[37] According to the World Intellectual Property Organization, trademark is "a sign capable of distinguishing the goods or services of one enterprise from those of other enterprises".[38] This definition is however somewhat a shortcut. It should be noted that the sign itself is not yet a trademark, but only the element of the trademark concept. The sign has to be associated with the product in a way that creates a complex relation in the public perception between the sign and the product. The core of the trademark is thus the relation between the sign and the product, recognized by consumers. This relation can be created by the constant usage of the sign in relation to certain products or by indicating the list of products to which the sign will be related in a registration form. In practice, though, the notion "trademark" is used just to determine the sign.[39] Nowadays, trademarks can take different forms such as pictures, logos, designs, colors, melodies, scents, store layout, menu, etc.[40]

17 It means that the primary role of the trademark is to determine the origin (source) of the product. The particular trademark leads to the certain public perception of the product, which allows to individualize the product based on its "commercial" source. What is more, this "commercial" source most frequently creates a consumer perception of the quality of the product or its certain features.

28 Lipson & Kurman, *supra* note 14 at 84.

29 Ian Paul, "Amazon quietly launches complete 3D printing store", (14 June 2013), online: *PCWorld* <http://www.pcworld.com/article/2042076/amazon-quietly-launches-complete-3d-printing-store.html>.

30 Michael Endler, "Microsoft Touts Windows 8.1 3-D Printing", (8 August 2013), online: *InformationWeek* <http://www.informationweek.com/hardware/peripherals/microsoft-touts-windows-81-3-d-printing/240159700>.

31 Lucas S Osborn, "Regulating three-dimensional printing: the converging worlds of bits and atoms" (2014) 51:2 San Diego Law Rev 553 at 560.

32 McKinsey Global Institute, *supra* note 6 at 19.

33 Compare: Jasper L Tran, "To bioprint or not to bioprint" (2016) 17:1 N C J Law Technol 123.; Andy Greenberg, "This Is The World's First Entirely 3D-Printed Gun", (3 May 2013), online: *Forbes* <http://www.forbes.com/sites/andygreenberg/2013/05/03/this-is-the-worlds-first-entirely-3d-printed-gun-photos/>; Janessa Rivera & Rob van der Meulen, "Gartner Says Uses of 3D Printing Will Ignite Major Debate on Ethics and Regulation", (29 January 2014), online: *Gartner* <http://www.gartner.com/newsroom/id/2658315>.

34 See for example: Nora Freeman Engstronm, "3-D Printing and Product Liability: Identifying the Obstacles" (2013) 162 Univ Pa Law Rev Online 35.

35 See for example: Daniel Harris Brean, "Asserting patents to combat infringement via 3D printing: it's no 'use'" (2013) 23:3 Fordham Intellect Prop Media Entertain Law J 771.

36 See among others: S Craig, "Protection for printing: An analysis of copyright protection for 3D printing" (2017) 2017:1 Univ Ill Law Rev 307; Julie Ahrens, "3D Printing and Copyright" (2013) 17:3 Copyr New Media Law Newsl 3.

37 See 15 U.S. Code § 1127 (2012)

38 "Trademarks", online: *World Intellect Prop Organ* <http://www.wipo.int/trademarks/en>.

39 See for example Article 15 of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS).

40 See for example: Vanessa Mackie, "Scent marks: the future of Canadian trade-mark law" (2005) 18:3 Intellect Prop J 417; José Tizón Mirza, "CJEU expands trade mark law to include the design of a store layout: Apple Inc v Deutsches Patent- und Markenamt (German Patent and Trade Mark Office)" (2014) 36:12 Eur Intellect Prop Rev 813; Richard J Berman, "Color me bad: a new solution to the debate over color trademark registration" (1994) 63:1 George Wash Law Rev 111.

Sometimes the trademark itself can be identified as a symbol of certain characteristics; for example, wealth, social position, fitness and healthy lifestyle. In this sense, trademark plays a quality and advertisement role.

18 Generally speaking, trademark law has two purposes. The first is consumer protection, with the goal to prevent consumers from the confusion of the producer of the good, which usually leads to the certain perception of its quality.[41] For example if the consumer buys a pair of Nike shoes, he/she connects in mind the logo and the shoes with the specific producer and then with the certain quality or, more generally, with the symbol of an active lifestyle. However, some commentators claim that this concept is currently declining in importance.[42] The second purpose concerns company incentives. Protection guaranteed by trademark law, which allows companies to control the use of the mark, encourages them to invest in a brand and thus in the higher quality and probably higher prestige.[43]

D. The Impact of 3d Printing Technology on the Trademark Law System

19 There are two major areas where the relation between 3D printing and trademark law collides. The first one concerns registering three-dimensional objects as trademarks. Secondly, certain elements of 3D printing such as democratization of manufacturing process may pose some threats on the trademark law system.

