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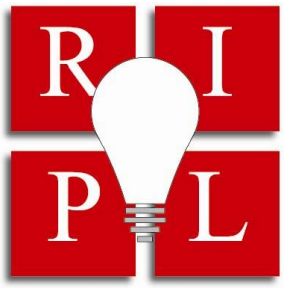

THE EMERGENCE OF THE INNOVATIVE ENTITY: IS THE PATENT SYSTEM LEFT BEHIND?

TALYA PONCHEK

ABSTRACT

This article is concerned with the question of whether the United States patent system achieves its goal, set by policymakers, to promote innovation. The article provides a systematic review of two bodies of literature and how each of them perceives the process and identity of the innovator. First, a review of the development of U.S. patent system, from pre-legislation England to the U.S. federal system, alongside the developments of the classical reasoning for property rights allocation, revealing that as the Anglo-American patent system is rooted in the privileges system, it views innovation as the creation of an individual inventor. Second, a review of the "evolution" of innovation production theories, and how their focus has shifted from the individual innovator to the sole firm, focusing these days on cross-organizational collaborations as an innovation generator. The review reveals a gap between how innovation is actually produced and how it is viewed by the Patent Act. This lack of congruence raises concerns regarding the ability of the Patent Act to fulfill its goal to foster innovation and provide the appropriate incentives to that end. The article asserts that policymakers should view innovation as the result of an intellectual effort by an 'innovative entity,' as opposed to a single inventor. The article analyzes where the Patent Act falls short of incentivizing the establishment of such an innovative entity, discussing in detail the sections regulating inventorship and ownership and the Act's libertarian property regime. Following a conclusion that the current U.S. Patent Act does not provide sufficient incentives required for the initiation of cross-organizational research and development (R&D) collaboration and the establishment of the innovative entity, it calls policymakers to address these issues. This is in order to ascertain the Act's ability to promote innovation and provide signals to actors operating in the innovation ecosystem that cross-organizational R&D collaborations are desired.

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TALYA PONCHEK*

I. INTRODUCTION

Innovation is the key component in the development of nations through technological progress. It is the driver of national and global economic well-being and competitiveness of nations.[1]

The patent system is generally considered to be the primary policy tool to promote innovation, encourage the development of new technologies, and increase the body of human knowledge.[2] It does so by providing a one-size-fits-all tool, in the sense that all inventions, irrespective of technological field, must satisfy the same statutory patentability criteria.[3] This article is concerned with the question of achieving this goal. The setting for this article is the United States Patent Act.

This article postulates that while innovation production theories have undergone (and still go through) an "evolution," the patent system may become less effective in achieving its goal for lack of congruence between its view of the innovation process and how innovation is really carried out.

The terms 'innovation' and 'invention' denote different stages on the innovation production continuum. Invention is associated with the first link in the innovation process, the generation of new ideas, conducting research and development (R&D) activities. Innovation refers to the commercialization process of the output, leading its distribution and diffusion to potential markets. Not every invention is commercialized and released to the market. The opposite is true as well; not every innovation

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[1] Maxim Kotsemir, Alexander Abroskin & Meissner Dirk, *Innovation Concepts and Typology – An Evolutionary Discussion* 3 (Higher School of Economics Research Paper No. WP BRP 05/STI/2013), available at: http://ssrn.com/abstract=2221299.

[2] Dan L. Burk & Mark A. Lemley, *Is Patent Law Technology-Specific?*, 17 BERKELEY TECH. L.J. 1155, 1176 (2002). Ofer Tur-Sinai, *Technological Progress and Well-Being,* 48 LOY. U. CHI. L.J. (forthcoming 2016), http://ssrn.com/abstract=2590038.

[3] *See id.* at 1155. *But cf.* Sean B. Seymore, Atypical Invention, 86 NOTRE DAME L. REV. 2057, 2058–59 (2011) (citing several scholars who criticize the one-size-fits-all attribute of the patent system).

originates from an invention. For the purpose of the argument I wish to make in this article, and unless stated otherwise, I postulate that the image of the innovator in this article coincides with that of the inventor. This relies on the common view of the patent system as an enabler of commercialization activities,[4] originating from our modern understanding of the patent system's role.

The question of whether the patent system achieves its goal is discussed in this article by presenting the following argument: the incentives the patent system provides are currently directed towards the individual inventor/innovator whereas, in light of our newfound understanding of how innovation is produced,[5] they should address an entity, which I refer to as an 'innovative entity.'[6] To provide a basis for this premise, this article is divided into four parts.

The article begins with Part II which includes a theoretical analysis of the development of the innovator's image as the individual inventor through the eyes of the patent system. The idea of an exclusive privilege

> originated with the feudal custom of granting the lord of the manor the right of holding and controlling a market or a fair. The royal grant of such right involved the element of exclusion, although it was limited only in the sense that no other fair or market could be held within a distance determined by the royal grant. Within the market or fair, however, there was free competition.[7]

The origin of the U.S. patent system is the historical English monopolies granted by the monarchs. The Anglo-American patent system made its greater advances through the unprecedented and frequent uses to which Queen Elizabeth I put her prerogative were quite unlike any exercise of this sovereign power before.[8] Some call these years "the birth years of the English patent system."[9] The enactment of the 1624 Statute of Monopolies signifies the initiation of the modern patent system.[10]

In those days the 'patent system,' which did not resemble our modern day system, was mainly concerned with attracting artisans and craftsmen to create new industries in England. For this reason, it was focused on providing incentives on the individual level, focused on a specific person.[11] The aim here, however, is not to cover the vast history of the development of modern day patent system, but the theoretical analysis is concerned with the identity of the innovator as it emerged through the years.

The notion of the individual at the center of the innovation process, in the eyes of the law, developed in the nineteenth century with the rise of justifications for ownership of intellectual assets, alongside civil liberties and notions of private

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[4] *But cf.* Ted Sichelman, *Commercializing Patents*, 62 STANFORD L. REV. 341 (2010).

[5] *See* Talya Ponchek, *To Collaborate or Not to Collaborate? A Study of the Value of Innovation from a Sectoral Perspective*, 7 J. KNOWL. ECON. 43 (2016) [*hereinafter* Ponchek (2016)] (offering empirical evidence to support this notion).

[6] *See infra* Part V.

[7] Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 2)*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 849, 851 (1994) [hereinafter Walterscheid (1994)].

[8] Ramon A. Klitzke, *Historical Background of the English Patent Law*, 41 J. PAT. & TRADEMARK OFF. SOC'Y 615, 628 (1959).

[9] *Id.*

[10] Pasquale Joseph Federico, *Origin and Early History of Patents*, 11 J. PAT. & TRADEMARK OFF. SOC'Y 292, 294 (1929).

[11] *See infra* Part II.

property.[12] Some even view the Intellectual Property Clause of the Constitution as representing a property right bestowed upon inventors (and authors).[13] The U.S. federal patent system was shaped by these discussions. The theories developed to justify the inventor's ownership in his intellectual output, place emphasis on the individual inventor. These justifications included a mix of both natural rights to control and enjoy fruit of labor and utilitarian arguments. These arguments were based on the same underlying concept: inventors as individuals who create new technological innovation through their intellectual capacity.[14] The discussion of the development of the image of the innovator in the eyes of the patent system is divided into two: Part II discusses the development of the patent system, from pre-legislation England to the American federal system; Part III is focused on justifications to intellectual property rights, stemming from the discussions of property rights in the eighteenth century. Though the development of the federal system was greatly influenced by the discourse of property rights, this article discusses them separately as it distinguishes between a positive discourse (Part II) and a normative discourse (Part III).

Despite the changes the patent system has undergone over the years, one main attribute remains constant: the patent system views innovation as an individual endeavor. The innovator is the intellectual genius: "an individual who creates new ideas though his intellectual capacities."[15] American culture loves its individual innovators: Thomas Edison, Alexander Graham Bell, Henry Ford, David Packard, Steve Jobs, and Bill Gates were all given a place in the hall of fame of individual inventors.[16] The problem is however that innovation production theories do not share this view.

Innovation production theories indeed once held the same notion that innovation is conducted by a single entrepreneur, the individual innovator, who single handedly develops her innovation. This viewpoint was shared across disciplines: sociologists, anthropologists and economists, led by Schumpeter, at what came to be known as

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[12] Hans Morten Haugen, *Intellectual Property Rights – Rights of Privileges?*, 8 J. WORLD INTELL. PROP. 445, 448 (2005).

[13] *See infra* Part II.C, n. 100.

[14] Oren Bracha, *Geniuses and Owners: The Construction of Inventors and the Emergence of American Intellectual Property*, *in* TRANSFORMATION IN AMERICAN LEGAL HISTORY: ESSAYS IN HONOR OF PROFESSOR MORTON J. HOROWITZ 369, 374–75 (Daniel W. Hamilton & Alfred L. Brophy eds., 2009) [hereinafter Bracha (2009)].

[15] *Id*. at 374.

[16] Michael J. Meurer, *Inventors, Entrepreneurs and Intellectual Property Law*, 45 HOUS. L. REV. 1201, 1202–03 (2008); *See, e.g.*, Christopher A. Cotropia, *The Individual Inventor Motif in the Age of the Patent Troll*, 12 YALE J.L. & TECH. 52, 54 (2009); Edward G. Greive, *The Doctrine of Inventorship: Its Ramifications in Patent Law*, 17 W. RES. L. REV. 1342, 1342 (1966) ("The traditional inventors were usually individuals like Thomas Edison, who alone had 1039 patents issued to him."). *But c.f.*, Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 745 (2012) (claiming that the canonical story of the lone genius inventor is largely a myth, since almost all the great inventions, which were invented by individuals, were in fact invented simultaneously or nearly simultaneously by two or more people working independently of each other); and John Lienhard, *Reflections on Information, Biology, and Community,* 32 HOUS. L. REV. 303, 309 (1995) ("We all recite the myth of the lonely intellectual. Yet, creativity, with all its need for retreat and isolation, is not a lonely act after all. If great inventors like Edison or Bell had one overriding form of genius, it was a genius for forming communities of open and inventive collaborators around themselves. These scholars, too, treasured community.").

Schumpeter Mark I theory. The first crack in this notion was the emergence of Schumpeter Mark II theory, which placed the organization at the center of the innovation system, and not the individual innovator, as research became corporate.

Since then, however, views of how innovation is produced have evolved and changed drastically. This evolution is the result of the realization that the knowledge, skills and resources needed to produce innovation may reside in other organizations operating in the innovation ecosystem. Thus placing emphasis on innovation production via collaborations and interactions.[17] Part IV provides a theoretical analysis of the "evolution" of innovation production theories during the twentieth century.

The evolution of innovation production theories raises concerns regarding the patent system's role in providing incentives to invent and innovate. While innovation production theories have adapted to the changing times, the patent system remains largely the same, holding to a great extent the eighteenth century's views of how innovation is produced.[18] Part V discusses the concerns this incompatibility portrays. The discussion begins with an introduction of the innovative entity. It then continues to discuss specific sections of the Act that were meant—at least in the eyes of Congress—to address the issue of collaboration and innovation, but fall short.[19] These "designated" sections do not provide sufficient incentives to promote the establishment of the innovative entity and therefore the development of innovation. But the problem does not end there. The property regime portrayed in the Act provides more impediments on the establishment of an innovative entity.

The rights granted by the Patent Act can be conditioned by parties to a contract, thus overcoming the barriers identified in Part V. Nevertheless, one should not easily overlook and dismiss the significance of amending the Act, consequently providing the necessary incentives.

This article is innovative in the sense that it adds to current literature a theoretical analysis of 35 U.S.C. § 116 and 262, specifically with regard to innovation production, tying it to its historical roots. The literature pertaining these sections does so with regard to the subject of correct joint inventorship and the outcomes of omitting an inventor's name from the patent application.[20] Though this is an important aspect of the Act, it is a narrow one nonetheless. This article offers a broader analysis of the Act in light of its objective to foster innovation.

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[17] *See infra* Part IV (providing a theoretical analysis of the "evolution" of innovation production theories during the twentieth century).

[18] *See infra* Part V (discussing the concerns this incompatibility portrays).

[19] Christopher McDavid, *I Want a Piece of That! How the Current Joint Inventorship Laws Deal with Minor Contributions to Inventions*, 115 PENN ST. L. REV. 449, 453 (2010) ("Congress believed that the amendment "recognize[d] the realities of modem team research").

[20] *See, e.g.*, Rivka Monheit, *The Importance of Correct Inventorship*, 7 J. INTELL. PROP. L. 191, 192 (1999); Bradley M. Krul, *The 'Four Cs' of Joint Inventorship: A Practical Framework for Determining Joint Inventorship*, 21 J. INTELL. PROP. L. 73 (2013); Bruce M. Collins, *The Significance of Inventorship Determinations*, 7 APLA Q. J. 117 (1979); Adam J. Sibley & Rodney L. Sparks, *The Difficulty of Determining Joint Inventorship, Especially with Regard to Novel Chemical Compounds and Their Applications*, 8 LOY. L. & TECH. ANN. 44 (2009).

II. FOSTERING INNOVATION: FROM GUILD MONOPOLY TO PRIVATE INDIVIDUAL RIGHTS

This Part aims to provide a glimpse into how the patent system came to view innovation as being done by an individual. The following discussion moves from the eleventh century to the current U.S. Patent Act. It does not provide a comprehensive historical review, but instead focuses on main events leading to the development of the modern patent system.[21]

Despite this article's focus on the Anglo-American patents system, the modern patent system was not founded in England. The custom of granting limited term monopoly privileges to inventors or importers for introducing new trade or industry began in Italy, particularly in Venice late in the fourteenth and early in the fifteenth century. From there it spread to Germany, France, the Netherlands, and England. The practice of granting monopoly privileges was widely followed in many parts of western and central Europe in the sixteenth and seventeenth centuries. Privileges were granted to inventors or importers almost everywhere in Europe. Patent privileges were merely one type in the large genus of privileges, charters, franchises, licenses, and regulations issued by the Crown. Thus, apart from its expression in statute form, the patent system is not chiefly an English creation. It was developing simultaneously in several countries at about the same time, though not at the same rate.[22] As the focus here is the development of the U.S. patent system, based on English common-law, while civil-law is the system on which the legal regime is based in the rest of Europe, this article reviews only the development of the Anglo-American patent system.

A. The English Ancestor

A preliminary word is in order. The reader must note that the term "patent," as understood prior to the establishment of the U.S. federal system, is nothing similar to its current meaning and it is not what we now know as a "patent."

1. Pre-Legislative History

The foundation of the patent system was laid long before the United States of America. The foundation of the patent system as we know it today was placed as far

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[21] The body of literature discussing the history of the patent system is vast and wide-ranging. *See, e.g.*, Fritz Machlup & Edith Penrose, *The Patent Controversy in the Nineteenth Century*, 10 J. ECON. HISTORY 1, 3 (1950); Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 3 continued)*, 77 J. PAT. & TRADEMARK OFF. SOC'Y 847 (1995).

[22] Walterscheid (1994), *supra* note 7, at 689–715. *See e.g.*, Craig Allen Nard & Andrew P. Morriss, *Constitutionalizing Patents: From Venice to Philadelphia*, 2 REV. OF LAW & ECON. 2, 264, available at: http://ssrn.com/abstract=585661; Edward C. Walterscheid, *To Promote the Progress of Useful Arts: American Patent Law and Administration, 1798-1836 (Part 1)*, 79 J. PAT. & TRADEMARK OFF. SOC'Y 61 (1997) [*hereinafter* Walterscheid (1997)].

as the medieval guild practices in Europe.[23] At this time it was recognized that the Crown had the right to grant any part of the common property of the nation to individuals provided that such grant would benefit the public.[24] Acting upon this idea of promoting the public interests the British monarchs granted these privileges.[25] English monarchs, since the fourteenth century, made periodic attempts to aid the development of new industries through importation mainly, and local inventions.[26]

The concept of *group as opposed to individual monopoly* had long been known and practiced in England. The first attempts to protect knowledge was done by the craft guilds. They recognized the value of their craft knowledge and made considerable efforts to control and limit its availability within the membership of the guild.[27] And so guilds operating in England were granted *group monopolies*.

During the eleventh century the guild system made its appearance in England. It flourished in the thirteenth and fourteenth centuries and continued through the eighteenth century, though declined.[28] By the fifteenth century many guilds had already developed a proprietary view of their knowledge resources.[29] The guilds' asserted that they owned the craft knowledge and practices of their occupation. This exhibits the recognition of value that could be gained from the organized control of valuable knowledge on behalf of the group members who stood to gain from its exploitation.