I. Shape as a Trademark

20 According to the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS),[44] shapes are a registrable subject matter. Under Article 15(1) TRIPS, a trademark can be constituted by *any* sign, or *any* combination of signs, capable of distinguishing the goods or services of one undertaking from those of other undertakings. Such signs, in particular words including personal names, letters, numerals, figurative elements and combinations of colors as well as any combination of such signs, shall be eligible for registration as trademarks. Although, shape marks are not listed, they could be generally accepted as registrable marks, taking into account that the list of signs is of non-exhaustive character. However, many jurisdictions impose some limitations on registering shape marks. According to Article 4 (1)(e) of the Directive (EU) 2015/2436 of the European Parliament and of the Council of 16 December 2015 to approximate the laws of the Member States relating to trade marks,[45] signs which consist exclusively of: (i) the shape, or another characteristic, which results from the nature of the goods themselves; (ii) the shape, or another characteristic, of goods which is necessary to obtain a technical result; and (iii) the shape, or another characteristic, which gives substantial value to the goods, should not be registered. It means that the functional shape cannot be registered as a trademark under EU law, which significantly limits the scope of application of trademark protection over 3D prints. The essence of majority of the 3D prints (including toys, clothing, footwear, decorative elements) is, in fact, to serve functional purposes – for those 3D prints the shape is crucial for use. Recently, *Nestle* lost a battle before the Court of Justice of the European Union (CJEU) for registering its *Kit Kat's* four finger shape because the shape was functional and not distinctive.[46] Similarly, *Lego's* three-dimensional red eight-stud brick shape could not be registered as a trademark, because the shape of the brick is necessary to obtain a technical result.[47] Restrictions

41 Dan L Burk, "Trademark doctrines for global electronic commerce" (1998) 49:4 S C Law Rev 695. At 699-700.

42 Felix S Cohen, "Transcendental Nonsense and the Functional Approach" (1935) 35:6 Columbia Law Rev 809 at 815–818.

43 Osborn, *supra* note 31 at 582. See also: Qualitex Co. v. Jacobson Prods. Co., 514 U.S. 159, 164 (1995) and Park 'N Fly, Inc. v. Dollar Park & Fly, Inc., 469 U.S. 189, 198 (1985).

44 1869 UNTS 299, 33 ILM 1197 (1994). The TRIPS Agreement is Annex 1C of the Marrakesh Agreement, signed in Marrakesh, Morocco on 15 April 1994 and came into effect on 1 January 1995. Currently TRIPS Agreement was adopted by 162 parties (see more: <http://www.wipo.int/wipolex/en/other_treaties/parties.jsp?treaty_id=231&group_id=22>). The TRIPS Agreement establishes a minimum standard, which means that the signatories countries can adopt more protective rules, but they cannot fall below set requirements. See WTO website: "WTO | intellectual property - overview of TRIPS Agreement", online: <https://www.wto.org/english/tratop_e/trips_e/intel2_e.htm>.

45 OJ L 336, 23.12.2015.

46 Case C215/14, Société des Produits Nestlé SA v Cadbury UK Ltd (16 September 2015) ECLI:EU:C:2015:604. See more: John Murray Brown, "KitKat can be copied as Nestlé loses trademark protection", (15 December 2016), online: *Ir Times* <http://www.irishtimes.com/business/agribusiness-and-food/kitkat-can-be-copied-as-nestl%C3%A9-loses-trademark-protection-1.2907537>.

47 Case C48/09 P, , Lego Juris A/S v Office for Harmonisation in the Internal Market (Trade Marks and Designs) (OHIM),(14 September 2010) ECLI:EU:C:2010:516. See more: CNN Wire Staff, "LEGO brick not a trademark, court rules - CNN.com", (15 September 2010), online: <http://edition.cnn.com/2010/BUSINESS/09/15/eu.lego.trademark/index.html>. On the other hand, CJEU ruled that Lego's mini three-dimensional figures can be classed as a protected trademark shapes. Case T396/14 Best-Lock (Europe) Ltd v Office for Harmonisation in the Internal Market (Trade Marks and Designs) (OHIM) 16 June 2015, ECLI:EU:T:2015:379.

See more: Sarah Butler, "Lego blocks legal bid to remove

surrounding the registration of shape trademarks exist also under the U.S. law system.[48] According to the functionality doctrine, the shape eligible to register cannot be essential to the use or purpose of the product and cannot affect the cost or quality of the product.[49] If the shape does not have utility it can be registered, if it is distinctive. However, the lack of utility will be applied in the minority of the cases, while many of the 3D prints will be functional shapes – excluded from the trademark registration. Among that minority of the cases where a 3D print is distinctive but does not serve a functional purpose it may be registerable.

21 Furthermore, taking into account the essence of trademark protection, it should be pointed out that granting trademark protection does not mean that the trademark owner has an exclusive and unlimited right to the sign. Trademark owners have a right to use the sign as their trademark, which means with the connection to the origin of the product. In this minority of cases when a shape can be registered as a trademark, using a shape by a consumer for his/her personal, descriptive or aesthetic reason, infringement of the shape trademark will not take place.[50]

22 Nonetheless, the greater possibilities of 3D printing poses, several questions concerning the registration of a trademark consisting of three-dimensional objects (shapes), including the role of the trademark law system, the growing scope of registerable subject matter, the reasons for the registration of shapes, and the enforcement of trademark protection given to shapes if the 3D printing would become the norm.[51]

II. The Impact of Certain Elements of 3D Printing Technology on the Trademark Law System

23 This section examines the potential impact of certain features of 3D printing on trademark law, and the way it can influence the protection of both companies and consumers. As a consequence, companies will have to rethink their business models to protect their brands.

1. Democratization of Production Process

24 The main feature of 3D printing is liberalization of the production process. Almost anyone can become a manufacturer, carrying out their own projects or producing items on the basis of designs supplied by others and made accessible via the Internet. The manufacturing process itself is made easier, and it is possible to skip over some stages of production, which means that manufacturing is greatly facilitated. Creation of a product requires only the proper code, materials, and the printer. Allowing private entities to "print" objects blurs the line between the producer and the consumer. This, in turn, leads to considerable threats of printing (in practice – manufacturing) fake trademarked goods by private entities in their homes.

2. Dissemination of Production Process: Participation of Hobbyists

25 Along with liberalization, the production process is disseminated. The process may involve many independent entities: the designer of the code; the designer of the printer; the operator of the printer; the supplier of materials; and the seller, who can produce the object him/herself, or can create the product in a printing shop and then sell it. It means that the design, production, and the distribution of products can be "democratized".[52] What is more, many of the 3D printer owners use previously generated computer projects and designs which are available on the Internet. The possibility of sharing models and projects creates the new online ecosystem,[53] which makes it more difficult for companies to control the use of their products and trademarks. Moreover, taking into account that 3D printing can be a home process without a professional third party, the possibility of producing fake goods is moved from well-organized criminal groups to the domesticity of regular users.[54]

26 3D printing is also a very precise technology that enables the production of objects in great resolutions. By using a layer-by-layer method, it is now possible to create objects whose production would be impossible with the use of traditional methods.

trademark protection for its mini-figures", (16 June 2015), online: *The Guardian* <https://www.theguardian.com/lifeandstyle/2015/jun/16/lego-trademark-protection-mini-figures-european-court-justice-best-lock>.

48 Qualitex Co. v. Jacobson Products Co., Inc., 514 U.S. 159, 164-165 (1995).

49 Scardamaglia, *supra* note 25 at 39.

50 *Ibid* at 41.

51 Scardamaglia, *supra* note 25 at 44–45; See more: Mark A Lemley, "IP in a World Without Scarcity" (2015) 90 N Y Univ Law Rev 460.

52 McKinsey Global Institute, *supra* note 6 at 16.

53 *Ibid* at 14.

54 Compare: Richard Nieva, "Ashes to ashes, peer to peer: An oral history of Napster", (5 September 2013), online: *Fortune* <http://fortune.com/2013/09/05/ashes-to-ashes-peer-to-peer-an-oral-history-of-napster/>.

Home-made 3D printed goods can be of excellent quality, so that it would be difficult to distinguish fake trademarked goods from the originals. One can conclude that this technology might generally improve the quality of faked goods.

3. The Role of CAD File

27 It is also common practice to freely share a CAD file over the Internet through online platforms, e-mails, cloud technology, etc. Many of the platforms are used by hobbyists who upload, download and exchange files for free.

4. Modifications

28 Another hugely important feature of 3D printing is the possibility of modifying a CAD file, which is the source of a 3D printout. The point of 3D printing is not only "printing" (adding) layer-by-layer to create three-dimensional objects. What is important is that this technology enables the users to download the file, copy it and make modifications. Both a 3D printer and a CAD (digital) file play the essential roles in the printing process. As in the case of 2D printing, in which it is important to have a file (text or drawing file) that is sent to the printer and printed on a piece of paper, in 3D printing it is necessary to have a project that is then "printed" in a spatial form. The difference lies in the higher technological level of the project (more details, higher precision in the case of multiple-element objects, greater knowledge about the software).

29 Having a digital file and a suitable computer program enables, in turn, to modify the project. The user basically has two paths leading to the final result in the form of a printed object. Firstly, having a CAD file and program at disposal, the user can create his/her own project. However, this requires some design skills. Nevertheless, the project can be created by a special software through scanning a physically existing object that will be then transformed into a digital file.[55] Secondly, the user can find already prepared projects on the Internet.[56] In both cases, a significant issue from the perspective of trademark law is the ability to modify the project. Ready-to-go projects can be personalized by adding, changing or deleting individual items.

55 See online tutorials: <https://www.instructables.com/id/3d-Scan-Anything-Using-Just-a-Camera/>, <https://www.3dhubs.com/talk/t/3d-scanning-what-technologies-to-use-for-3d-printing/1743>.

56 For example: <http://www.thingiverse.com/>.

5. Worldwide Scope

30 "Zipping" a physical object into a digital file opens new possibilities for creating objects. By providing the possibility of producing objects from a digital file, 3D printing seems to create a bridge between the digital and the physical world. A digital file also allows one to send, receive, and exchange files freely. The worldwide access to the Internet enables people to share any number of CAD files between users in different parts of the world.[57]

31 **How can these characteristics influence trademark law?** Firstly, it has to be emphasized that at least under EU law, the private reproduction of a trademark is not an infringement. This means that the essence of 3D printing, embodied in a homemade production, will not directly and radically affect the core of trademark protection. Nonetheless, 3D printing possibilities may have an impact on companies' interests. At this point, it is necessary to distinguish between three different scenarios: the individual prints the fake trademarked goods for his/her personal use, he/she distributes it to public, or sells it. In the first case, as mentioned above, an infringement will generally not take place. Printing trademarked goods for personal use (e.g. printing fake trademarked kitchen equipment) will not infringe the rights of the brand because it is not related to selling, distributing or advertising.[58] However, even if individuals produce goods for personal use, they can distribute (e.g. wear or use) them in public, which may lead to some confusion. Osborn, the American author, observes the problem of post-sale confusion related to 3D printing. Post-sale confusion occurs not at the moment of purchase, but later when the others see someone wearing or using the goods and then get confused about the origin of the products.[59] He stresses that without the post-sale confusion, "the purchase or use of pirated goods by a knowing buyer would not infringe because they were not confused as to the source".[60] While printing the object, individuals have complete knowledge of the origin of the object and that the object does not come from the brand owner source[61]

57 *Ibid* at 560.

58 Compare 15 U.S. Code § 11 14(l)(a) (2012). See Art. 20 (1) Trade-marks Act R.S.C., 1985, c. T-13 (Canada).

59 Osborn, *supra* note 31 at 583; See more: Michael J Allen, "The scope of confusion actionable under federal trademark law: who must be confused and when?" (1991) 26:2 Wake For Law Rev 321 at 325–326; Anne M McCarthy, "The post-sale confusion doctrine: why the general public should be included in the likelihood of confusion inquiry" (1999) 67:6 Fordham Law Rev 3337 at 3348–3351.