The guilds were actually a group monopolies sanctioned by the state and were *never granted to one person*.[30] With the growth of towns in the eleventh century, "merchants began to protect themselves by forming guilds, obtaining by charter the sole right of regulating trade within a town. They could thus monopolize all trade including, not only the sale of goods, but also all manufacturing."[31] These group monopolies were "necessarily municipal or regional in character"[32] and were apparent throughout Europe.[33] Private monopolies, however, were still to come. The guilds set the stage for the subsequent private monopoly patents. It was an easy step from the

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[23] Kenneth L. Sokoloff & B. Zorina Khan, *Intellectual Property Institutions in the United States: Early Development & Comparative Perspective*, available at: http://www.dklevine.com/archive/sokoloff-kahn.pdf.

[24] Federico, *supra* note 10; Klitzke, *supra* note 8, at 622 ("[T]he right of the Crown to grant privileges for new trades was recognized very early . . . [T]he right of the English sovereign to grant privileges was of ancient origin and was derived from the early common law").

[25] Federico, *supra* note 10, at 293.

[26] Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 2)*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 849, 850 (1994)]*hereinafter* Walterscheid (1994)].

[27] Susan Sell & Christopher May, *Moments in Law: Contestation and Settlement in the History of Intellectual Property*, 8 REV. INT'L POL. ECON. 467, 475 (2001).

[28] Walterscheid (1994), *supra* note 26, at 851.

[29] Pamela O. Long, *Invention, Authorship, Intellectual Property and the Origin of Patents: Notes Toward a Conceptual History*, 32 TECH. & CULTURE 846, 875 (1991) (arguing that it is within medieval cities the attitude developed that craft processes constituted intangible property with commercial value subject to conditions of ownership).

[30] Klitzke, *supra* note 8, at 622.

[31] *Id*. at 621-22.

[32] Walterscheid (1994), *supra* note 7, at 852.

[33] E. Wyndham Hulme, *The History of the Patent System Under the Prerogative and at Common Law*, 12 L. Q. REV. 141, 141-42 (1896).

guild monopolies to the private monopolies, once the sovereign had fully established his power over the regulation of trade.[34]

The purpose of the group monopolies granted to guilds was to prevent non-guild members from competing with the members. Within the guild "there was free competition in selling and manufacturing but competition from outsiders was prevented. Trade was carefully regulated and price maintenance was practiced," though sometimes the monopoly power was abused.[35] Though a monopoly was provided to the guild as one body—recognizing it is comprised of various individual craftsmen—the competition within the guilds allowed those individuals to still compete between themselves and maintain the individual nature of craftsmanship.

The shift from group monopoly to individual monopoly was twofold. First, these guilds had frequently abused their monopolistic powers.[36] Within the guild there was free competition in selling and manufacturing but competition from outsiders was prevented. Second, the power of the guilds declined as the industry was becoming national rather than local.[37] Starting as early as the fourteenth century, "[T]he Crown had made periodic attempts to aid the development of new industries mainly by importation . . . The primary mechanism used to encourage the development of national manufactures and industries was the use of the royal prerogative to grant certain privileges by means of letters patent" to individuals "who would introduce new industries,"[38] also referred to as "letters patent of monopoly for invention."[39] The term "invention" meant the establishment of a new trade or industry, either through importation or through actual discovery of new technology. It was not required that the grantee be the "inventor" in the modem context and frequently was not. "There was a requirement for novelty, but only in the sense that the 'invention' had not been worked in England" before.[40] These were a subdivision of "letters patent for privileges," or simply "letters patent" granted to induce the grantee to engage in a business that would benefit the public.[41] "Letters patent" was the name of official documents by which all kinds of monopolies were granted, both legal and illegal.[42]

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[34] Klitzke, *supra* note 8, at 622-23.

[35] *Id*. at 622; Federico, Federico *supra* note 10, at 296.

[36] Walterscheid (1994), *supra* note 7, at 851.

[37] Federico, *supra* note 10, at 296.

[38] Walterscheid (1994), *supra* note 7, at 850. This letter of patent was not given to the inventor, but to residents who were importing technologies discovered elsewhere. *See* Sokoloff & Khan, *supra* note 23, at 3 (this practice was widespread in most European nations of that time); Walterscheid (1994), supra note 7, at 855-56 (Elizabethan monopoly patents were primarily granted for the importation of new industry); Federico, *supra* note 10, at 293.

[39] Walterscheid (1994), *supra* note 7, at 850.

[40] *Id*. at 870.

[41] Giles S. Rich, *Are Letters Patent Grants of Monopoly?*, 15 W. NEW ENG. L. REV. 239, 241 (1993).

[42] Rich, *supra* note 41, at 247-48 ("In England, over three centuries ago, the word "monopoly" was associated in the public mind with privileges of sole selling, to be sure, but more often than not with the sole selling of things that had previously been in the public domain. Such privileges deprived the public of some of the freedom and liberty that it had enjoyed before and hurt where it hurt most, in the pocketbook . . . If the public had the same thing before, the monopoly is illegal; if it got the thing from the patentee, the monopoly is legal."). These illegal monopolies were referred to as "*Odious Monopolies*." They were a common practice during Queen Elizabeth I and her successor King James I reign. *See* Walterscheid (1994), *supra* note 7, at 853-54, 862-71. Some view all types of monopolies as illegal. *See* EDWARD COKE, 3 INSTITUTES OF THE LAWS OF ENGLAND 181 (1797). However, he did not discuss patents nor inventions. *Id*.

They were an administrative channel for conferring privileges and exercising royal power.[43] These "patents" are very different then what we know today as the meaning of words like "patents" often changes with time and place.[44] These "letters patent" were very different than modern days patents.[45] Letters patent of monopoly for invention were just another form of public royal grants like any other royal grants (*e.g.*, land, offices or honors), aimed to entice foreign artisans.[46] They were not granted to the inventor but to the importers of new trades or crafts, the manufactures, and did not allow the selling of goods.[47] The widen and duration of these grants were not constant and were at the sole discretion of the Crown. Some grants encompassed a wide range of rights, while others were narrower.[48]

The term "letters patent" literally referred to the official document used in such grants: an open letter (*literae patentes*) addressed to the public that announced the privileges conferred by the Crown upon a specific individual.[49] But in the middle of the sixteenth century, during the Tudor dynasty reign, "instead of issuing letters patent to foreign artisans" to benefit the public, "the Crown began to negotiate in secret for the purpose of attracting skilled" foreign artisans into the Crown's service,[50] issuing closed letters (*literae clausae*).[51] The importance of the this practice to the discussion here is the fact that this practice further escalated during the reign of Queen Elizabeth I leading to the enactment of 1623 Statute of Monopolies.

In the early days, however, the privileges granted did not involve any monopoly "but instead were directed to such things as offering the [Crown's] protection and franchises to those introducing the new trade or craft", and were known as "letters of protection."[52] They lacked any element of privilege of exclusivity or a monopoly bestowed on the artisan. These letters of protection provided the Crown's protection to foreign artisans to induce them to come to England and a license to practice their trade in spite often being in conflict with the charters of a guild.[53]

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[43] Oren Bracha, *The Commodification of Patents 1600-1836: How Patents Became Rights and Why We Should Care*, 38 LOY. L. A. L. REV. 177, 184 (2004) [*hereinafter* Bracha (2004)].

[44] Rich, *supra* note 41, at 241.

[45] *See* Ranon A. Klitzke, *Historical Background of the English Patent Law*, 41 J. PAT. & TRADEMARK OFF. SOC'Y 615, 637-38 (1959) (discussing these differences).

[46] Bracha (2005), *supra* note 43, at 184. Some letters patents for invention were actually granted to individuals that could be considered inventors under our modern understanding of "invention," only to invite them to operate in England, though this was not the purpose. The first patent for a newly invented process was granted to John of Shiedame and his company in 1440. He was invited to introduce a method of making salt on a scale which was never attempted before in England. *See* Hulme, *supra* note 33, at 143.

[47] Walterscheid (1994), *supra* note 7, at 870.

[48] Federico, supra note 10, at 298 ("The nature and conditions of each grant varied greatly, some specifically reserved the rights of the users of old machines, others covered not oily the instant invention but also all subsequent improvements, some required the employment of a number of apprentices and, in the case of foreign patentees, the employment of native apprentices was stipulated. There was no fixed period for the duration of the patent, the first few granted were for ten years but later six, seven, twenty, twenty-one and thirty years were common").

[49] Bracha (2004), *supra* note 43, at 184.

[50] Federico, *supra* note 10, at 293; Walterscheid (1994), *supra* note 7, at 850.

[51] Oren Bracha, *Owning Ideas: A History of Anglo-American Intellectual Property*, 9 (2005) (S.J.D. dissertation, Harvard Law School), *available at* https://law.utexas.edu/faculty/obracha/dissertation/ [*hereinafter* Bracha (2005)].

[52] Walterscheid (1994), *supra* note 7, at 850.

[53] Klitzke, *supra* note 45, at 623-24.

Letters patent were a creature of royal prerogative and in the sole discretion of the monarch. The monarch granted all letters patent as "a matter of grace and favour."[54] The grant process was based on case-specific policy decisions of the monarch to confer particular privileges on a certain individual in order to promote some economic, social, or political goal.[55] While some general policy may have applied with regard to certain grant applications, each grant was an independent decision based on the exercise of specific discretion and a weighing of the interests involved. "Each grant created its own tailored set" of the public benefits a grantee was expected to supply and the privileges bestowed.[56] The process of issuing such letters patent included an examination if such privilege is for the public good.[57] The monopoly bestowed upon the artisan, "as opposed to a mere privilege, while also obtainable from the sovereign, was in derogation of the common right of freedom of trade and could not be granted without some consideration" of the public good.[58]

Queen Elizabeth I grants were attacked most vigorously. As she "acceded to the English throne, the country was still far behind in industrial arts in comparison to the continental Europe.[59] She continued granting letters patent in order to further develop the national industry by importing skilled artisans and entrepreneurs to introduce new industries in England.[60] The Queen flagrantly misused her prerogative by granting monopolies in industries which were already established in England."[61] This practice led to the legislation of the first Anglo-American patent law.[62]

2. The Statute of Monopolies of 1623

The previous section discusses the abuse of guilds' monopolistic powers which resulted in their disappearance from commerce life in England. However, the guilds

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[54] Bracha (2004), *supra* note 43, at 186.

[55] George Ramsey, *The Historical Background of Patents,* 18 J. PAT. & TRADEMARK OFF. SOC'Y 6, 6-9 (1936).

[56] Bracha (2004), *supra* note 43, at 185-86.

[57] Federico, *supra* note 10, at 293.

[58] Klitzke, *supra* note 45, at 625-26.

[59] *Id.* at 632.

[60] *Id.* at 633. *See, e.g.*, CHRISTINE MACLEOD, INVENTING THE INDUSTRIAL REVOLUTION: THE ENGLISH PATENT SYSTEM, 1660-1800, 11 (1988) ("[A]cquisition of superior Continental technology was the predominant motive for the issue of patents under the guidance of Elizabeth I's chief minister, William Cecil, later Lord Burghley").

[61] Klitzke, *supra* note 45, at 633.

[62] Such grants were attacked most vigorously in the Parliament. *See* Klitzke, *supra* note 45, at 633. Though outside the scope of this article it is worth mentioning one of the prominent antecedents that led to the enactment of the Statute, that is, the case of *Darcy v. Allen*, 77 Eng. Rep 1620 (K.B. 1603) (known also as the Case of Monopolies) [*hereinafter* Case of Monopolies]. Edward Darcy held a patent for the sole importing, making, and selling of playing-cards. A London haberdasher, Allen, infringed the patent and Darcy brought suit. The court held that the queen had been "deceived" in granting the patent and that it was contrary to common law. *See* Federico, *supra* note 10, at 301. Though the Statute was not enacted directly after the decision in this case, the uproar of the public caused by the Crown's grants alongside this decision and previous attempts to enact the legislation led the Parliament, 20 years later, to finally legislate the Statute. *See* D. Seaborne Davies, *Further Light on the Case of Monopolies*, 48 L. Q. REV. 394 (1932), for a comprehensive discussion of the Case of Monopolies.

were not the only to abuse their power. Queen Elizabeth I provided her grantees with arbitrary powers to search the stores and houses of suspected infringers, and collect heavy penalties from the guilty.[63] These grantees often knew little of the particular art, and were granted a monopoly as the Crown's treasury was low in funds.[64] The monopoly system became a system of plunder.[65] As the grant of letters patent was considered part of the royal prerogative, and was given by the favor and grace of the Queen, the Crown regarded itself as the sole patron and arbitrator of any dispute related to the new industries introduced by the authority of its letters patent.[66] Letter patents were rarely disputed in the courts of common-law, as appealing to the courts would have been considered disrespectful of the Queen's authority and was viewed as a challenge on her absolute right of jurisdiction in all disputes arising from the letters patent.[67] There was also no established right which allowed a challenge to the validity of royal grants in the courts of common-law. Thus, letters patent became constant sources of resentment.[68] Following the public protests against the letters patent there were several attempts to legislate a bill to limit the Queen's prerogative.[69]

The Statute of Monopolies of 1623 was enacted on May 1624.[70] The Statute repealed the practice of royal monopoly grants declaring:

> [T]hat all monopolies and all commissions, grants, licenses, charters, and **letters patents** heretofore made or granted, or hereafter to be made or granted to **any person or persons** . . . or **corporate** . . . for the sole buying,

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[63] Federico, *supra* note 10, at 299.

[64] The Queen obtained her share of the money by charging annual rents for the patents, either by a cash payment or a share of the profits from a grant. *See* Klitzke, *supra* note 45, at 623; Federico, *supra* note 10, at 299; Nard & Morriss, *supra* note 22, at 264.

[65] Klitzke, *supra* note 45, at 644.

[66] Federico, *supra* note 10, at 298-99.

[67] E. Wyndham Hulme, *The History of the Patent System Under the Prerogative and at Common Law*, 12 L.Q. REV. 141, 151 (1896); Ramon A., Klitzke, *Historical Background of the English Patent Law*, 41 J. PAT. & TRADEMARK OFF. SOC'Y 615, 637-38 (1959).

[68] *Id.* at 299.

[69] The distress and annoyance caused by the letters patent and the abusive conduct of the grantees led to many protests being raised in Parliament. The Queen managed to control these protests, which were manifested in the form of bills aimed at legislating the process of granting letters patent. She managed to push away the Parliament's first attempt in 1597. However, she was unable to resist the Parliament's second attempt in 1601. In her speech in Parliament, the Queen granted the courts of common-law the jurisdiction to decide which grants should be allowed to stand. She issued a proclamation revoking at once the worst monopolies and leaving the others, free from any restraint, to be tried in the courts of common-law, thus leaving it to the courts to decide what grants should be allowed to stand, and guaranteed immunity to those seeking to test the monopolies' validity. The bill in parliament was then withdrawn. The Queen asserted and retained to the end of her reign the absolute right of jurisdiction in all disputes arising out of those grants. The Case of Monopolies was one of the first cases brought to court following the Queen's proclamation. Her successor, King James I, however was not as successful, and the situation was worse than in the previous reign. *See* Federico, *supra* note 10, at 300-02. It was during the reign of Elizabeth's successor, James I, in 1924 that the *Statute of Monopolies* was passed. Rich, *supra* note 41, at 242. *See* Nard & Morriss, *supra* note 22, at 271-88 (discussion of James I reign until the enactment of the Statute). *But cf.*, it has already been ascertained, but not widely recognized, that James I supported the passage of the Bill. *See* Chris R Kyle, *"But a New Button to an Old Coat": The Enactment of the Statute of Monopolies, 21 James I Cap 3*, 19 J. LEGAL HISTORY 203, 218 (1998).

[70] Statute of Monopolies of 1623, 21 Jac. 1, c. 3 (1624) (Eng.), *available at*: http://www.ipmall.info/hosted_resources/lipa/patents/English_Statute1623.pdf.