60 Osborn, *supra* note 31 at 583. See more: Anne M McCarthy, "The post-sale confusion doctrine: why the general public should be included in the likelihood of confusion inquiry" (1999) 67:6 Fordham Law Rev 3337 at 3348–3351.

61 Weinberg, *supra* note 8 at 8.

in cases of fake trademarked goods. However, taking into account the general public protection, in the American doctrine, McCarthy argues that "the use of a trademark likely to cause confusion among the general public in a post-sale context should be actionable under federal trademark law".[62] This statement may apply to the case of fake trademarked printed goods which are distributed among the general public. Under EU law it is, however, debatable whether the risk of confusion occurs when the trademark has not been commercially exploited. It would mean that only when the printed good has been sold and distributed by the individual, there might be infringement of the trademark. Even in this case, trademark owners would probably have to prove that the particular individual printed the trademarked good and that it was used in public.[63] This, in turn, can be extremely difficult to achieve and in turn renders the trademark protection impossible to enforce.

32 Narrowing down the trademark protection only to the cases when the trademark has been commercially exploited is a significant limitation of the role of trademark system, especially in the light of new technological developments. As explained above, the potential of 3D printing is fulfilled by individuals printing objects by themselves. This, however, may bring piracy into private homes. While one or two printed fake trademarked goods are probably not enough to jeopardize the interests of the company, the growing interest in 3D printing may adversely affect the brand's power. Some authors use the example of the impact of Napster on a music scene.[64]

33 3D printing not only changes the role of the brand as an "intermediary" between a producer and its consumers, but also raises questions about the line between a producer and a consumer. At what point does the individual, who reprints objects using his/her 3D printer, become a professional? Does he/she have to sell 3D printed objects? How should we classify the individual who sells these objects only occasionally? How should we classify the individual who distributes these objects for free or only for a symbolic payment? What if he/she does it on a massive scale? These and similar questions lead to a problem that in the case of 3D printing, the current form of trademark protection scope excludes many potential threats to the company's brand form trademark protection due to a commercially-oriented exploitation and the blurred lines of commercial uses. The problem will probably grow in the future along with further developments of 3D printing.

34 Even if the trademark protection may only apply when commercial uses take place, 3D printing might create and exacerbate problems of trademark's infringement. 3D printing opens up further possibilities of counterfeiting goods and enables anyone to become a counterfeiter at his/her own home and take commercial advantages of 3D prints. One may say that this is basically the same problem that already exists today. What 3D printing changes is that counterfeiting is becoming easier, faster, more accessible and relatively cheaper (if the price of 3D printers and materials continues to drop). Moreover, the use of CAD files in the online environment and empowering regular users with sophisticated tools of creating objects change the context of counterfeiting. 3D printing may increase the incentive for regular users to create copies of trademarked goods and to start making profit off them.

35 The current stage of 3D printing development addresses a practical question concerning how realistic it is for 3D printing to become a serious risk for companies from the product sectors and to threaten the brand's interests. There are two issues that have to be taken into account. First of all, the main practical obstacle for 3D printing becoming the major way of producing marked goods is the cost. A series production of marked goods (elements, components, etc.) is still a cheaper way for companies to produce goods than using 3D printing technology. As long as the costs of 3D printing remain higher than series production, companies will probably not switch to 3D printing on a regular basis. It may very well be that the series production will remain the mainstream, whereas 3D printing will occupy only margin and niche markets limited to hobbyists' activities or, on the other hand, highly specialized sectors such as the medical market (e.g. hearing aid and prosthetic production). In that case, the brand infringements through 3D printing will remain at a margin. Nonetheless, it may only be a matter of time before this technology will reach the price level that will turn it into cost-effective method of producing goods. Well-known examples from the past include copy machines and 2D printers. If that happens, the new scheme for the functioning of the production process will have to be adapted to further development. It is also possible that in the future, a consumer would buy a design(model) rather than a complete object. Those predictions may seem visionary, but history has many lessons to teach us about the impact of innovations.

62 McCarthy, "The post-sale confusion doctrine: why the general public should be included in the likelihood of confusion inquiry" (1999) 67:6 Fordham Law Rev 3337 at 3338, 3340.

63 Osborn, *supra* note 31 at 583.

64 Richard Nieva, "Ashes to Ashes, Peer to Peer: An Oral History of Napster", CNN MONEY (Sept. 5, 2013, 5:00 AM), <http://tech.fortune.cnn.com/2013/09/05/napsteroral-history>.

36 The second practical consideration regarding 3D printing and trademark law is that 3D printing will not play an important role in many categories of counterfeited goods. One can mention for example, food, cosmetics, and cleaning articles, which consist of ingredients that home printers are not capable of using. Even if it was theoretically possible to print such products, realistically none of the consumers would do this if he/she could buy the same products for a few Euros in the store next door. Again, the price and costs are of key importance in the practical usage of 3D printing. Moreover, the current development of this technology concentrates mainly on printing in certain type of materials, such as plastic or some textiles. It means that 3D printing is currently available only for producing the limited types of goods. This, in turn, means that for trademark considerations reprinting only limited goods could create potential for brand infringement. Therefore, the possibility of counterfeit trademarked goods through 3D printing will concern mainly luxury goods such as watches, handbags, decorative elements, which are relatively accessible through 3D printing and profitable for counterfeiters.