> selling, making, working, or using of anything within this realm . . . are altogether contrary to the laws of this realm, and so are and shall be utterly void and of none effect . . . .[71]

The declaration in Section 1, above, that all monopolies, including letters patents are contrary to the law, was the heart of the Statute.[72] Having said that, the statute limits the categorical ban on monopolies:

> (a) Provided also, that any declaration before mentioned shall not extend to any letters patents (b) and grants of privilege for the term of fourteen years or under, hereafter to be made, of the **sole working or making of any manner of new manufactures** within this realm (c) **to the true and first inventor** (d) **and inventors** of such manufactures, which others at the time of making such letters patents and grants shall not use (e), so as also they be not contrary to the law nor mischievous to the state by raising prices of commodities at home, or hurt of trade, or generally inconvenient (f): the same fourteen years to be accounted from the date of the first letters patents or grant of such privilege hereafter to be made, but that the same shall be of such force as they should be if this act had never been made, and of none other (g). [73]

This section served as the basis of the English patent law for more than two hundred years.[74] It excluded several classes of grants from the categorical ban on monopolies: letters patents were not to be prejudiced by the statute if they had been granted for new inventions for not more than fourteen years.[75] The meaning of the term "to invent" was "to originate, to bring into use formally or by authority, to found, establish, institute or appoint."[76] The "inventor" in the Statute is not the inventor of modern day "invention."[77]

The Statute did not present fundamentally new ideas. The principles proclaimed were already established in the common law,[78] discussed twenty years before in the case of monopolies and the following case law.[79] It re-established that the validity of all monopolies and patents is to be determined by the courts of common law.[80] In 1601

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[71] Statute of Monopolies §1 (emphasis added).

[72] Bracha (2004), *supra* note 43, at 196.

[73] Statute of Monopolies § 6 (emphasis added).

[74] Walterscheid (1994), *supra* note 26, at 875.

[75] Federico, *supra* note 10, at 303.

[76] E. Wyndham Hulme, *On the History of Patent Law in the Seventeenth and Eighteenth Centuries*, 18 L. Q. REV. 280, 280 (1902).

[77] A modern day patentable "invention" has to be "any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof . . . ." (35 U.S.C. § 101).

[78] Federico, *supra* note 10, at 303; *but cf.*, Walterscheid (1994), *supra* note 26, at 874, n. 104 (some disagreement among the various commentators as to the extent to which the statute actually departed from existing law).

[79] Federico, *supra* note 10, at 303.

[80] Statute of Monopolies § 2: "And *all monopolies*, and all such commissions, grants, licenses, charters, *letters patents*, proclamations, inhibitions, restraints, warrants of assistance, and all other matters and things tending as aforesaid, and the force and validity of them, and every of them, ought

Queen Elizabeth I gave up her right to determine the validity of her grants in her own courts.[81] This was prior to the *Case of Monopolies* and long before the Statute of Monopolies.[82] The position of the grantee, the inventor, was not changed by the statute. An inventor did not have *a right* to a patent and the statute did not confer upon him any such right. He was still in the position of a humble petitioner of the Crown's grace.[83]

Based on the above we can say that the identity of "the true and first inventor and inventors"[84] is any person, persons or corporate.[85] Besides the mentioning of the corporate, which will be explained shortly, it is quite clear that the Statute considers patents to be introduced by individuals. The manufacturing process, or the introduction of a new industry, at the basis of the patent are done by individuals. The inventor is necessarily a person.

The question that still remains is how the above conclusion sits with the mention of a corporate. Section 9 includes a list of exceptions relating to corporations.[86] These

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to be, and shall be forever hereafter examined, heard, tried, and determined, by and *according to the common laws of this realm, and not otherwise*." (emphasis added).

[81] Ramon A., Klitzke, *Historical Background of the English Patent Law*, 41 J. PAT. & TRADEMARK OFF. SOC'Y 615, 638 (1959).

[82] Klitzke, *supra* note 45, at 638.

[83] Federico, *supra* note 10, at 303-04.

[84] Statute of Monopolies § 6.

[85] Statute of Monopolies § 1. Similarly, these grantees are also mentioned in Sections 3 and 4. Section 3 states:

> And *all person and persons, bodies politic and corporate* whatsoever, which now are or hereafter shall be, shall stand and be disabled, and incapable to have, use, exercise, or put in ure any monopoly, or any such commission, grant, license, charter, letters patents, proclamation, inhibition, restraint, warrant of assistance, or other matter or thing tending as aforesaid, or any liberty, power, or faculty grounded or pretended to be grounded upon them, or any of them.

However, § 4 which establishes the jurisdiction of the common-law courts to examine and determine the validity of monopolies, alongside § 2, only refers to "person and persons," as follows:

> And if *any person or persons* at any time after the end of forty days next after the end of this present session of parliament shall be hindered, grieved, disturbed, or disquieted, or his or their goods or chattels any way seized, attached, distrained, taken, carried away, or detained by occasion or pretext of any monopoly, or of any such commission, grant, license, power, liberty, faculty, *letters patents*, proclamation, inhibition, restraint, warrant of assistance, or other matter or thing tending as aforesaid, and will sue to be relieved in or for any of the premises, that then and in every such case *the same person and persons* shall and may have his and their remedy for the same at then common law by any action or actions to be grounded upon this statute . . . .

Having said that, it is not unreasonable that only a person or persons have standing in the common-law courts as representatives of the corporation.

[86] Statute of Monopolies § 9:

> Provided also, that this act or anything therein contained shall not in any wise extend or be prejudicial unto the city of London, or to any city, borough, or town corporate within this realm, for or concerning any grants, charters, or letters patent to them, or any of them made or granted, or for or concerning any custom or customs used by or within them or any of them; or unto any corporations, companies, or fellowships of any art, trade, occupation, or mystery, or to any companies, or societies of merchants within this realm erected for the maintenance, enlargement, or ordering of any trade or merchandise; but that the same charters, customs, corporations, companies, fellowships, and societies, and their liberties, privileges,

exceptions were included to preserve the monopolies granted to trading companies due to the role they played in the promotion of foreign trade.[87] The explanation provided by Robert Ashton,[88] of what these trading companies are, resembles guilds and for this reason the inclusion of these trading companies in Section 3 does not have bearing on this article's thesis.[89]

The Statute of Monopolies remained the only statute on patents in England until a period far into the nineteenth century.[90] It would be the young United States that would first provide the English speaking world with a legislative enactment treating the concept of the patent as property.

B. American Colonies and States

The trend of providing inventors legal monopolies over their inventions gradually spread to and throughout the American Colonies with the settlers.[91] Skilled craftsmen were an important resource in the colonies. There was a high demand, but shortage in people.[92] Patent grants in American colonies were deeply rooted in the English letters patent.[93] The colonial assembly, the representatives of the community, tried to entice such skilled artisans in the same manner as Queen Elizabeth I had done before.[94] The colonial assembly had the discretion to grant a patent. In the absence of the monarch one had to petition the legislature, offer specific public benefits, and hope to receive a case-specific privilege.[95] Yet the "seventeenth century [common law] developments that reshaped the English framework were, for the most part, absent in the colonies."[96]

Some colonies legislated local feeble versions of the Statute of Monopolies. Yet these were mainly declaratory acts with little practical effect.[97] For example, the Colony of Connecticut passed such law in 1672 deeming that "There shall be no

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> powers, and immunities, shall be and continue of such force and effect as they were before the making of this act, and of none other; anything before in this act not contained to the contrary in any wise notwithstanding.

[87] Chris Dent, *'Generally Inconvenient': The 1624 Statute of Monopolies as Political Compromise*, 33 MELBOURNE U. L. REV. 415, 449 (2009) (mentioning also that this was done despite complaints being made against trading corporations in the 1624 Parliament).

[88] ROBERT ASHTON, THE CITY AND THE COURT: 1603-1643, at 72 (1979) cited in Dent, *supra* note 87, at 449, n. 235.

[89] This approach is reaffirmed by Sir Edward Coke whose interpretation of what was meant by "the true and first inventor" is *the person or individuals* who first introduced or discovered the invention and worked it in England. He is silent about the corporations. Sir Edward Coke, Lord Chief Justice of England, published his *Institutes of the Laws of England,* in which he provides a contemporary commentary on the Statute of Monopolies. EDWARD COKE, 3 INSTITUTES OF THE LAWS OF ENGLAND 181-85 (1797).

[90] Federico, *supra* note 10, at 305.

[91] Frank D. Prager, Historic Background and Foundation of American Patent Law, 5 AM. J. LEGAL HIST. 309, 311 (1961).

[92] Bracha (2009), *supra* note 14, at 372.

[93] Bracha (2004), *supra* note 43, at 211.

[94] Bracha (2009), *supra* note 14, at 372.

[95] *Id.* at 213.

[96] *Id*. at 214.

[97] *Id*. at 214 (referring to them the more sophisticated).

monopoly granted or allowed amongst us, but of such new inventions as shall be adjudged profitable to the country, and for such time as the General Court shall deem meet."[98] Similarly, the Massachusetts 1641 Body of Liberties provided "No monopolies shall be granted or allowed amongst us, but of such new Inventions that are profitable to the Countrie, and that for a short time."[99] The Act of March 26, 1784 of South Carolina stated "The inventors of useful machines shall have a like exclusive privilege of making or vending their machines for the like term of fourteen years, under the same privileges and restrictions hereby granted to, and imposed on, the authors of books."[100]

The state patent legislation says nothing about the who is the innovator, the identity of the inventor, and simply echoes Section 6 of Statute of Monopolies. "The only respect in which the later state legislation showed any sign of change was the growing differentiation of invention patents as a special subset of grants, and the gradual emergence of the modem concept of invention." Having said that, "the state legislation did not move at all from the patent-privileges model."[101]

C. Development of the Federal Patent System

On the eve of signing the Constitution, in 1789, though more than a century of semi-independent development had passed, the American patent grant practice was still rather similar on both the practical and the conceptual level to the traditional English framework. In fact, Colonial and State patent legislation and their bureaucratic practices were more similar to the early English individual privileges, granted as a result of a case-specific policy-political decision by government in the name of the public good,[102] than its contemporaneous British counterpart.[103]

The genesis of the U.S. federal patent system was in the Intellectual Property Clause of the Constitution that gave Congress the power to "promote the Progress of Sciences and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries."[104] Some argue that the U.S. Constitution created the "first modem patent institution regime."[105] Others go further and draw from the constitutional text far-reaching conclusions about an underlying concept of patents as rights, and even as natural rights.[106] The justification for recognition of rights in intellectual output will be discussed at length in the Part III. However, not everyone shares this view. Critics say that there is no reason to assume that, apart from creating the grant power on the federal level, the clause constituted any break with traditional patterns and that they have rejected the idea

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[98] *See* Ramsey, *supra* note 55, at 13.

[99] *See* Bracha (2004), *supra* note 43, at 214.

[100] *See* Karl Fenning, *The Origin of the Patent and Copyright Clause of the Constitution*, 17 GEO. L.J. 109, 115 (1929).

[101] Bracha (2004), *supra* note 43, at 215.

[102] *Id.*

[103] *Id.* at 216.

[104] U.S. Const. art. I, § 8, cl. 8.

[105] B. Zorina Khan & Kenneth L. Sokoloff, *History Lessons: The Early Development of Intellectual Property Institutions in the United States*, 15 J. ECON. PERSP. 233, 235 (2001).

[106] Prager, *supra* note 91, at 318.

that patent protection was some sort of natural right.[107] The immediate sources of influence and inspiration available to the framers were English patents and the grant practice in the colonies and the states.[108] There is no evidence that any of the framers contemplated, at that stage, a break with those familiar patterns or the creation of a "modem patent system."[109]

The enactment of the Constitution was followed by a flood of various individual privilege petitions. Congress thus decided to legislate a general law.[110] It passed the 1790 Act to Promote the Progress of the Useful Arts.[111] Its wording, as well as those of the Acts which followed, was influenced by the late eighteenth century crisp vision of the patent rights idea consolidated with some ideological support.[112]

"In some respects, the 1790 Act did constitute a break from previous traditions and the beginning of a modem patent system."[113] It "created a general patent regime" and "patents were no longer case-specific, legislative grants" of the colonial assembly or states.[114] Neither was it an arrangement of defining the "outer-limits of an exception to a general ban on monopolies," as the Statue of Monopolies did.[115] Instead, the "Act defined in comprehensive terms the outline of a uniform patent regime," though the grant process remained a matter of privilege.[116] It was a sort of a hybrid between the old English and colonial privilege regime and the patent-rights model that modern patent system entails.[117] The Act also provided its account on the identity of the inventor. Section 1 states:

> Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That upon the petition of **any person or persons** . . . setting forth, that **he, she, or they**, hath or have invented or discovered any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used, and praying that a patent may be granted therefor . . . to **such petitioner or petitioners, his, her or their heirs, administrators or assigns** for any term not exceeding fourteen years, the sole and exclusive right and liberty of making, constructing, using and vending to others to be used, the said invention or discovery.[118]

The inventor is no longer of the craftsman (or craftswoman) but an intellectual inventor who creates and discovers. This image of the inventor (the patentee following the grant of the patent) is a common thread through the sections of the Act.

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[107] Adam Mossoff, *Who Cares What Thomas Jefferson Thought about Patents? Reevaluating the Patent Privilege in Historical Context*, 92 CORNELL L. REV. 953, 963-65 (2007).

[108] Ramsey, *supra* note 55, at 15.

[109] Bracha (2004), *supra* note 43, at 216.

[110] *Id.* at 216.

[111] An Act To Promote the Progress of Useful Arts, Patent Act of 1790, Ch. 7, 1 Stat. 109-112, available at: http://ipmall.info/hosted_resources/lipa/patents/Patent_Act_of_1790.pdf.

[112] Bracha (2004), *supra* note 43, at 219.

[113] *Id.* at 219.

[114] *Id.*

[115] *Id.*

[116] *Id.*

[117] *Id.* at 222.

[118] Patents Act of 1970 § 1 (emphasis added).

This Act was replaced three years later by the Patent Act of 1793,[119] which established a registration system, alongside the examination process its predecessor ascertained.[120] The Act, similar to its 1790 predecessor, identifies the person as the inventor. The Act stated as follows:

> Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That when **any person or persons**, being a citizen or citizens of the United States, shall allege that **he or they** have invented any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement on any art, machine, manufacture or composition of matter, not known or used before the application, and shall present a petition to the Secretary of State, signifying a desire of obtaining an exclusive property in the same, and praying that a patent may be granted therefor . . . and giving a short description of the said invention or discovery, and thereupon granting to such **petitioner, or petitioners, his, her, or their heirs, administrators or assigns**, for a term not exceeding fourteen years, the full and exclusive right and liberty of making, constructing, using, and vending to others to be used, the said invention or discovery.[121]

The Patent Act of 1836[122] is "generally acknowledged to be the foundation for the modem patent examination system in the U.S. It created the Patent Office, a service of examiners, modem interference practice, administrative appeal practice, and the modem patent numbering system:"[123]

> And be it further enacted, That **any person or persons** having discovered or invented any new and useful art, machine, manufacture, or composition of matter, or any new and useful improvement on any art, machine, manufacture, or composition of matter, not known or used by others before **his or their** discovery or invention thereof, and not, at the time of his application for a patent, in public use or on sale, with his consent or allowance, as the inventor or discoverer; and shall desire to obtain an exclusive property therein, may make application in writing to the Commissioner of Patents, expressing such desire, and the Commissioner, on due proceedings had, may grant a patent therefor.[124]

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[119] An Act To Promote the Progress of Useful Arts, Patent Act of 1793, Ch. 7, 1 Stat. 109-112, available at: http://www.ipmall.info/sites/default/files/hosted_resources/lipa/patents/Patent_Act_of_1790.pdf.

[120] Walterscheid, *supra* note 26, at 63, 72-73. There are a number of reasons accounting for the short life of the Patent Act of 1790. *See* Bracha (2004), *supra* note 43, at 227; Craig Allen Nard, *Legal Forms and the Common Law of Patents*, 90 BOSTON U. L. REV. 51, 65 (2010).

[121] Patents Act of 1973 § 1 (emphasis added).

[122] Patent Act of 1836, Ch. 357, 5 Stat. 117, available at: http://www.ipmall.info/hosted_resources/lipa/patents/patent_act_of_1836.pdf.

[123] Walterscheid (1997), *supra* note 26, at 63.

[124] Patent Act of 1836 § 6 (emphasis added).

With regard to this article, the Act demonstrates the view of the federal system regarding the image of the inventor, by laying down a list of obligations the individual has to comply with to be granted a patent. Also, the use of the word "he" is providing further support of the argument that the federal patent system placed the individual at the heart of the innovation process.

Granted, we could not expect Acts legislated in the late eighteenth century to foresee the advancement of technological innovation which led to the development of a new understanding of how innovation is produced. The importance of the review so far is that these Acts had bearing on how the current U.S. Patent Act is phrased, and more importantly, how the law views innovation production—as being initiated by the individual inventor.