37 It is also important to distinguish between three types of printing: printing only the trademark; printing the whole item, to which the trademark is attached; and printing the whole item without the trademark. 3D printing enables all of these possibilities. As mentioned above, trademarks do not protect products as such, but the reference to a certain commercial source, which is connected with a company's good image and quality. Therefore, reprinting products does not infringe the trademark, unless the trademark is affixed to them. From the practical point of view, if a user decided to print the object for personal use, he/she would probably not bother to attach the trademark to it, as they would be more interested in the functional (or decorative) side of the object. Again, the luxury goods will be an exception here. Of course, when the shape was registered as the trademark or when the object consisted of engraved signs which already appeared during the printing process, this could lead to infringement. However, registering functional shapes is hardly possible under existing law and only commercial use would constitute infringement. Furthermore, 3D printing not only enables one to simply copy goods, but also provides the unlimited possibilities of editing files and makes possible the uncontrollable and easy modification of trademarked goods and a trademark itself. Users can for example personalize and customize a file, as well as create fusion or parodies of trademarked goods.[65] Thus, the user now has the practical possibility to easily remove the trademarked name or logo from products before printing (which, however, does not infringe the trademark as such) or, what is probably more detrimental from the perspective of the company, the trademark (e.g. logo, sign) can be added to the product, which does not come from the trademark owner company. For example, the sign "LV" (standing for the Louis Vuitton brand) can be attached to a no name handbag, which in turn might be sold as an original. As 3D printing can precisely recreate existing products or trademarks, it can easily transform into a new method for counterfeiting goods. Counterfeiting is not a new problem, but now it can be done by anyone at home with a 3D printer and software.

38 One of the features of 3D printing which facilitates counterfeiting is that 3D printing is based on a dataset of an object – a CAD file. The online environment enables users to share and exchange files, and to find complete projects of different items on online platforms – many of them are available to download for free. A CAD file can be produced by an individual and then released online. Producing a dataset requires some design skills (if it is created from the beginning by the individual) or a more or less sophisticated scanner technology (scanning options can be offered by 3D printers). The easiness of finding many complete projects online supports the argument that the files will be offered online by professional counterfeiters rather than produced by each individual. Professional counterfeiters are to be understood as persons who counterfeit goods for dishonest or illegal purposes and for commercial reasons. They can offer a dataset free of charge or on payment which will still be cheaper than purchasing an original product. However, further developments of reprinting and scanning technology (more effective and cheaper solutions) may result in more individuals being able to create a dataset. This also shows the more basic problem of 3D printing – this technology empowers regular users with greater tools that, if applied dishonestly, can transform them into counterfeiters and facilitate the brand's infringement. The fact that the sender does not lose his/her possession over the object while sending a file causes additional loss of a company's control over its trademark.[66] Moreover, 3D printing blurs the line between a producer and a user, as well as the line between commercial and non-commercial activities. As mentioned above, in order to constitute the infringement, the trademark protection requires "use" of the trademark in the commercial sense. In the case of 3D printing it might be difficult to determine when a CAD file or a 3D printed trademarked good is used in commerce. The judicial interpretation based on the factual situation of the specific case will probably play a key role.[67]

65 Osborn, *supra* note 31 at 585–586.

66 Scardamaglia, *supra* note 25 at 33.

67 Case US, Wickard v. Filburn, 317 U.S. 111, 128-29 (1942).

39 Taking into account only a CAD file, which includes a project of a trademarked good, the question also arises whether the file can be perceived as a product. It refers to a lively discussion, mainly in the area of product liability law, on the definition of product and the possibility of considering a digital file as a product. Currently many legal scholars, contrary to hard law rules, agree to that interpretation.[68] However, a trademark will not be used every time with the same digital file. Lucas Osborne highlights that it might happen that a file with a trademark and a design of the object will be separated, but a user will be able to combine those two files and the embedded trademark on the product.[69]

40 Even if the problem of counterfeited reprinted goods may still seem marginal (limited to certain types of 3D printed items commercially exploited), it might be a growing trend along with the further development of 3D printing. It is probably a matter of time, when companies might start losing their control over the use of their trademarks. In that scenario, companies will also face practical problems with enforcing their rights and for most of them enforcement of trademark protection may not be profitable. The costs of a court procedure are generally high, especially when the infringement of the trademark was committed by a single entity acting commercially. Even if the company decides to file a case, in practice there will be many obstacles with proving the infringement of trademark and even finding the infringer on the Internet. In the case of a single infringement of trademark, it may not be lucrative for companies to protect their rights in a court, whereas easiness, speed, and low costs of creating objects in 3D printing technology will probably increase the problem of infringement.

41 Moreover, the scope of trademark protection in the case of a registered trademark is, in principle, territorially limited. When we take into account that Internet connectivity enables us to share the files freely, territorial limitation of trademark might not be a sufficient solution. The international harmonization in terms of a uniform standard of trademark protection and the facilitation of registering trademarks definitely bring benefits to international companies. The Madrid Arrangement Concerning the International Registration of Marks and the Madrid Protocol for the International Registration of Marks (the two treaties forming the so-called Madrid System administered by the International Bureau of the World Intellectual Property Organization (WIPO) in Geneva) enable the "extension" of a trademark application made in one country to other countries, selected in the application which are the members of the Madrid Union.[70] The Madrid Union now has 98 members, which cover 114 countries and 80% of world trade.[71] This system improves the scope of trademark protection, but practical problems may arise with the enforcement of trademark owner rights.