The current act in power is the Patent Act of 1952.[125] It has undergone some radical changes during 2011,[126] mainly the decision to change the "first-to-invent" principle to "first-to-file" system.[127] The "first-to-file" system is employed by most countries of the world. The U.S. jointed the "first-to-file family of nations" on March 16, 2013. According to this principle, a patent will be granted to the first person filing an application. Some say that this change benefits corporations, which may also include the innovative entity.[128] However, I do not argue that incentivizing the innovative entity should be on the expenses of the individual inventor. The system can allow them both to coexist. Contrarily, the "first-to-invent" principle grants a patent to the person who first invented it and thus promoting the identification of the "real" inventor.[129] First-to-invent served not only as an incentive to motivate individual inventors, but also to protect them from large firms and their resources, preferring to file an application and be granted a patent than paying royalties to the person whom is the true inventor.[130]

The focus on the individual as the inventor is evident throughout the Act as follows:

When used in this title unless the context otherwise indicates -

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[125] The Patent Act of 1952, Title 35 U.S.C., Ch. 950, § 1, 66 Stat. 792, available at: http://www.gpo.gov/fdsys/pkg/USCODE-2011-title35/pdf/USCODE-2011-title35.pdf.

[126] Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (to be codified in scattered sections of 35 U.S.C.).

[127] 35 U.S.C. § 102.

[128] Andrew L. Sharp, *Misguided Patent Reform: The Questionable Constitutionality of First-to-File*, 84 U. COLO. L. REV. 1227, 1236-7 (2013) ("First-to-file will require the few individual patent applicants still remaining to engage in a race to the patent office, a race corporations with deep pockets will win. Corporations have the resources to file large numbers of applications, they can hire the most competent attorneys, and they have the procedures in place to quickly file an application after an employee conceives of an idea. Individual applicants do not have the resources to file numerous applications, and they generally do not have attorneys on retainer ready to file an application. As a result, large, well-funded corporations will systematically win the patent race, and their share of the economy will further grow").

[129] Masaaki Kotabe, *Comparative Study of U.S. and Japanese Patent Systems*, 23 J. INT'L BUS. STUD. 147, 149-51 (1992).

[130] Cotropia, *supra* note 16, at 55, 66-68; Marl A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 710 (2012). As I further discuss, the "individualism" nature of the patent system currently extends to the sole organization as well.

. . .

(f) The term 'inventor' means **the individual** or, if a joint invention, **the individuals** collectively who invented or discovered the subject matter of the invention.
(g) The terms 'joint inventor' and 'coinventor' mean any 1 of **the individuals** who invented or discovered the subject matter of a joint invention.[131]

When discussing the conditions for patentability, the law asserts that a person will be entitled to a patent.

(a) NOVELTY; PRIOR ART. A person shall be entitled to a patent unless— [132]

Similarly, ownership is a personal activity:

Subject to the provisions of this title, patents shall have the attributes of personal property.[133]

In summary, we see that throughout its development, the U.S. patent system views the individual as the center of the innovation process. The individual is the inventor, and it is the individual who is the future patentee. This view of the innovation process is quite straight forward when taking into account how patent law came to be—its roots are in the English Statute of Monopolies.

III. INCENTIVIZING INNOVATION THROUGH THE PATENT SYSTEM: REVIEW OF MAIN JUSTIFICATIONS

It is unclear if the federal patent system gave rise to the property rights discourse, or if this discourse gave rise to the federal system. However, it is quite clear the two are intertwined, stemming from the same reasoning: the image of the intellectual genius, heroic inventor, as an owner of their intellectual product.

During the late eighteenth and early nineteenth centuries the inventor, previously identified indistinguishably with the craftsman, came to be identified as intellectual genius.[134] This new founded persona of the inventor alongside the transformation of the institutional model of patents and the appearance of property rights during the first half of the nineteenth century were echoed in the justifications aimed to incentivize invention and innovation.[135] In the early days, the inventor, identified as either an artisan or a skilled craftsman received a privilege—a grant from the monarch. This was not a property right as the monarch retained all ownership of property. It was the uproar against privileges and aspiration to be granted a right in one's work that ignited the discussion of rights. These justifications were based on the

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[131] 35 U.S.C. § 100 (emphasis added).
[132] 35 U.S.C. § 102.
[133] 35 U.S.C. § 261.
[134] Bracha (2009), *supra* note 14, at 370.
[135] Bracha (2004), *supra* note 43, at 218.

development of property rights in the eighteenth century "as one of the core civil rights parallel to, and mutually reinforcing, the right to life and the right to liberty."[136]

A set of justifications emerged, accompanying the new image of the inventor, as an owner of intellectual assets, for his government-protected entitlements. These justifications consisted of a mix of natural right in the fruit of one's labor and utilitarian arguments.[137] Both the natural right and the utilitarian justifications are based on the same underlying concept of the individual at the center of the innovation process—the person who creates new innovations through her intellectual capacity.[138]

A. Locke's Law of Nature and the Personality Theory

One of the main theories used to justify property rights is the labor theory which is based on John Locke's theory of natural law. John Locke is the "most important philosopher in the establishment and development of property rights. At the time when Locke developed his well-known defense of the labour theory to just that man could claim property, there was no perception that the rights generated by patents actually constituted property rights."[139]

The terminology used by Locke shows that this theory is also focused on the individual inventor. Locke can be viewed as asserting that *every person* has a natural right to the fruits of her labor, regardless of whether the creation is physical or intellectual. Whatever *a person* has removed out of its natural state, and mixed her labor therewith, belongs to her.[140] This right cannot be compromised even if allocating such rights decreases social welfare.[141] "Locke's conclusion that *a person* has a property right in the fruits of her labor follows from his argument that *a person* owns a right to her own body, hence to the labor of her body, and therefore to anything that results from mixing her labor with common resources."[142] The focus on the individual is even apparent from the additional condition specified by Locke for the acquisition of property: the duty to leave enough for others asserts that *one* may prevent others from using her labor product only if there remain sufficient resources in the public domain to allow others to labor and acquire property as well.[143]

Another theory that is often used to "justify the need for the patent system is *Hegel's personality theory*"[144] as refined by Radin.[145] According to this theory, "private

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[136] Haugen, *supra* note 12, at 448.

[137] Bracha (2009), *supra* note 14 at 374-75, 377-78.

[138] *Id*. at 375.

[139] Haugen, *supra* note 12, at 448.

[140] JOHN LOCKE, TWO TREATISES OF GOVERNMENT § 25-29 (Jonathan Bennett ed., 2008) (1690), *available at*: http://www.earlymoderntexts.com/assets/pdfs/locke1689a.pdf; Ofer Tur-Sinai, *Beyond Incentives: Expanding the Theoretical Framework for Patent Law Analysis*, 45 AKRON L. REV. 243, 257-59 (2012) [*hereinafter* Tur-Sinai (2012)].

[141] Eli M. Salzberger, *The Law and Economics Analysis of Intellectual Property: Paradigmatic Shift from Incentives to Traditional Property*, 7 REV. L. & ECON. 435, 437 (2010).

[142] Tur-Sinai (2012), *supra* note 140, at 258.

[143] In fact, Locke specified two additional conditions, the second one being the no waste prohibition. Since it is less relevant to the point I am trying to make here I do not discuss it further. For a review of Locke's second condition see Tur-Sinai (2012), *supra* note 140, at 270-72.

[144] GEORG WILHELM FRIEDRICH HEGEL, PHILOSOPHY OF RIGHT (S.W. Dyde trans., 2001) (1821).

[145] Margaret Jane Radin, *Property and Personhood*, 34 STAN. L. REV. 957 (1982).

property is necessary as a means of developing and realizing *one's personality*."[146] A *person's* self-identity is intertwined with their control over assets. The conclusion "is that every person should receive a threshold amount of property that would enable them to function as a free individual and develop their personality."[147]

B. The Utilitarian Approach

There is universal agreement that the purpose of the patent system is to promote innovation, through the creation of inventions, by granting exclusive rights to the patentee.[148] This is the basic utilitarian purpose of the patent system.[149] The underlying assumption is that patent protection of intellectual product is necessary due to its "public good" attribute, since research output is comprised in part (and sometimes entirely) of intangible property. The distinctive characteristics of a public good are "non-excludable" and "non-rivalrous." It can be used by multiple parties without diminishing its availability and it is almost impossible to exclude others from appropriating it.[150] Put simply, the enjoyment of one person does not exclude enjoyment by others. These characteristics in combination may serve as a disincentive for innovation. Potential innovators would know that once they revealed their breakthroughs to the world other people would be able to take advantage of them for free whereas innovators would not be able to recoup the costs of their innovations. Since appropriating such assets is easy, this leads to free riders, which diminishes incentives to invent and innovate.[151] This argument implies that there is "a danger that the pace of technological innovation will fall below socially optimal levels."[152] Another argument asserts that potential inventors might devote their energies to other more lucrative activities at the expense of others, causing society at large to suffer.[153]

The patent system overcomes these obstacles and promotes innovation by granting the patentee the right to exclude others from practicing the patented invention, thus enhancing incentives to invent while mitigating market failure (the

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[146] Tur-Sinai (2012), *supra* note 140, at 274 (emphasis added).

[147] *Id*.

[148] Though opinions are divided as to whether the patent system actually achieves its goals. *See* Burk & Lemley, *supra* note 2, at 1580-81 (citing defenders of the patent system, vocal critics, and those who cannot decide whether the system is good or bad).

[149] Burk & Lemley, *supra* note 2, at 1596-97; Mark A. Lemley, *The Myth of the Sole Inventor*, 110 MICH. L. REV. 709, 736 (2012); Rebecca S. Eisenberg, *Patents and the Progress of Science: Exclusive Rights and Experimental Use*, 56 U. CHI. L. REV. 1017, 1024-28 (1989).

[150] Burk & Lemley, *supra* note 2, at 1580-81 (stating that the public good is usually expensive to develop but easy to appropriate); *See also e.g.*, Nancy Gallini & Suzanne Scotchmer, *Intellectual Property: When Is It the Best Incentive System?*, *in* 2 INNOVATION POLICY AND THE ECONOMY 51, 52 (Adam B. Jaffe, Josh Lerner & Scott Stern eds., 2002).

[151] Peter Lee, *Social Innovation*, 92 WASH. U. L. REV. 1, 25 (2014). *See also*, Eisenberg, *supra* note 149, at 1024-25.

[152] William Fisher, *Intellectual Property and Innovation: Theoretical, Empirical, and Historical Perspectives*, http://cyber.law.harvard.edu/people/tfisher/Innovation.pdf (last visited June 6, 2016).

[153] This argument was developed by scholars like Jeremy Bentham and John Stuart Mill, Jeremy Bentham, *A Manual of Political Economy (1793-95)*, *in* 3 THE WORKS OF JEREMY BENTHAM 31, 49 (John Bowring ed., 1843), available at: http://socserv.mcmaster.ca/econ/ugcm/3ll3/bentham/manualpoliticaleconomy.pdf), and JOHN STUART MILL, PRINCIPLES OF POLITICAL ECONOMY (John M. Robson, ed., 5th ed., 1862)). *See id*. n. 1, at 2.

incentive theory).[154] This right is given to the patentee for a limited time in exchange for her disclosure of the new technology to the public (the *disclosure theory*),[155] thus encouraging the disclosure of inventions that might otherwise be kept secret.[156] During this limited time period the patentee "should be able to cover her R&D costs and make a reasonable profit in the market with her invention."[157]

These incentives to innovate, in the form of allocation of private rights, are most effective "if the rewards of exclusivity are bestowed upon a *single owner* rather than a diffuse group among whom royalties must be split." It is for this reason that the patent system must "identify individual inventors to whom it can assign exclusive rights."[158]

Prospect theory is another theory which provides economic justifications for the patent system.[159] It was developed in light of the fundamental controversy regarding the proper scope, availability, and even need for patents in order to optimize innovation. While the basic agreement between inventor and society embodies utilitarian goals, how this agreement should be implemented remains unclear.[160]

Prospect theory is rooted in many of the same economic traditions as *incentive theory*, however its focus is not on ex-ante incentives to innovate. Instead, it emphasizes granting *ownership to one patentee* in order to control R&D and to

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[154] Lee, *supra* note 151, at 25. Burk & Lemley, *supra* note 2, at 1580 ("such legal restraints on patentable inventions are justifiable if they offer a net benefit to society, trading the disutility of restricted output and higher prices for the greater social utility of inventions that might otherwise not be produced"). *See* Salzberger, *supra* note 141, at 439-40, for a comprehensive discussion of this theory.

[155] The limited time (and scope) of the monopoly is also important from an economic point of view. It mitigates the phenomenon of owners setting (usually) a price that will maximize their profits, leading to underuse of innovation, rather than a price, which equals their marginal or average cost of production. *See* Salzberger, *supra* note 141, at 441; Mark A. Lemley & Carl Shapiro, *Probabilistic Patents*, 19 J. ECON. PERSP. 75 (2005) (a patent does not provide absolute exclusion, but rather presents a legal right to try to exclude). However, this limited time monopoly raises concerns regarding its possible consequence of restraints on the patentability of future inventions. *See* Ofer Tur-Sinai, *Cumulative Innovation in Patent Law: Making Sense of Incentives*, 50 IDEA 723, 725 (2010) (explaining that the cumulative nature of innovation dictates the frequent need of inventors to rely on the discoveries and inventions of previous inventors in order to make their own contribution, and that the potential conflict between the exclusive rights and the need to capitalize on their invention in order to continue developing the technology may result in a chilling effect). Having said that, the concerns regarding access to patentable technology are beyond the scope of this work. The *Disclosure Theory*, though considered a utilitarian justification, is subordinate to the primary utilitarian justification—the *Incentive Theory*. *See* Eisenberg, *supra* note 149, at 1028-30.

[156] Kenneth J. Arrow, *Economic Welfare and the Allocation of Resources for Invention*, *in* THE RATE AND DIRECTION OF INVENTIVE ACTIVITY: ECONOMIC AND SOCIAL FACTORS 609, 614–16 (National Bureau of Economics Research (NBER) ed., 1962). *But cf.*, Lemley, *supra* note 130, at 745 (explaining that nowadays patent description and claims are worded vaguely and broadly, which prevents future inventors from learning about the protected technology, thus violating the contract between inventor and society, concluding that the justification behind disclosure theory does not support the current patent system).

[157] Tur-Sinai (2012), *supra* note 140, at 248.

[158] Lee, *supra* note 151, at 27 (emphasis added).

[159] Edmund W. Kitch, *The Nature and Function of the Patent System*, 20 J.L. & ECON. 265 (1977).

[160] Burk & Lemley, *supra* note 2, at 1599 (providing a comprehensive discussion of the five distinct approaches to the proper scope and allocation of patent rights).

efficiently diffuse it into the market through licensing.[161] The granting of exclusive rights to *individual patentees*:

> enhances social efficiency by allowing the patentee to rationally coordinate the development of a technological prospect. These efficiency gains stem from the fact that *a single entity* manages a technological resource that would be lost if a diverse group of loosely affiliated individuals all had claims on the invention.[162]

The fundamental economic bases of this approach are the "tragedy of the commons"[163] and the hypothetical Coasean world without transaction costs.[164] The tragedy of the commons calls for privatization (or commodification) of public goods to ensure the enjoyment of everyone. The most notable example in this context is the greenery which is open for everyone to herd their sheep. People with access to common property overuse it because each individual reaps all of the benefits of his personal use, but shares only a small portion of the costs.[165] The establishment of *individual property rights* prevents these situations. Kitch's prospect theory places a strong emphasis on the role of a *single patentee* in coordinating the development, implementation, and improvement of an invention.[166] The theory is supported by the Coase theorem. According to this theorem, giving *one party* the power to control and orchestrate all subsequent use and R&D relating to the patented technology should result in efficient licensing, assuming information is perfect, all parties are rational, and licensing is costless.[167] Though this theory has been the object of criticism, its relevance here stems from its emphasis on *regulating the individual's activity*, while the *individual* may very well be an organization. [168] It is the *individual's action* which needs to be regulated to foster innovation, and this action is comprised of public goods.[169]

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[161] *Id*. at 1600. *See, e.g.*, Lemley, *supra* note 130, at 711; Kitch, *supra* note 159, at 276-78; Robert P. Merges, *Of Property Rules, Coase, and Intellectual Property*, 94 COLUM. L. REV. 2655, 2660-61 (1994).