E. Optimal Solutions

42 The above considerations show that the issue of the relationship between 3D printing and trademark law is multi-threaded. Even though it is limited only to certain problems (and goods), the growing pace of technological development will probably deepen this interaction. In the literature, a comparison of the current technological state of 3D printing and its impact on IP law can be found within the music market and the emergence of mp3 files and platforms such as Napster.[72] The significant difference between those examples lies in the possibility of modifying a CAD file, which was not the case with mp3 files. Simply put, even if users exchanged mp3 files or illegally copied them, Beyoncé's songs would remain Beyoncé's songs (even when copyright is infringed). 3D printing allows for a lot of interference in both the trademark itself and the trademarked good by manipulating the CAD file (removing or adding trademarks, reprinting whole items).

43 In search of solutions in connection with the development of new technologies, including 3D technology, it is worth referring to the proposed concept by Lessig. According to Lessig, there are four modalities that have an impact on regulating technology: legal norms, social norms, markets, and "architecture".[73] It means that hard law regulations are not the only factor that can provide adequate responses to the threats posed by 3D printing. Lessig claims that social norms can be enforced by a community; the market regulates people's behavior through prices; the "architecture" of the physical and digital world has an impact on how technology is used – the "architecture" of technology can have

68 See for example on the ground of product liability: Max Loubser & Elspeth Reid, *Product liability in South Africa* (Claremont: Juta, 2012) at 81; Contrary M A (Michael A) Jones et al, *Clerk & Lindsell on torts*, twenty-first edition. ed, Common law library (London: Sweet & Maxwell, 2014) at 847.

69 Osborn, *supra* note 31 at 585.

70 "Protocol Relating to the Madrid Agreement Concerning the International Registration of Marks", online: *World Intellect Prop Organ* </treaties/en/registration/madrid_protocol/index.html>.

71 "Members of the Madrid Union", online: *World Intellect Prop Organ* <http://www.wipo.int/madrid/en/members/>. See the list of members: <http://www.wipo.int/export/sites/www/treaties/en/documents/pdf/madrid_marks.pdf>.

72 *Ibid* at 603, 612; Scardamaglia, *supra* note 25 at 37.

73 Lawrence Lessig, "The Law of the Horse: What cyberlaw might teach" (1999) 113:2 Harv Law Rev 501 at 507 ff.

an impact on people's behavior, for example if the technology is well-designed and user-friendly it can build people's trust and encourage them to use it more often.[74]

44 How can these modalities refer to the case of 3D printing and trademark law? In the case of trademark protection, a lot depends on a company's policy. Strategic management and decision making directly influence the regulatory possibilities of "architecture" and market – for example, how much the company is motivated to protect their trademarks, what precautions it takes to protect them, how it regulates products' prices, etc. Probably, in the case of trademark and 3D printing possibilities, hard law regulations will not be an effective solution. Even if the regulations were stricter, companies would have to use a lot of power to enforce them, for example by "chasing" hobbyists and single private entities who infringe trademark use. Introducing stricter regulations, for example through tougher criminal penalties, would probably not lead to satisfactory results, if again there will be no tools to enforce them. Moreover, it might be against the principle of justice if a hobbyist was treated at the same way as well-organized criminal groups.

45 Therefore, the following parts will focus on different solutions; specifically, selling certificated 3D printable files by companies, and hard law regulations focused on liability of online intermediaries that facilitate the sending of files that can infringe trademark rights.

I. Certificated 3D Printable Files

46 The first solution is that trademark owners should create their own certificated 3D-printable files.[75] Offering certificated files for sale would be a way to adjust their business model to the new technological and "3D-prinatable" reality. The examples from the music and film industry show that their stubborn resistance to necessary changes, as well as looking for solutions only among existing legal rules (for example suing traders and users), and lack of alternative to peer-to-peer platforms do not guarantee an effective level of protection (both for companies and consumers).[76] To meet the expectations of consumers and to follow the technological trends, companies may also decide to provide users with the possibility to make changes, personalize and customize a file. This approach may help to keep the pace of technological trends and provide companies with the income, taking into account that some consumers would rather buy certificated files, if their price is reasonable or if consumers obtain additional services and benefits (e.g. access to special platforms). Selling certificated files is also profitable for companies because a company does not have to produce the whole product and in turn pay the full production costs and overheads (materials, labor force, storage costs, etc.). This proposal will be explained below in detail, considering all the advantages and disadvantages and taking into Lessig's concept of "architecture" as regulatory means. The starting point in assessing this solution would be a question: why would companies be interested in authorizing users to print and use their trademarks, if they did not have control over the quality of the product?

47 Selling authorized CAD files with a product design and trademark can potentially lead to a loss of control over a production process, the materials used, and the quality of workmanship. 3D printing technology allows users to apply different materials, which may not be the material used by the trademark owner in its production line. As a consequence, 3D printed and trademarked goods could not maintain the required level of quality and the trademarked good could convey a poor reputation for the line of products or the company itself. Therefore, the efforts of the company which has invested in the brand could fail.

48 What is more, computer software enables users to make changes in the digital design: color scheme, shape, size, etc. It is also easy to copy the content of the file, including the protected logo or design and use it in another file. Distributing files could also potentially increase the number of counterfeit products.