[162] Lee, *supra* note 151, at 27. *Cf*. Harold Demsetz, *Toward a Theory of Property Rights*, 57 AM. ECON. REV. 347, 354-56 (1967).

[163] Garrett Hardin, *The Tragedy of the Commons*, 162 SCIENCE 1243 (1968).

[164] *See generally* Ronald H. Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960); Salzberger, *supra* note 141, at 461 ("Coase argued that inefficient legal rules will be bypassed by individuals attempting to achieve efficient allocation of entitlement, but this will happen only when there are no transaction costs").

[165] Burk & Lemley, *supra* note 2, at 1600; Salzberger, *supra* note 141, at 463 (explaining that the tragedy of the commons describes a situation in which an increase in demand in the absence of property rights leads to over-consumption, and the tragedy lies in creating a worse situation for all individuals).

[166] Kitch, *supra* note 159, at 271-80.

[167] Burk & Lemley, *supra* note 2, at 1602.

[168] Tur-Sinai (2012), *supra* note 140, at 250.

[169] It is important to note here that the current ongoing trend of commercialization of research outputs imposes increasingly high transactions costs to obtain IPR, monitor, enforce, negotiate and license these outputs. The result of the expanded coverage of IPRs and the increased transaction costs is the reduced volume of research that is accessible, de-facto impeding the production of new innovation. *See* Lawrence Lessig, *Free(ing) Culture for Remix*, 2004 UTAH L. REV. 961 (2004). *See, e.g.*, Fisher, *supra* note 152, at 4 ("Suppose Innovator #2 wishes to build upon the work of Innovator

IV. THE EVOLUTION OF INNOVATION PRODUCTION THEORIES

Today innovation is mostly identified with economists' definition of innovation:

> Innovation activities are all scientific, technological, organizational, financial and commercial steps which actually, or are intended to, lead to the implementation of innovations. Some innovation activities are themselves innovative, others are not novel activities but are necessary for the implementation of innovations. Innovation activities also include R&D that is not directly related to the development of a specific innovation.[170]

However, economists are not the only scholars interested and researching innovation. Before economics developed a host of theories, beginning in the 1930s and continuing to this day, anthropologists and sociologists formulated their own theories to explain how innovation is produced. Though economics ultimately won the "definition race," their theories were influenced and affected by the sociological and anthropological theories. Their loss has bearing on the identity of the innovator as described in the innovation production theories.

It is important to note that I use the term "innovator" in this Part and not "inventor." The innovator participates in all stages of the innovation process, including diffusion of the commercialized output in the market. Her involvement is in the entire process and does not end when the invention leaves the lab grounds and is commercialized.

The sociologist Gabriel Tarde developed the first innovation theory. Tarde's theory of innovation (known as "Tarde's cycle"),[171] like his successors, is characterized by a

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#1. The need to secure a license from Innovator #1 will, at a minimum, add to Innovator #2's costs. If, for some reason, Innovator #1 is unable or unwilling to grant the license, the work of Innovator #2 may be frustrated altogether"); Burk & Lemley, *supra* note 2, at 1610-13. This phenomenon of IPRs creating barriers to scientific R&D and innovation is referred to as the "tragedy of the anti-commons." *See* Michael Heller & Rebecca S. Eisenberg, *Can Patents Deter Innovation? The Anticommons in Biomedical Research*, 280 SCIENCE 698 (1998). This is closely related to the concerns raised regarding the limited monopoly as mentioned in *supra* note 155. However, empirical literature includes evidence that both asserts and rejects the anti-common phenomenon. *See* Timothy Caulfield, et al., *Patents, commercialization and the Canadian stem cell research community*, 3 REGEN. MED. 483 (2008) (as an example of an empirical study that asserts the existence of the phenomenon); *see also* John P. Walsh, Ashish Arora & Wesley M. Cohen, *Research Tool Patenting and Licensing and Biomedical Innovation*, *in* PATENTS IN KNOWLEDGE-BASED ECONOMY (W. M. Cohen & S. Merrill, eds., National Academics Press, 2003) (as an example of an empirical study that rejects the existence of the phenomenon).

[170] OECD, OSLO MANUAL: GUIDELINES FOR COLLECTING AND INTERPRETING INNOVATION DATA 47 (2005), http://www.oecd.org/innovation/inno/oslomanualguidelinesforcollectingandinterpretinginnovationdata3rdedition.htm (*hereinafter* Oslo Manual) (last visited June 6, 2016).

[171] Benoît Godin, *Innovation: The History of a Category* 27 (Project on the Intellectual History of Innovation Working Paper No. 1, 2008), http://www.csiic.ca/PDF/IntellectualNo1.pdf [*hereinafter* Godin (2008)] (last visited June 6, 2016). The sequence is as follows: multiple *imitations* (or repetitions), which then enter into competition with each other, coming up against and opposing each other - the opposition phase. This opposition is resolved, either through the *destruction of the imitation flows* or *through adaptation*, which signifies creative joint production, that is the emergence of a new invention. *See* Faridah Djellal & FaÏz Gallouj, *The Laws of Imitation and Invention: Gabriel Tarde and the Evolutionary Economics of Innovation* 11 (2014), https://halshs.archives-ouvertes.fr/halshs-00960607/document (translating from GABRIEL TARDE, LES LOIS SOCIALES 106

sequential view of innovation.[172] Anthropologists also hold a sequential view of innovation.[173] Invention and diffusion came to be understood as part of the same sequential or linear process: invention is followed by diffusion.[174] Both of these sequential views begin with a single entity. The use of the "word" entity here is not done by mistake. These theories were focused on the individual (i.e., a singular, person or organization) recognized as the innovator.

Sociologists viewed innovation as a linear process led by a *single individual*, the entrepreneur, or by *a sole organization*.[175] The Sociologist Everett Rogers, considered the 'Schumpeter of sociologists', introduced a definition of innovation still used extensively in the literature. Innovation is "an idea perceived as new by an *individual* . . . or *other unit* of adoption."[176] Historians and psychologists joined sociologists, even though their view of the innovator was more extreme[177] as they saw the innovator as a great man, a genius or a hero.[178] For sociologists an innovator was not one who invents but one who adopts an invention for the first time. Nonetheless they saw innovation as a social rather than an individual process.[179] Their view strongly relates to the discussion of the genius inventor in Part III.[180]

For sociologists, an innovator is not one who just invents, but one who is engaged in the social process that is innovation (rather than an individual process).[181] Certainly "without the inventor there can be no inventions,"[182] but "the inventors are not the only individuals responsible for invention."[183] Invention is not a one-step creation but a cumulative (or evolutionary) process.[184] It is also increasingly systematic; and it is the output of organized research laboratories specifically dedicated to this end. In this sense sociologists delineated a movement from the independent inventor towards organized research in industrial laboratories.[185]

(Félix Alcan, 8th ed., 1921) (1898): It is through imitative repetition that invention—the basic means of social adaptation—spreads and becomes stronger and tends, through the conjunction of one of its own imitation rays with an imitation ray emanating from some other invention, whether old or new, either to arouse new struggles or, perhaps directly or perhaps as a result of such struggles, to yield new, more complex inventions, which in turn will soon be radiating out imitatively, and so on indefinitely).

[172] *See* Godin (2008), *supra* note 171, at 32, for a comprehensive summary of sociologists' sequence of innovation starting with Tarde from the nineteenth century and ending with Rogers form the 1980s.

[173] Benoît Godin, *Innovation Without the Word: Willian F. Ogburn's Contribution to Technological Innovation Studies* 32 (Project on the Intellectual History of Innovation Working Paper No. 5, 2010), http://www.csiic.ca/PDF/IntellectualNo5.pdf [*hereinafter* Godin (2010a)].

[174] Benoît Godin, *Invention, Diffusion and Linear Models of Innovation* 5 (Project on the Intellectual History of Innovation Working Paper No. 15, 2013), http://www.csiic.ca/PDF/AnthropologyPaper15.pdf [*hereinafter* Godin (2013)].

[175] Benoît Godin, *The Vocabulary of Innovation: A Lexicon* 33 (Project on the Intellectual History of Innovation Working Paper No. 20, 2014), http://www.csiic.ca/PDF/LexiconPaperNo20.pdf [*hereinafter* Godin (2014)].

[176] EVERETT M. ROGERS, DIFFUSION OF INNOVATION 14, 11 (3rd ed., 1983) (emphasis added).

[177] Godin (2014), *supra* note 175, at 33.

[178] Godin (2008), *supra* note 171, at 28.

[179] *Id.* at 30.

[180] *Id.*

[181] *Id.*

[182] S. COLUM GILFILLAN, THE SOCIOLOGY OF INVENTION 78 (1935).

[183] *Id.* at 81. *See also*, Godin (2010a), *supra* note 173.

[184] GILFILLAN, *supra* note 182, at 3.

[185] *Id.* at 52-54, 63; HORNELL HART, THE TECHNIQUE OF SOCIAL PROGRESS 552-562 (1931).

Schumpeter also placed the entrepreneur at the center of his theory. In his early writings, known as Mark I, he describes the innovation process as carried out by an individual innovator.[186] Schumpeter also holds a sequential view of innovation: (1) invention—the generation of new ideas; (2) innovation—the development of new ideas into marketable products and processes; (3) diffusion—new products and processes spread across the potential market.[187] For Schumpeter, the entrepreneur, the individual innovator, as an exceptional personality, endowed with particular intellectual capacities and psychological characteristics, is motivated, exercises energy and ingenuity, and is willing to make an effort to generate innovation.[188] In this sense Schumpeter's view of the entrepreneur is similar to that of the psychologists and historians described above.

It is customary to distinguish between two Schumpeterian periods known as Schumpeter Mark I and Schumpeter Mark II.[189] Mark II signifies a shift in Schumpeter's understanding of the innovation process in which he claims that large firms are the major source of innovation.[190] This view is often thought to refer to some sort of collaboration since the shift is associated with his understanding that the market is moving towards larger industrial units. That is, research becomes corporate but is also able to adapt to changing environments, especially the increasing intervention of the public sector in research life (i.e., a growing need to interact with the public sector.)[191] Schumpeter is considered by some to be the first to have noted the increasing importance of collective innovative activities.[192]

The purpose of the above review of varying perspectives of the different discipline is to provide a general explanation of the *innovation process*, initiated by the innovator and diffused into the market. But the unknown was greater than what was known. They are silent as to what this process entails and what needs to be done to ensure its

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[186] JOSEPH A. SCHUMPETER, THE THEORY OF ECONOMIC DEVELOPMENT: AN INQUIRY INTO PROFITS, CAPITAL, CREDIT, INTEREST AND THE BUSINESS CYCLE (1934) [*hereinafter* SCHUMPETER (1934)].

[187] Paul Stoneman, *Introduction*, *in* HANDBOOK OF THE ECONOMICS OF INNOVATION AND TECHNOLOGICAL CHANGE 1, 2-3 (Paul Stoneman ed., 1995). *See also*, Benoît Godin, *Innovation and Science: When Science Had Nothing to Do with Innovation, and Vice-Versa* 5, n. 3 (Project on the Intellectual History of Innovation Working Paper No. 16, 2014), http://www.csiic.ca/PDF/WorkingPaper16.pdf.

[188] SCHUMPETER (1934), *supra* note 186, at 81-94.

[189] Knut Ingar Westeren, *Innovation: From Schumpeter to the Knowledge Economy*, *in* FOUNDATIONS OF THE KNOWLEDGE ECONOMY: INNOVATION, LEARNING AND CLUSTERS 57, 57-59 (Knut Ingar Westeren ed., 2012).

[190] JOSEPH A. SCHUMPETER, CAPITALISM, SOCIALISM AND DEMOCRACY (Routledge, 1994) (1942). *See, e.g.*, David J. Teece, *Competition, Cooperation, and Innovation Organizational Arrangements for Regimes of Rapid Technological Progress*, 18 J. ECON. BEHAVIOR & ORG. 1, 4 (1992) (Schumpeter's claim that large firms were necessary to promote innovation has fostered exploration of the links between innovative performance and market structure. Schumpeter linked firm size and innovation for three distinct reasons. First, he contended that only large firms could afford the cost of R&D programs. Second, large, diversified firms could absorb failures by innovating across broad technological fronts. Third, firms needed some element of market control to reap the rewards of innovation. The Schumpeterian legacy has spurred discussion of the link between firm size and innovation, and between market structure and innovation.).

[191] Westeren, *supra* note 189.

[192] Ben R. Martin, Katholieke Universiteit Leuven: *Science, Technology and Innovation Policy Studies–What Have We Learned? What Are the New Challenges?* (15-19 September 2014, Slide 8), (on file with author).

success. The individual innovator or sole organization may be the source, but they are only the tip of the iceberg. Views of how innovation is produced have greatly evolved as reviewed below.

The 1950s-1960s, following economists' sequential view of innovation, joined by social scientists from other disciplines, represented the development and proliferation of the "black box" model of innovation.[193] The basic assumption of this model is that the input and output is more important than the innovation process itself.[194] Studies conducted at the time did not invest great effort inquiring into what transpires inside the "black box."[195] As a "black box," technological innovation was conceived to be a system containing unknown components and processes. Economists attempted to identify and measure the main inputs that went into the "black box," and encountered increased difficulty in their attempts to identify and measure its outputs.[196] They devoted very little thought to what actually went on inside the "box."[197] Economists of that time were more concerned in a way with the macro level rather than with the micro level. The main focus was the *individual innovator* and particularly *the sole organization*. Following Schumpeter's lead, economists were interested in the firm's behavior, as at the time the firm was considered to be the organization involved in the innovation process.[198] Also, the economists' focus on technological innovation did not take into account other non-R&D activities that could be considered as innovation (such as marketing, manufacturing, etc.).[199]

Studies conducted during the 1960s-1970s indicate a gradual "opening" of the "black box" of innovation as researchers showed greater interest in the process of innovation production.[200] Two linear models emerged during this period: the technology-push and the demand-pull model.[201] According to the technology-push model, innovation stems from basic R&D and the assumption is that "more R&D in" results in "more successful new products out."[202] Demand-pull, or market-pull, focuses on the marketplace and on potential consumer demand as the catalysts of the innovation process.[203] The process was considered to be sequential, though not necessarily continuous, which could be divided into a series of functionally distinct,

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[193] Dora Marinova & John Phillimore, *Models of Innovation*, *in* THE INTERNATIONAL HANDBOOK ON INNOVATION 31, 45-46 (Larisa van Shavinina ed., 2003).

[194] *Id*. at 223.

[195] NATHAN ROSENBERG, INSIDE THE BLACK BOX vii (1982).

[196] Stephen J. Kline & Nathan Rosenberg, *An Overview of Innovation*, *in* THE POSITIVE SUM STRATEGY: HARNESSING TECHNOLOGY FOR ECONOMIC GROWTH 275, 278 (Ralph Landau and Nathan Rosenberg eds., 1986).

[197] *Id*.

[198] Benoît Godin, *In The Shadow of Schumpeter: W. Rupert Maclaurin and the Study of Technological Innovation 5* (Project on the Intellectual History of Innovation Working Paper No. 2, 2008), http://www.csiic.ca/PDF/IntellectualNo2.pdf.

[199] Kline & Rosenberg, *supra* note 196, at 275, 278-79.

[200] Marinova & Phillimore, *supra* note 193, at 46.

[201] For an elaborate discussion on the two linear models *see* David Mowery & Nathan Rosenberg, *The Influence of Market Demand Upon Innovation: A Critical Review of Some Recent Empirical Studies*, 8 RES. POL'Y 102 (1979).

[202] Roy Rothwell, *Towards the Fifth-generation Innovation Process*, 11 INT'L MARKETING REV. 7, 7-8 (1994).

[203] D. Nobelius, *Towards the Sixth Generation of R&D Management*, 22 INT'L J. PROJECT MGMT. 369, 369-70 (2004).

independent yet interacting stages.[204] The two models presented innovation as an interplay between technology-push and demand-pull.[205] This represented an opposite view to the Schumpeterian perspective which regarded the innovation sequence as a one- direction process.[206]

The main criticism directed against the linear models is that they do not provide an accurate description of the real-life innovation process. This process cannot be reduced to either technology-push or demand-pull, and cannot be treated as a sequence of actions. This criticism is also relevant for the sequential models that preceded technology-push and demand-pull and which were put forth by sociologists and anthropologists. The question as to which comes first, technology-push or demand-pull, or whether they occur simultaneously, is somewhat of a chicken or egg question which remained undiscussed.[207]

While the linear models were thought to provide a simplified description of the innovation process, the theory that followed took into account the complex interactions involved in the process. The "interactive model" did not discard the notion of technology-push and market-pull but rather incorporated them. Rothwell and Zegveld described the newfound understanding of the innovation production process:

> The overall pattern of the innovation process can be thought of as a complex net of communication paths both intra-organizational and extra-organizational, linking together the various in-house functions and linking the firm to the broader scientific and technological community and to the marketplace. In other words the process of innovation represents the confluence of technological capabilities and market-needs within the framework of the innovating firm.[208]

This model stresses the variety of interactions necessary for the success of innovation.[209] Similar models were proposed by Rothwell as well as by Kline and Rosenberg. Rothwell divided his discussion of the interactive model into two parts: the "coupling model," which is still essentially a sequential process but includes feedback loops,[210] and the "integrated model."[211] The latter appears to describe the inter-organizational relationship, as it is mainly concerned with linking the firm to the broader scientific and technological community and to the marketplace. The "coupling model," on the other hand, describes intra-organizational relationships as it focuses on linking together various in-house functions.[212] It seems that the two models present different perspectives of the interactive model which should be examined together as

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[204] Rothwell, *supra* note 202, at 8-9.

[205] JACOB SCHMOOKLER, INVENTION AND ECONOMIC GROWTH (1966).

[206] Bengt-Åke Lundvall, *Innovation System Research: Where It Came From and Where It Might Go* 10 (Globelics Working Paper Series No. 2007-01, 2007), http://www.globelics.org/publication/innovation-system-research-where-it-came-from-and-where-it-might-go-3/.

[207] Marinova & Phillimore, *supra* note 193, at 46.

[208] ROY ROTHWELL & WALTER ZEGVELD, REINDUSTRIALIZATION AND TECHNOLOGY 50 (1985).

[209] Marinova & Phillimore, *supra* note 193, at 47.

[210] Rothwell, *supra* note 202, at 9-11.

[211] *Id.* at 11-12.

[212] *Id.* at 10.

parts of the overall model. Kline and Rosenberg proposed the "chain-link model" as an alternative to the linear model. Similar to Rothwell's "coupling model," it includes feedback and loops which take into consideration potential innovators seeking existing intra-organizational and inter-organizational knowledge. The "chain-link model" also carries out additional research in order to resolve any possible problems arising from each of the links in the innovation process chain.[213]

The shortcoming of the interactive model is that it does not take into account the environment in which firms operate,[214] as firms seldom operate alone.[215] The concept of Systems of Innovation ("SI") emerged during the 1990s in response to this shortcoming.[216] Nonetheless, the focus was still on the entrepreneur as the individual who drives the process described in the model. As Rothwell explains: "[A]t the very heart of the successful innovation process were '*key individuals*' of high quality and ability; people with entrepreneurial flair and strong personal commitment to innovation."[217]

Preliminary signs of the emphasis which innovation theories placed on collaboration could be found in Schumpeter's later work, Mark II, which was understood to reflect the realization of the role of teamwork and collaboration in the innovation process. It was not, however, until the development of the SI model that the need for collaboration in this process became a key concept.

The complexity of innovation requires interactions not only between units of the firm but also with other organizations. This notion is incorporated into the SI model and highlights innovation as a process that does not take place in isolation, but rather in collaboration and interdependence with other organizations.[218] These organizations may be other firms (suppliers, customers, etc.) or non-firms (universities, government offices, etc.).[219] The organization's behavior is shaped by laws, rules, norms and routines referred to as "institutions."[220] The organizations and institutions are components of a system for the creation and commercialization of knowledge.[221] Following Schumpeter, the SI model mainly stresses the leading role of the firm in the innovation process, and the need for firms that do not have the substantial resources required to develop in-house innovation to establish collaborations with other organizations.[222]

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[213] Kline & Rosenberg, *supra* note 196, at 289-94.

[214] Jan Fagerberg, Ben R. Martin & Esben S. Andersen, *Innovation Studies: Towards a New Agenda*, *in* INNOVATION STUDIES: EVOLUTION AND FUTURE CHALLENGES 1, 6 (Jan Fagerberg, Ben R. Martin & Esben Sloth Andersen eds., 2013).

[215] Bengt-Åke Lundvall, *The Economics of Knowledge and Learning* 9 (2003), http://www.globelicsacademy.net/pdf/BengtAkeLundvall_1.pdf.

[216] CHARLES EDQUIST, SYSTEMS OF INNOVATION: TECHNOLOGIES, INSTITUTIONS AND ORGANIZATIONS (1997).

[217] Rothwell, *supra* note 202, at 11.

[218] Kline & Rosenberg, *supra* note 196, at 289-94.

[219] *Id.*

[220] *Id.*

[221] Charles Edquist, *Systems of Innovation*, *in* THE OXFORD HANDBOOK OF INNOVATION 181, 182 (Jan Fagerberg, David C. Mowery, Richard R. Nelson eds., 2005). *Compare with* Rothwell, *supra* note 202 (describing a similar model: "Systems Integration", which emerged during the mid-1990s and is still in effect, focusing on collaboration within a wider system—involving competitors, suppliers, distributors, etc.). *See also* Roy Rothwell, *Successful Industrial Innovation: Critical Factors for the 1990s*, 22 R&D MGMT. 221 (1992).

[222] Marinova & Phillimore, *supra* note 193, at 47.

The economic evolutionary theory was a fertile ground for the development of the SI approach, entered on the firm's behavior. However, unlike the classical and neoclassical theories it did not treat the firm as the sole entity engaged in innovation. Additionally, it maintained that the firm's innovative behavior involves a wider range of organizations that supply the knowledge and skills—underpinning the efforts of the individual firm.[223]

The most well-known derivative of the SI model is the National System of Innovation ("NSI").[224] A NSI is defined as a set of organizations which jointly and individually contribute to the development and diffusion of new technologies and institutions which provide a framework for the implementation of government policies influencing the innovation process.[225] The NSI concept is not confined to the national level and can also be applied globally,[226] as well as to regions,[227] sectors[228] and technologies.[229]

Another model explaining the innovation process that emerged alongside the SI model was the Triple Helix ("TH") model introduced by Etzkowitz and Leydesdorff.[230] According to this model, in increasingly knowledge-based societies, the university can play an enhanced role in the innovation process. This innovation is dependent on collaborations between the public, private and academic spheres, in order to create new knowledge that will drive the innovation process.[231]

I view TH as a complementary framework to the SI model, by explaining or describing the dynamics between the variety of institutional arrangements and policy models that make up the NSI model.[232] In other words, I see the TH model as an elaborate explanation of the interactions between some of the organizations and

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[223] RICHARD R. NELSON, NATIONAL INNOVATION SYSTEMS: A COMPARATIVE ANALYSIS (1993).

[224] *See* CHRISTOPHER FREEMAN, TECHNOLOGY POLICY AND ECONOMIC PERFORMANCE: LESSONS FROM JAPAN (1987); BENGT-ÅKE LUNDVALL, NATIONAL SYSTEMS OF INNOVATION: TOWARDS A THEORY OF INNOVATION AND INTERACTIVE LEARNING (1992); RICHARD R. NELSON, NATIONAL INNOVATION SYSTEM: A COMPARATIVE ANALYSIS (1993).

[225] J. Stan Metcalfe, *Technology Systems and Technology Policy in an Evolutionary Framework*, 19 CAMB. J. ECON. 25, 38 (1995).

[226] *See* Jennifer W. Spencer, *Firms' Knowledge-Sharing Strategies in the Global Innovation System: Empirical Evidence from the Flat Panel Display Industry*, 24 STRAT. MGMT. J. 217 (2003).

[227] *See* Bjørn T. Asheim & Meric S. Gertle, *The Geography of Innovation: Regional Innovation Systems*, *in* THE OXFORD HANDBOOK OF INNOVATION 291 (Jan Fagerberg, David C. Mowery, Richard R. Nelson eds., 2005). Regional systems of innovation are closely linked to the concept of innovative milieu; *see, e.g.*, Marinova & Phillimore, *supra* note 193, at 50-51.

[228] *See* Keith Pavitt, *Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory*, 13 RES. POL'Y 343 (1984).

[229] *See* Metcalfe, *supra* note 225.

[230] *See* Loet Leydesdorff & Henry Etzkowitz Henry, *The Triple Helix as a Model for Innovation Studies*, 25 SCI. & PUBLIC POL'Y 195 (1998); Henry Etzkowitz & Loet Leydesdorff, *The Dynamics of Innovation: From National Systems and "Mode 2" to a Triple Helix of University–Industry–Government Relations*, 29 RES. POL'Y 109 (2000) [*hereinafter* Etzkowitz & Leydesdorff (2000)]; Loet Leydesdorff & Henry Etzkowitz, *The Transformation Of University-Industry-Government Relations*, 5 J. SOC. (2001), available at: http://www.sociology.org/content/vol005.004/th.html.

[231] Henry Etzkowitz, *Innovation in Innovation: The Triple Helix of University-Industry-Government Relations*, 42 SOC. SCI. INFO. 293, 295-96 (2003); Etzkowitz & Leydesdorff (2000), *supra* note 230, at 111-12; William P. Boland, et al., *Collaboration and the Generation of New Knowledge in Networked Innovation System: A Bibliometric Analysis*, 52 PROCEDIA–SOC. & BEHAVIORAL SCI. 15, 16 (2012).

[232] Etzkowitz & Leydesdorff (2000), *supra* note 230, at 109.

institutions in the NSI's "grand scheme."[233] This view is affirmed by Ranga and Etzkowitz's new concept of Triple Helix Systems ("THS").[234] Whether one views SI as a separate analytical framework from TH or sees the two as complementary frameworks, one must recognize the emphasis these frameworks place on collaboration. As such they are a stepping-stone for innovation scholars in understanding the place of collaboration in the innovation process.[235]

We see that the concept of cross-organizational collaboration was first introduced to innovation theories during the 1990s with the emergence of SI and TH. I view this change as an "evolution" of the theories, as they were initially centered on, following Schumpeter's sequential view, the individual innovator or the sole firm. Much emphasis is placed on the knowledge, skills and resources necessary for innovation. The ability of an organization to identify, access, absorb, and use these is crucial for innovation.[236] The 1990s models recognize that knowledge, skills, and resources do not reside in the firm itself, or only in other firms. They are widely distributed in the innovation ecosystem, in various organizations operating in it, such as universities, public research institutions, etc. The interaction between firms and other organizations is as important to the innovation production process as firm-to-firm interactions. These interactions are at the center of the SI and TH models.[237] Cross-organizational collaborations drive structural changes far beyond the scope of what any one organization or person could do alone.[238]

The twenty first century introduces two other models aimed to provide a more accurate explanation of the innovation production process. Quadruple and Quintuple Helix[239] emerged as an answer to the understanding that neither the TH nor SI model

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[233] However, the main criticism against the Triple Helix theory is that it tends to support a perspective in which the DUI-mode of learning is neglected (Lundvall, *supra* note 206, at 15). For this reason, amongst others, criticism has been heard more than once claiming that the Triple Helix approach/model/theory is not suitable for developing countries or regions. *See, e.g.*, Rhiannon Pugh, *The Good, the Bad, and the Ugly: Triple Helix Policies and Programmes in Wales* (Triple Helix International Conference 2013, London 8th-10th July 2013), http://www.triplehelixconference.org/th/11/bic/docs/Papers/Pugh.pdf.

[234] Marina Ranga & Henry Etzkowitz, *Triple Helix Systems: An Analytical Framework for Innovation Policy and Practice in the Knowledge Society*, 27 INDUSTRY & HIGHER EDUC. 237 (2013).

[235] Alongside SI and Triple Helix, a new paradigm emerged during the early years of the 21st century. Open Innovation is understood to be the antithesis of the traditional vertical integration model, also known as the 'closed model of innovation.' *See* Henry Chesbrough, *Open Innovation: A New Paradigm for Understanding Industrial Innovation*, *in* OPEN INNOVATION: RESEARCHING A NEW PARADIGM 1 (Henry Chesbrough, Wim Vanhaverbeke & Joel West eds., 2006); Wim Vanhaverbeke, *The Inter-Organizational Context of Open Innovation*, *in* OPEN INNOVATION: RESEARCHING A NEW PARADIGM 205 (Henry Chesbrough, Wim Vanhaverbeke & Joel West eds., 2006).

[236] Marinova & Phillimore, *supra* note 193, at 47.

[237] Jan Fagerberg, Ben R. Martin & Esben S. Andersen, *Innovation Studies: Towards a New Agenda*, *in* INNOVATION STUDIES: EVOLUTION AND FUTURE CHALLENGES 1, 6-7 (Jan Fagerberg, Ben R. Martin & Esben Sloth Andersen eds., 2013).

[238] Martin Curley & Bror Salmelin, Open Innovation 2.0 Conference, Dublin, Ireland: *A New Paradigm* 5 (2013), http://ec.europa.eu/information_society/newsroom/cf/dae/document.cfm?doc_id=2182.

[239] Elias G. Carayannis & Ruslan Rakhmatullin, *The Quadruple/Quintuple Innovation Helixes and Smart Specialisation Strategies for Sustainable and Inclusive Growth in Europe and Beyond*, 5 J. KNOWL. ECON. 212 (2014).

addresses the multi-levelness of the knowledge-based economy.[240] It has been argued that the TH model does not take into account all the conditions necessary for long-term growth.[241]

This Part summarizes the evolution of the innovation theories. The beginning was modest; innovation was viewed as a sequential process, a macro view of the stages leading to diffusion. Since the 1960s an effort was made to examine how innovation is produced, what are the components, who are the actors and what needs to be done to produce more innovation. While early models maintained the linearity aspects of the sequential view, the twentieth-century brought along an understanding that innovation is neither sequential nor linear, but collaborative and interactive.

V. THE INNOVATOR'S NEW IDENTITY: THE EMERGENCE OF THE 'INNOVATIVE ENTITY'

This article sets out to examine if the patent system achieves its goal of incentivizing innovation.[242] In this Part, I argue that in light of the development of innovation production theories there is a need to recognize the change in the innovator's identity. This requires policymakers to rethink the incentives provided by current U.S. patent system, if they still foster the creation of innovation.

A. Introducing the Innovative Entity

Following the historical review and the discussion of the theories of how the patent system incentives inventors, I concluded that in the eyes of the law the innovator image coincides with that of the inventor, thus bestowing her with ownership of the protected technology.[243] The focus has moved from the inventor being the center of the innovation production process to the firm—as it also had the abilities to conduct commercialization activities. But now it is understood that a complex network of relationships between different organizations is required to produce innovation. This complex network of relationships is comprised of cross-organizational collaborations between different actors in the innovation ecosystem.

In light of these changes, I argue here that there is a need to recognize the new image of the innovator, an identity that the Act must address. The point I wish to make here is that the innovator cannot assume the individual inventor's identity

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[240] Elias G. Carayannis & David F. Campbell, *Mode 3 Knowledge Production in Quadruple Helix Innovation Systems Twenty-first-Century Democracy, Innovation, and Entrepreneurship for Development*, *in* 7 QUADRUPLE HELIX INNOVATION SYSTEMS, SPRINGER BRIEFS IN BUSINESS 1 (2012).

[241] Cinzia Colapinto & Colin Porlezza, *Innovation in Creative Industries: From the Quadruple Helix Model to the Systems Theory*, 3 J. KNOWL. ECON. 343 (2012).

[242] Lawrence M. Sung, *Collegiality and Collaboration in the Age of Exclusivity*, 3 DEPAUL J. HEALTH CARE L. 411, 412-3 (2000) ("At its heart, the patent system seeks to promote innovation by providing inventors with an opportunity for pecuniary reward through the government grant of temporary exclusionary rights in their inventions.").