49 The next considerable disadvantage to this proposal concerns consumer protection. The buyer of the certificated file can print the object and use it for personal use only or can start selling the 3D printed goods. Both scenarios can have harmful effect not only for the companies, but also for the public. As mentioned above, the role of the trademark is to prevent consumers from the confusion of the origin of the good. If the trademarked good no longer gives the consumer clear information regarding the source of the product, the trademark law system starts losing its gist. Confusion can occur when the buyer uses the 3D-printed object for personal use (regardless of the fact, whether he/she uses it in public, e.g. shoes, or not, e.g. kitchen gear), as well as when he/she sells 3D-printed and trademarked goods, which can infringe trademark. Buyers

74 Lawrence Lessig, "The Law of the Horse: What cyberlaw might teach" (1999) 113:2 Harv Law Rev 501 at 509.

75 Scardamaglia, *supra* note 25 at 52–53; Osborn, *supra* note 31 at 585–586.

76 Bob Lefsetz, "Lefsetz Letter » Blog Archive » Losing The Press War", (28 November 2005), online: <http://lefsetz.com/wordpress/2005/11/28/238/>, <http://lefsetz.com/wordpress/2005/11/28/238/>.

purchasing 3D-printed but trademarked goods may wrongly believe that they are buying a product from the trademark owner. Even if 3D-printed and trademarked goods are intended for personal use, in the event of its damage, the public may associate the trademark with low quality, which will have adverse consequences for the trademark owner.

50 The problem of increasing the risk of liability for injuries caused by defective products (product liability) is not directly connected with the trademark law system, but can have impact on the company's functioning, business strategies and the general image of the brand. According to a general rule of product liability law, liable entity is a producer. Although it might be problematic to indicate a producer (a company which sells 3D files or a person who prints them), the company distributing certificated files can be involved in a causal link and thus be jointly and severally liable (under contribution or recourse rights).

51 Despite the indicated doubts regarding the possibility of selling certificated CAD files, attention should be given to the advantages. The wider possibilities of printing trademarked products at home can completely change the business models. These possibilities are based on the assumption that 3D printing will be more accessible for ordinary people. First of all, if 3D printers are becoming more widespread and companies will allow individuals to use certificated files, the counterfeit market might lose its significance. It would not make sense to buy counterfeit goods, if there is the possibility to print a trademarked good from a certificated file for a good price. Together with the file, a company may sell additional services and provide their users with benefits (e.g. access to an online platform, software, updates). The price of the certificated file and business decisions of companies are thus a crucial element of this proposal.

52 Secondly, thanks to 3D technology and certificated file sales opportunities, companies would not have to use international outsourcing.[77] Currently, a large part of production costs include the labor force. In order to decrease those costs, big companies are moving their business to China or Indonesia.[78] 3D printing technology switches to distributed manufacturing and allows more local actors to play a role in the production process. Selling certificated files for regular users could thus cut additional costs of producing goods, if the buyers are going to print (manufacture) objects by themselves. Thirdly, selling certificated files may encourage more people to wear trademarked goods, which can be perceived as a good advertisement of a product. And last but not least, selling certificated files could be the way for companies to increase their income. Taking into account the current rapid development of new technologies, especially those which are Internet-based, it is nearly impossible to control all users who can print out the fake trademarked goods anyway. By selling certificated files, companies can generate an additional income – not selling files will remain the *status quo* in which users get files for free (through hobbyist platforms, scanning software, modifying existing files, sharing files, etc.). In the future, companies and trademark owners may also decide to completely replace their production of pre-made goods and sell only printable files.

53 The above-mentioned scenario might sound too visionary; in practice, it might occur that by selling certificated 3D files, companies would lose control over their trademarks and the quality over products and 3D printing technology would be used to produce more counterfeit goods. To avoid further problems, if companies decide to sell their trademarks and designs to individuals, certain "architectural" elements of the files should be considered as a way to prevent the detrimental effects of releasing a trademark. The idea behind the sale of CAD files is that the file can be customized. However, to protect a company's interests, the number and the scope of changes or modifications might be limited. Similarly, in order to maintain the adequate level of quality of the products, the file can be restricted only to use certain types of materials to print certain products. Currently, home printers usually use only basic materials such as plastic; however, it is likely that in a few years individuals will gain more technological possibilities to print in more sophisticated materials. Moreover, 3D printed trademarked goods could have some special characteristics so that the public can recognize that the particular product was 3D printed and not manufactured by a trademark owner. In an attempt to maintain control of the quality of the products, files can be programmed to send data to companies, so that they could analyze how many products have been printed, as well as the location of the print. However, this possibility raises sensitive problems related to privacy protection.

II. Market Rules: Price Policy

54 Along with architectural changes, market rules might be also an important factor. The market can regulate people's behaviors through the price of the product.[79] Trademarked goods are usually more expensive than no-name brands. It can be part of the marketing strategy (paying more can be perceived as something more luxurious or of a higher quality)

77 Federico-O'Murchu, *supra* note 1.

78 Maney, *supra* note 24.

79 Lessig, *supra* note 73.

or it can be justified by the costs invested by a company to create a well-known brand (higher quality, advertising, etc.). Lowering the price of certificated files may prompt more people to start buying original trademarked files.

III. Social Norms: Education

55 Social norms in this case basically refer to the users' perception regarding whether or not it is wrong to use counterfeit goods (goods produced by the third party with embedded trademark) in general.[80] A report of the Organisation for Economic Co-operation and Development (OECD) and the European Union's Intellectual Property Office published on 18 April 2016, "Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact" estimates the value of imported fake goods worldwide at USD 461 billion in 2013.[81] As noted in the report, the trade in counterfeit and pirated goods hit the hardest the US, Italian and French brands and is often proceeded by organized criminal groups.[82] 3D printing can contribute to further growth of fake goods, although not all of them. The counterfeit market is now expanding its scope from items like shoes or bags, to more sophisticated goods such as pharmaceuticals.[83] 3D technology can facilitate the production of certain fake trademarked goods both by private entities and criminal groups. However, regardless of the entity that produces fake goods, the important factor is the reaction of the public and the personal will for buying counterfeit goods. Often the reason for buying or producing counterfeit goods is the lack of knowledge. A society which is well-informed about the detrimental effects of using counterfeit goods can make more conscious decisions and even generate social norms concerning whether it wants to contribute to the counterfeiting industry.