[243] *See also* Edwin C. Hettinger, *Justifying Intellectual Property*, 18 PHILOSOPHY & PUB. AFFAIRS 31, 50 (1989).

anymore, but today's innovator is in fact an *innovative entity*.[244] This is not to say that there are no individuals still inventing. Recognizing the emergence of the innovative entity should not be on the expenses of the individual inventor. The system should provide incentives to them both. This 'innovative entity' is comprised of actors operating in the innovation ecosystem that have joint forces as part of a collaboration in order to produce innovation. The 'innovative entity' is an entity of organizations, each comprised of a large number of individuals—researchers, marketing personnel—from different departments in the organization, working in collaboration amongst themselves. This, however, does not pull the rug out from under my argument. While the inventor may well still be the innovator, this is usually limited to certain fields in which initial investment is not substantive, as in IT, where garage innovators can still be found. Nevertheless, in scientific fields, research requires access to advanced research tools, biological materials and equipped labs. It requires also highly educated personnel.[245] Though at times well equipped, it is a rare sight to see a scientist working from home. Furthermore, an organization is more than the sum of the individuals comprising it. Organizational knowledge base, its "memory" as referred to by some scholars, comprises the sum of participating individuals' knowledge.[246] Once this body of knowledge is created, new people can use it and it survives people leaving the organization.[247] Some even argue that the sum of organizational knowledge exceeds the sum of individuals.[248] Hall explains that Nelson and Winter treat organizations as "autonomous entities in their own rights, possessing transcendent knowledge," which is comprised of organizational experience. Nelson and Winter "specifically equate this

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[244] The proficient reader may notice that the term 'innovative entity' resembles the term 'inventive entity' used in the Pre-AIA 35 U.S.C. § 102(e). Under U.S. law an 'inventive entity' is anyone other than the inventor, referring to either an individual person or a single organization.

[245] For a discussion of what scientific research initials in the stem cell field in Israel, *see* Niva Elkin-Koren, et al., *Facilitating Collaboration in Stem Cell Research through Intellectual Property* (The Haifa Center for Law & Technology, University of Haifa, Faculty of Law in collaboration with Samuel Neaman Institute for Advanced Studies in Science and Technology (Monograph)) [Hebrew], available at: http://weblaw.haifa.ac.il/he/Research/ResearchCenters/techlaw/StemCells/publications/Documents/ip_stem_cells_full_report.pdf.

[246] Jillian Owen, Frada Burstein & William P. Hall, *Knowledge Reuse in Project Management*, CONSTRUCTING THE INFRASTRUCTURE FOR THE KNOWLEDGE ECONOMY: METHODS AND TOOLS, THEORY AND PRACTICE 443, 444; James P. Walsh & Gerardo R. Ungson, *Organizational Memory*, 16 ACADEMY MGMT. REV. 57, 61 (1991); RICHARD R. NELSON & SIDNEY G. WINTER, AN EVOLUTIONARY THEORY OF ECONOMIC CHANGE (1982); WILLIAM P. Hall, *Organizational Autopoiesis and Knowledge Management* 4 (ISD '03 Twelfth International Conference on Information Systems Development, Melbourne, Australia, 25-27 August 2003), http://www.orgs-evolution-knowledge.net/Index/DocumentKMOrgTheoryPapers/Hall2003OrganizationalAutopoiesisKnowledgeManagement.pdf.

[247] Jillian Owen, Frada Burstein & William P. Hall, *Knowledge Reuse in Project Management*, *in* CONSTRUCTING THE INFRASTRUCTURE FOR THE KNOWLEDGE ECONOMY: METHODS AND TOOLS, THEORY AND PRACTICE 443. *See* James P. Walsh & Gerardo R. Ungson, *Organizational Memory*, 16 ACADEMY MGMT. REV. 57, 61 (1991).

[248] RICHARD R. NELSON & SIDNEY G. WINTER, AN EVOLUTIONARY THEORY OF ECONOMIC CHANGE (1982) WILLIAM P. Hall, *Organisational Autopoiesis and Knowledge Management* 4 (ISD '03 Twelfth International Conference on Information Systems Development, Melbourne, Australia, 25-27 August, 2003), http://www.orgs-evolution-knowledge.net/Index/DocumentKMOrgTheoryPapers/Hall2003OrganizationalAutopoiesisKnowledgeManagement.pdf.

to Polanyi's[249] tacit knowledge,[250] and note that such knowledge is built into the constitutive structure of the organization and exists independently of individuals' knowledge."[251] The organization's tacit knowledge is not attributed to its employees, in the same sense as the inability of the employee to convey her tacit knowledge to her replacement. The creation of a collaborative tacit knowledge, as part of the research collaboration, not attributed to the individuals of cross-organizational collaboration, strengthens the need to recognize the emergence of the innovative entity.

B. The Patent Act Under the Magnifying Glass

The reader may ask, and rightfully so, why should we be concerned as the Patent Act has evolved. The current U.S. Patent Act includes section 262 that regulates the situation of two or more patent owners:

> JOINT OWNERS. In the **absence of any agreement** to the contrary, **each of the joint owners** of a patent may make, use, offer to sell, or sell the patented invention within the United States, or import the patented invention into the United States, **without the consent of** and **without accounting to the other owners**.[252]

This section establishes the rights each partner has in the joint patent if there is no prior agreement that governs the relationship between the partners. At first look it seems that the law is flexible enough to accommodate the emergence of an innovative entity. This understanding is supported by section 116, which regulates the situation in which two or more inventors develop an invention jointly:

> (a) JOINT INVENTIONS—When an invention is made by two or more persons jointly, they shall apply for patent jointly and each make the required oath, except as otherwise provided in this title. Inventors may apply for a patent jointly even though
>
> (1) they did not physically work together or at the same time,
>
> (2) each did not make the same type or amount of contribution, or

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[249] NELSON & WINTER, *supra* note 248, at 104-05.

[250] *See, e.g.*, MICHAEL POLANYI, PERSONAL KNOWLEDGE REISSUE: TOWARDS A POST-CRITICAL PHILOSOPHY, The University of Chicago Press (1958).

[251] WILLIAM P. Hall, *Organizational Autopoiesis and Knowledge Management* 4 (ISD '03 Twelfth International Conference on Information Systems Development, Melbourne, Australia, 25-27 August 2003), http://www.orgs-evolution-knowledge.net/Index/DocumentKMOrgTheoryPapers/Hall2003OrganizationalAutopoiesisKnowledgeManagement.pdf. *See* NELSON & WINTER, *supra* note 248, at 106.

[252] 35 U.S.C. § 262 (emphasis added).

> (3) each did not make a contribution to the subject matter of every claim of the patent.253

The above section seemingly supports the notion that the Act is broad enough to accommodate the emergence of the innovative entity. The 1984 Amendment to the Act[254] added sub-sections (1)-(3) as a way to clarify the joint inventorship requirements.[255] The use of the word 'inventorship' comes from the term 'inventive entity' used in the Act. Unlike the innovative entity, however, an inventive entity refers to co-inventors that are viewed as separate individuals and it is an artificial term that does not constitute the levels of commitment the notion of innovative entity denotes, as I discuss below.[256] Congress amended the Patent Act to codify prior case law.[257] Prior to the 1984 Amendment courts were in disagreement as to the circumstances under which joint inventorship existed. The result was conflicting case law as different courts had articulated different standards.[258] What was never disputed was the courts' requirement of collaboration between the co-inventors.[259] The conflict was with regard to the extent of this alleged collaboration. The two conflicting standards were the "all claims" rule and the "non-all claims" rule.[260] The "all claims" rule required each inventor to contribute to every claim in the patent.[261] The "non-all claims" rule allowed for joint inventorship when different inventors had contributed to different claims, as long as they met the other requirements of inventorship and their contributions resulted in one invention.[262] The 1984 Amendments enacted the "non-

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[253] 35 U.S.C. § 116.

[254] The Patent Law Amendments Act of 1984 (Pub. L. No. 98-622, § 104(a), 98 Stat. 3383, 3384-85 (1984)).

[255] Joint inventorship is widely considered to be arbitrary and lacking coherent standards. *See* Mueller Brass Co. v. Reading Indus., Inc., 352 F. Supp. 1357, 1372 (E.D. Pa. 1972) (explaining that joint inventorship is "one of the muddiest concepts in . . . patent law"). As I further explain in this Part, I doubt that the amendment did clarify what this term entails.

[256] Monheit, *supra* note 20, at 192.

[257] 130 CONG. REC. 28, 073 (1984) (statement of Rep. Kastenmeier).

[258] David W. Carstens, *Joint Inventorship Under 35 U.S.C. § 116*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 616, 618 (1991); Monheit, *supra* note 20, at 202.

[259] David W. Carstens, *Joint Inventorship Under 35 U.S.C. § 116*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 616, 625-26 (1991).

[260] Joshua Matt, *Searching for an Efficacious Joint Inventorship Standard*, 44 B.C.L. REV. 245, 257-58 (2002).

[261] Rival Mfg. Co. v. Dazey Prod. Co., 358 F. Supp. 91, 101, 177 U.S.P.Q. (BNA) 432, 439 (W.D. Mo. 1973) ("[Independent mechanical features that are . . . separate claims in a patent, although incorporated in a single machine, remain separate and distinct inventions."); Stewart v. Tenk, 32 F. 665, 666 (C.C.S.D. IMI1. 887) (stating that because the inventors had not co-invented the claim at issue they were not joint inventors and a separate patent should have been issued to the sole inventor of that claim, as "a joint patent can be sustained only for a joint invention."); *Ex parte Martin*, 215 U.S.P.Q. (BNA) 543, 544 (P.T.O.B. App. 1981) (reciting that joint inventorship requires "that every claim of an application be a product of the same inventive entity.").

[262] SAB Industri AB v. Bendix Corp., 199 U.S.P.Q. (BNA) 95, 104 (E.D. Va. 1978) (clarifying that joint inventors do not have to combine their efforts as to each claim in the patent); Vekamaf HoUand B.V. v. Pepe Benders, Inc., 211 U.S.P.Q. (BNA) 955, 966 (D. Minn. 1981) (holding that under the "non-all claims" rule joint inventorship for patents is recognized "even if all of the joint inventors did not contribute to each and every one of the claims.").

all claims" rule by providing three cases that would not disqualify one from being a joint inventor.[263]

In the following paragraphs I maintain that section 116, along with section 262, does not provide the Act with the flexibility required to recognize the emergence of the innovative entity.

1. Conception is Only Half of an Innovation

It is quite obvious from section 116's wording that the Act views the inventor as an individual that can co-invent with other individuals. This is in line with other sections of the Act, as discussed in Part II.C, and is hardly a surprise.

The individual attribute of the Act is not restricted to its wording alone, but also has an influence on the courts' interpretation. It is the reason for the courts' emphasis on the 'conception step.' The inventive process has two parts: conception and reduction to practice.[264] Courts place emphasis primarily on the conception of the invention.[265] Conception is the stage in which the inventor conceives of the solution to a problem, which constitutes the subject matter of the invention.[266] After the 1984 Amendment, it was determined who the inventor is based on the question: who conceived the subject matter of *at least* one patent claim. An inventor is not required anymore to contribute to each of the patent claims. The rationale is "[b]ecause an inventorship determination focuses on the invention *claimed* and not merely *described* in a patent, the first step in an inventorship analysis is to determine the scope and meaning of the claims."[267] The problem with courts' focus on the conception stage is that they are missing the purpose of the patent system.

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[263] Joshua Matt, *Searching for an Efficacious Joint Inventorship Standard*, 44 B.C. L. REV. 245, 257-58 (2002).

[264] Ethicon, Inc. v. United States Surgical Corp., 135 F.3d 1456, 1460 (Fed. Cir. 1998) (""Conception is the 'formation in the mind of the inventor, of a definite and permanent idea of the complete and operative invention, as it is hereafter to be applied in practice.'" Hybritech, Inc. v. Monoclonal Antibodies, Inc., 802 F.2d 1367, 1376, 231 U.S.P.Q. 81, 87 (Fed.Cir. 1986) (quoting 1 ROBINSON ON PATENTS 532 (1890)). An idea is sufficiently "definite and permanent" when "only ordinary skill would be necessary to reduce the invention to practice, without extensive research or experimentation." Burroughs Wellcome v. Barr Labs., Inc., 40 F.3d 1223, 1228. *See also* Sean B. Seymore,, *Atypical Inventions*, 86 NOTRE DAME L. REV. 2057, 2066 (2011) ("The inventive process has two steps: conception and reduction to practice."); George M. Sirilla, *How the Federal Circuit Clarified the "Muddy Concept" of Joint Inventorship*, 91 J. PAT. & TRADEMARK OFF. SOC'Y 509, 514 (2009) ("invention under the patent statute comprises conception and reduction to practice").

[265] *Burroughs Wellcome*, 40 F.3d at 1227-28 ("Conception is the touchstone of inventorship, the completion of the mental part of invention"); Monsanto Co. v. Kamp, 269 F. Supp. 818, 824, 154 U.S.P.Q. (BNA) 259**,** 262 (D.D.C. 1967) ("Each [inventor] needs to perform but a part of the task if an invention emerges from all of the steps taken together. It is not necessary that the entire inventive concept should occur to each of the joint inventors, or that the two should physically work on the project together.").

[266] Sherry L. Murphy, *Determining Patent Inventorship: A Practical Approach*, 13 N.C. J.L. & TECH. 215, 227 (2012) ("Conception, the "touchstone of inventorship," is the mental part of invention, the brain intensive problem-solving that goes on inside an inventor's mind as a problem and potential solutions are considered in detail.").

[267] Patrick G. Gattari, *Determining Inventorship for US Patent Applications*, 17 INTELL. PROP. & TECH. L.J. 16, 16 (2005).

The reduction to practice step that was briefly indicated above is the heart of the innovation process. Innovation ends with the diffusion of the product or process across the potential market. *Burroughs Wellcome Co., v. Barr Laboratories, Inc., Novopharm, Inc. and Novopharm Ltd.*[268] is the leading case on the question of how to determine joint inventorship where one person (or persons) has (or have) the initial idea and another aids in its reduction to practice.[269] This general description is actually the purpose for which actors in the innovation ecosystem enter collaboration. Collaboration grants access to additional or previously unavailable expertise, prior knowledge, scarce biological materials, expensive research tools, and other capabilities needed to compete in changing markets. Through collaboration, duplication of efforts can be avoided. But it also leads to better utilization of resources. Collaboration prevents scientists from investing resources only to find out that the technology they have been working on vigorously already exists, developed by another research group.[270] Collaboration also has an important social aspect: the creation of new innovation, which is beneficial to society and serves both as an incentive to enter collaboration and as an important benefit.[271]

In *Burrough Wellcome*, the court stated that the conception requirement does not include knowledge that the invention will work, such knowledge is part of the reduction to practice.[272] I postulate that courts' interpretation of section 116 and their focus on the conception step prevents the Act from recognizing the emergence of the innovative entity, thus not providing sufficient incentives.

It is true that not every invention ends with an innovation. However, patents are granted for inventive technologies with a commercial promise.[273] Patents are directly related to technological novelty.[274] For this reason, the reduction step should not be overlooked, especially when taking into account the aim of the patents system to foster

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[268] *Burroughs Wellcome Co., v. Barr Laboratories, Inc., Novopharm, Inc. and Novopharm Ltd.*, 40 F.3d 1223 (Fed. Cir. 1994).

[269] George M. Sirilla, *How the Federal Circuit Clarified the "Muddy Concept" of Joint Inventorship*, 91 J. PAT. & TRADEMARK OFF. SOC'Y 509, 511 (2009).

[270] Talya Ponchek, *Does the Patent System Promote Scientific Innovation? Empirical Analysis of Patent Forward Citations*, 25 ALB. L.J. SCI. & TECH. 289, 304-305 (2015). *See also* Rochelle Cooper Dreyfuss, *Collaborative Research: Conflicts on Authorship, Ownership, and Accountability,* 53 VAND. L. REV. 1161, 1161-67 (2000) (noting the increased value of collaboration in today's research environment, arguing that the current prevalence and value of collaborative work product stems from a number of factors: intense specialization of many scientists, necessitating collaboration; the globalization of the marketplace; new avenues, particularly the Internet, that ease collaboration; the rise in use of transient expert collaborators such as consultants; the expansion of intellectual property rights; and the need to encourage highly accomplished experts to collaborate.). For an elaborate discussion of the benefits *see* Talya Ponchek, *Collaboration in Scientific R&D: Patent-Based Innovation Indicators Analysis Evidence from Stem Cell Research in Israel* 113-41 (doctoral thesis, University of Haifa, 2015) (on file with University of Haifa Library) [*hereinafter* Ponchek (2015)].

[271] *See, e.g.*, Sung, *supra* note 242, at 419 ("To be sure, the social aspects of collaboration play no small role. The rewards of interaction do not culminate with the successful completion of an innovative endeavor.").

[272] Burroughs Wellcome Co., v. Barr Laboratories, Inc., Novopharm, Inc. and Novopharm Ltd., 40 F.3d 1223, 1228 (Fed. Cir. 1994).