IV. The Liability for Intermediary Online Platforms

56 The last proposed solution is regulating the liability of intermediary online platforms, where CAD files are uploaded and downloaded. First of all, it is worth mentioning a recent case, Stichting Brein v Ziggo BV, XS4ALL Internet BV (Case C610/15)[84], which was resolved before the Court of Justice of the European Union. The referring court raises "the matter of the liability of operators of indexing sites of peer-to-peer networks for copyright infringements committed in the context of the use of those networks. Can those operators themselves be regarded as being the originators of those infringements, which would mean they are directly liable (first question)? Or, even if they are not directly liable, can an order be made blocking access to their websites, which, as I shall explain below, requires a form of indirect liability (second question)?"[85] The Court of Justice stated that "the concept of 'communication to the public', within the meaning of Article 3(1) of Directive 2001/29, must be interpreted as covering, in circumstances such as those at issue in the main proceedings, the making available and management, on the internet, of a sharing platform which, by means of indexation of metadata referring to protected works and the provision of a search engine, allows users of that platform to locate those works and to share them in the context of a peer-to-peer network" (para 48).

57 Although, the case is based on copyright and Directive 2001/29/EC,[86] not on trademark law, the concept of online operators' liability from this case could be transferred to online platforms where it is possible to upload and download unauthorized designs of a trademarked good or trademark itself.

58 The liability of online platforms (in general) is now widely discussed in the EU,[87] which is the expected direction of further legislation. The new liability regime for online providers is also discussed under the proposal for a Directive on copyright in the Digital Single Market.[88] In June 2018, the European Parliament voted in favor of new liability regimes under Article 13 of the proposal, which makes online

80 "Dan Ariely Explains the Problem With Fake Fashion: Part One", (3 July 2012), online: *High Low* <http://thehighlow.com/2012/07/dan-ariely-explains-the-particular-problem-with-fake-fashion-part-one/>.

81 "Trade in Counterfeit and Pirated Goods: Mapping the Economic Impact", online: *OECD ILibrary* <http://www.keepeek.com/Digital-Asset-Management/oecd/governance/trade-in-counterfeit-and-pirated-goods_9789264252653-en>; "Global trade in fake goods worth nearly half a trillion dollars a year - OECD & EUIPO - OECD", online: <http://www.oecd.org/industry/global-trade-in-fake-goods-worth-nearly-half-a-trillion-dollars-a-year.htm>.

82 note 80.

83 Steve Hargreaves, "Counterfeit goods market is booming and becoming more dangerous", (27 September 2012), online: *CNNMoney* <http://money.cnn.com/2012/09/27/news/economy/counterfeit-goods/index.html>.

84 Stichting Brein v Ziggo BV, XS4ALL Internet BV (Case C610/15), ECLI:EU:C:2017:99.

85 *Ibid*.

86 Directive 2001/29/EC of the European Parliament and of the Council of 22 May 2001 on the harmonisation of certain aspects of copyright and related rights in the information society, OJ L 167, 22.6.2001, p. 10–19.

87 "Online Platforms", online: *Eur Comm* <https://ec.europa.eu/digital-single-market/en/online-platforms-digital-single-market>.

88 Proposal for a directive on copyright in the Digital Single Market, COM/2016/0593 final - 2016/0280 (COD).

platforms liable for copyrighted material.[89] In 2019 the final wording of the Directive will be put to the vote.

F. Conclusions

59 The aim of this paper was to answer the question how, and to what extent, 3D printing can interfere with the trademark law system. To answer it, as a starting point, 3D printing was presented as a new disruptive technology. According to research, this technology with its freedom, easiness, and low costs of designing and printing objects can have a significant impact on society, economy and also law. Trademark law is one of the areas of law which might be influenced by 3D printing. First of all, there is a matter of registering three-dimensional objects as trademarks, which is generally not possible under existing law regulations. Secondly, although one may claim there is no significant potential impact of 3D printing on trademark law, the paper stated that democratization and dissemination of the manufacturing process, participation of hobbyists, the significant importance of CAD file, and the possibility of its modification, and worldwide scope of 3D printing based on the Internet may have an impact on the trademark law system. 3D printing was presented as a technology which empowers regular users with greater tools that, if applied dishonestly, can transform them into counterfeiters and facilitate infringement of a brand. Even though the problem of counterfeited reprinted goods may still seem marginal (limited to a certain types of 3D printed items commercially exploited), it might be a growing trend along with the further development of 3D printing.

60 Next, the paper analyzed possible solutions to prepared companies and consumers for this trend, which are based on Lessig's idea of four modalities: law, market, social norms and architecture. In the area of trademark law, stricter hard law regulation might not be an adequate response, thus we have to look for solutions in selling 3D printed certificated files by trademark owners, price regulation, and better educational programs on counterfeit goods. From the hard law perspective, establishing clear rules of liability for intermediary online platforms seems to be of key importance.

61 Hopefully, the solutions described above will enable the adjustment of the trademark law system to a new 3D printing reality. Then we can start thinking big, get excited about the great potential of 3D printing, and finally buy our first 3D printer.

89 See the comments: Matt Reynolds, "What is Article 13? The EU's divisive new copyright plan explained", (7 December 2018), online: *Wired* <https://www.wired.co.uk/article/what-is-article-13-article-11-european-directive-on-copyright-explained-meme-ban>; Tom Bedford, Emma Sims, "Article 13 approved: What are the EU copyright law amendments?" (10 December 2018), online at: *Alphr* <https://www.alphr.com/politics/1009470/article-13-eu-what-is-it-copyright>.