[273] *See, e.g.,* Keith Smith, *Measuring Innovation*, *in* THE OXFORD HANDBOOK OF INNOVATION 148, 159 (Jan Fagerberg, David C. Mowery & Richard R. Nelson eds., 2005).

[274] Sung, *supra* note 242, at 413 ("The inherent emphasis on innovation is reflected in the statutory conditions for obtaining a patent, which prescribe that inventions may be patented only if they are useful, new, and nonobvious in view of known technology referred to as prior art.").

and generate innovation. If the focus of the Act is not *both* conception *and* reduction to practice, then the act misses its purpose. That raises concerns not just with regard to its ability to incentivize the innovative entity, but more importantly to provide sufficient incentives to form the innovation entity.

2. Joint, not in collaboration

The innovative entity is the result of a collaboration between two or more organizations operating in an innovation ecosystem with an understanding that in order to be innovative they require access to resources and capabilities other organizations hold.

Courts have interpreted the term 'joint' in section 116 (which also appears in section 262) as requiring collaboration.[275] I suggest that the courts' interpretation reveals they actually require some jointness which does not amount to collaboration.[276] Collaboration is the highest level of jointness. It is this type of jointness that holds together the innovative entity. Elsewhere I offer a typology of characteristics of joint activities.[277] Each of these activities is different due to its level of 'jointness.' Collaboration is the most advanced activity, usually characterized by high levels of mutual attachment to pursue individual and collective benefits,[278] like equity joint ventures or research joint ventures.[279] It involves the bringing together of previously separated organizations into a new organizational texture, with full commitment to a common mission, shared planning, formal communication across multiple levels, pooled and jointly secured resources, shared rewards and products.[280] It is an activity that involves a process with beginning, middle and end components and thus is expected to evolve, change and develop over time.[281] Collaboration can lead to the creation a new entity such as a spin-off or subsidiary respectively.[282] The partners usually enter collaboration to develop a radical innovation based on their common

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[275] Monsanto Co. v. Kamp, 269 F. Supp. 818, 824, 154 U.S.P.Q. (BNA) 259, 262 (D.D.C. 1967) ("A joint invention is the product of collaboration of the inventive endeavors of two or more persons working toward the same end and producing an invention by their aggregate efforts.").

[276] *See, e.g.*, McDavid, *supra* note 19, at 451 ("In 1984, Congress amended the statute in an attempt to account for joint work efforts, yet, even today, it lacks a qualitative or quantitative guideline regarding the type of inventive contribution required to qualify as a joint inventor.").

[277] 'Collaboration' is a complex and intricate term, and an attempt to define it should be the subject of a separate paper. I attempt to do so in Ponchek (2015), *supra* note 270, at 73-112. This discussion includes a review of the confusion in the literature surrounding the difference between 'collaboration' and other joint activities, which led to abundant definitions and meanings to the term 'collaboration.'

[278] *See* Chris Huxham, *Collaboration and Collaborative Advantage*, *in* CREATING COLLABORATIVE ADVANTAGE 1 (Chris Huxham ed., 1996); Arthur Turovh Himmelman, *Rationales and Contexts for Collaboration*, *in* CREATING COLLABORATIVE ADVANTAGE 19 (Chris Huxham ed., 1996).

[279] Ponchek (2016), *supra* note 5, at 85-112

[280] Arthur T. Himmelman, *On Coalitions and the Transformation of Power Relations: Collaborative Betterment and Collaborative Empowerment*, AMERICAN JOURNAL OF COMMUNITY PSYCHOLOGY, Vol. 29, No. 2, 2001, 277-284, 277.

[281] Laurie K. Lewis, *Collaborative Interaction: Review of Communication Scholarship and a Research Agenda*, *in* 30 COMMUNICATION YEARBOOK 174, 174-89 (Christina S. Back ed., 2006).

[282] Steve Cropper, Collaborative Working and the Issue of Sustainability, *in* CREATING COLLABORATIVE ADVANTAGE 80, 82 (Chris Huxham ed., 1996).

beliefs, conviction and vision.[283] On a continuum of joint activities, collaboration is the most complex and advanced form of a joint activity.[284] As section 116 does not account for collaboration, but a general situation of joint work, it does not provide incentives to collaborate and form an innovative entity needed for the advancement of innovation.

Some may say that the Amendment does sit with the reality of an innovative entity in the sense that it recognizes that not every partner is required to make the same contribution. However, the cases described in sub-sections 116(1)-(3) do not provide as much substantive support as one would have hoped. In our day and age collaborative researchers' endeavors do not rely on researchers being from the same lab or the same organization, or even contribute the same amount or type of contribution. What seemed as cutting edge in 1984, is viewed today as the norm.

Though courts are correct in stating that partners are not required to work at the same location or at the same time, the willingness to challenge the classic premise of jointness which they view as 'collaboration,' will fall short in the sense that their definition of 'collaboration' does not take into account the high levels of commitment partners have to one another. In the eyes of the courts, collaboration entails *some element of joint behavior*, such as "working under common direction;"[285] when one inventor sees a relevant report and builds upon it, or when one inventor hears another's suggestion at a meeting.[286] The level of commitment in these examples is unclear. They stand for actions that may initiate collaboration. But the question of sustaining it, resulting with joint research output is not taken into account. This conclusion is further emphasized in light of section 262, as discussed below.

Moreover, the cases described in subsections 116(1)-(3) are a closed list that does not take into account other common situations, such as the collaboration between a firm and a university research lab, whereas the firm provides monetary support.[287] The fact that no labor was done on the firm's part does not change the meaning of the relationship and the levels of commitment, and it is still considered a collaboration. This example may lead to the unreasonable outcome that the firm would not be considered the owner of the joint patent, as section 116 establishes the identity of the

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[283] BARBARA GRAY, COLLABORATING: FINDING COMMON GROUNDS FOR MULTIPARTY PROBLEMS (1989); Barbara Gray, *Cross-Sectoral Partners: Collaborative Alliance among Business, Government and Communities*, *in* CREATING COLLABORATIVE ADVANTAGE 59, 61 (Chris Huxham ed., 1996).

[284] In short, other joint activities are networks, coordination and cooperation. These differ from one another and from collaboration in the texture of the joint activity, in the level of dependency between the partners, the commitment for sharing risks and profits, etc. Real life examples of coordination are cluster and consortium. Alliance is an example of cooperation. On a continuum of joint activities networks is on the one hand and collaboration is on the other. Ponchek (2015), *supra* note 270, at 98-112.

[285] Kimberly-Clark Corp. v. Procter & Gamble Distrib.Co., 973 F.2d 911, 917 (Fed. Cir. 1992).

[286] *Id.*

[287] *See, e.g.*, Thomas N. Bulleit, Jr., *Public-Private Partnerships in Biomedical Research: Resolving Conflicts of Interest Arising Under the Federal Technology Transfer Act of 1986,* 4 J.L. & HEALTH 1, 8 (1990) (explaining relationship between federal laboratories and a company ("firm") under the National Institutes of Health (NIH) Cooperative Research and Development Agreements ("CRADAs"): "[A] government scientist collaborates on a specified research project with a company scientist (the 'investigators'). The company might also fund one or more research fellows to work with the government's principal investigator on the research project. The company may also contribute other resources, such as additional research scientists, supplies or operating expenses. In exchange for this support and participation, the company obtains rights-typically an exclusive license or an option to an exclusive license-in any invention produced under the collaboration.").

(first) owners by stating the joint inventors "shall apply for a patent jointly."[288] Seemingly, as the firm does not contribute inventorship to the mix, it is not entitled to claim ownership in the joint invention. I now turn to discuss section 262.

3. Ramifications of the Scope of Contribution to the Conception

The conception stage, discussed in Part V.B.1, is also used by the courts to identify if an invention is the product of a sole inventor or of joint inventorship, i.e., more than one inventor contributes to its conception.[289] The importance of determining the identity of a co-inventor has to do with the link between inventorship and ownership. A patent is granted to the only true and original inventor.[290] Section 261 ties inventorship with ownership; the applicant is the inventor, unless the rights were assigned: "The applicant, patentee, or his assigns or legal representatives may in like manner grant and convey an exclusive right under his application for patent, or patents, to the whole or any specified part of the United States . . . ."[291]

Section 262 regulates situations of co-ownership. The courts' decisions regarding the co-inventor effects the identity of the co-owners respectively. Prior to the 1984 Amendments, co-inventorship was determined according to one of the two standards discussed in Part V.A.[292] The standard of "all claims" denotes that joint inventors have equal and undivided interests in the patent. This presumption was based upon the 'partnership theory.'[293] If joint inventors were "members of a 'partnership,' whereby they expended equal amounts of inventive effort and shared in the success or failure of their project, then a rule providing equal interests in any resulting patent seemed entirely equitable."[294] With the enactment of the 1984 Amendment, which expressly rejected the "all claims" rule, the partnership theory could no longer be used as a justification for the grant of equal and undivided interests for co-inventors.[295] The main problem with the partnership theory was the requirement of *equal amounts* of

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[288] *See, e.g.*, Andrew B. Dzeguze, *Avoiding the "Fifth Beatle" Syndrome: Practical Solutions to Minimizing Joint Inventorship Exposure,* 6 J. MARSHELL REV. INTELL. PROP. L. 645, 663-70 (2007) (discussing four types of situations that can result in co-inventorship (intra-company collaborations, inter-company collaborations, company collaborations with universities, and mentor-student collaborations at universities) that seem to pre-dominate the case law and suggesting practical steps which can avoid such disputes from arising, with particular emphasis on the unique attributes of each scenario. The author claims that despite being generally good business, these situations crate difficulties due to the unclear legal standard of inventorship is section 116 (but also due to the lack of basic good manner and problematic ethical conduct of the partners)).

[289] *See, e.g.*, Murphy, *supra* note 266, at 228-29.

[290] 35 U.S.C. § 101.

[291] 35 U.S.C. § 261.

[292] *See supra* notes 260-261 and accompanying text.

[293] Dale L. Carlson & James R. Barney, *Who Owns What's in Your Patent?*, INTELL. PROP. TODAY (1998), available at: http://www.wiggin.com/4689.

[294] *Id.*

[295] *Id.* (stating that since the enactment of the 1984 Amendment, the "all claims" rule "was effectively overruled by statute, and thus, the 'partnership' theory of joint inventorship was completely eviscerated."); Ethicon, Inc. v. United States Surgical Corp., 135 F.3d 1456, 1471 (Fed. Cir. 1998) (stating that after the 1984 Amendments to section 116, "the legal premise that each named person had made a full and equal contribution to the entire patented invention became obsolete").

inventorship, while in real-life the situation is quite different. The purpose of the 1984 Amendment was to "recognize the realities of modem team research."[296] This makes sense as inventive efforts are rarely a solitary endeavor in most modern industries. Different forms of joint activities, including collaboration, are commonplace.[297] To this end, the Amendment specifically recites three situations in which joint inventorship is not precluded. The criticism, however, has to do with section 116, stating what would not disqualify one from being a joint inventor, but not providing a definition of what is joint inventorship.[298]

Even if we were willing to say that section 116 accommodates collaboration and provides sufficient incentives to establish the innovative entity and generate innovation, section 262 prevents us from stipulating that assumption. The Amendment remained silent as to the rule in section 262.[299] The purpose of section 262 originally was to make sure the protected technology is commercialized thus benefiting not only the patentee but also society.[300] The co-inventor, however, is recognized as one and she is entitled to use the patented invention as she desires, without the need to acquire her partner's prior consent.[301] Even if we were ready to reject the premise of the difference between joint and collaboratively and say that section 116 in its current form is broad enough to view inventorship as the outcome of an innovative entity's work, section 262 pulls the rug out from underneath this argument.

Determining inverntorship in a collaboration is difficult as it entails interactions between different research groups in the same institution and between different

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[296] 130 CONG. REC. 28,073 (1984) (statement of Rep. Kastenmeier).

[297] David W. Carstens, *Joint Inventorship Under 35 U.S.C. § 116*, 73 J. PAT. & TRADEMARK OFF. SOC'Y 616, 617 (1991).

[298] *Id.* at 619 ("However, rather than providing a definition of "joint inventor", the foregoing paragraph merely lists the factors which shall not preclude a joint inventorship."). *See also*, George M. Sirilla, *How the Federal Circuit Clarified the "Muddy Concept" of Joint Inventorship*, 91 J. PAT. & TRADEMARK OFF. SOC'Y 509, 510 (2009).

[299] Dale L. Carlson & James R. Barney, *The Division of Rights Among Joint Inventors: Public Policy Concerns After Ethicon v. U.S. Surgical*, 39 IDEA 251, 260 (1999). *See also*, Joshua Matt, *Searching for an Efficacious Joint Inventorship Standard*, 44 B.C. L. REV. 245, 270 (2002) ("This discord, originating from the 1984 amendments to 35 U.S.C. § 116, has had effects that are in some instances directly contrary to the explicit Congressional intent of those amendments."); and McDavid, *supra* note 19, at 453 ("The inequity of permitting equal ownership interests for unequal contributions is the foundation of controversy in joint inventorship/ownership law and enhances the significance of distinguishing true inventive contributions from non-qualifying efforts.").

[300] *See, e.g.*, CRS REPORT FOR CONGRESS, INTELLECTUAL PROPERTY AND COLLABORATIVE RESEARCH 17 (2005), http://www.au.af.mil/au/awc/awcgate/crs/rl33063.pdf ("The policy basis for this rule appears to be premised upon creating the maximum opportunity for the patented technology to be exploited in the marketplace . . . The tenancy-in-common relationship also prevents one of many joint owners from a patent form "holding up" the entire transaction by demanding additional royalties or other consideration.").

[301] Section 262 raises other concerns which exceeds the scope of this article, but are worth mentioning even in a nutshell as they lead to absurd results. The main example is of an inventor granting a license to a competitor of the other co-owner(s). In *Ethicon, Inc. v. United States Surgical Corp.*, 135 F.3d 1456, 1471 (Fed. Cir. 1998) the case was even more absurd as Ethicon discovered after the co-inventor refused to join in the infringement suit against the plaintiff that the co-inventor was the one who had granted a license to the infringer-defendant Surgical Corp.

organizations.[302] The line as to who has done what, who contributed what, and how much is vague, hence the need to recognize a singular uniformed entity.[303] This would certainly justify maintaining a standard similar to the 'partnership theory' in section 262;[304] non-specified inventorship leads to inclusive ownership of the patent, i.e. ownership does not rely on the amount or type of inventorship each of the organizations comprising it has contributed. According to section 262, however, an inventor can license the patent without the permission of the other co-inventor(s) as many times as he or she desires, thereby reducing the value of the invention. This is especially worrisome if we think about an innovative entity which was established as part of a collaboration between a firm and a university. If the firm, which has the commercialization abilities that the university lacks, utilizes the patent, what gain would be left to the university?

Section 262 does not provide the necessary incentives to initiate collaboration and establish an innovative entity. The wording seems to defeat the purpose of establishing a collaboration, as it views joint ownership as a situation within each partner is free to use the patented invention as they desire. While this may be true in a more loosely joint activity such as a network (though it is usually unlikely that a network will lead to the creation of an invention),[305] it is not the case in collaboration. An innovative entity is created by cross-organizational collaborations. How can policymakers advance the initiation of collaborations and promote innovation production by the innovative entity, if the law does not even define the activity it is designate to advance?

The concerns regarding the Act's ability to achieve its goal run even deeper. Section 262 serves as an impediment to the initiation of collaboration, but more importantly it is a representation of a property regime that does not sit with the reality of an innovative entity. In the next Part the article explains why a Libertarian property regime, as manifested in the Patent Act, hinders innovation production.

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[302] Carstens, *supra* note 297, at 617 ("Often this collaboration is immediate and well documented. Other times, ideas generated within multinational firms may circulate over the course of years by inter-office memo or newsletter."). *But cf.* Sean B. Seymore, *My Patent, Your Patent, or Our Patent? Inventorship Disputes Within Academic Research Groups*, 16 ALB. L.J. SCI. & TECH. 125, 135 (2006).

[303] Eric Ross Cohen, *Clear as Mud: An Empirical Analysis of the Developing Law of Joint Inventorship in the Federal Circuit*, 28 BERKELEY TECH. L.J. 383, 385 (2013) ("[J]oint inventorship law attempts to apply the vague standard requirements of inventorship to the expansive variety of collaborative scenarios in which multiple parties are involved in the inventive process."). *See, e.g.*, Brian M. Gaff, *Who Invents What?*, COMPUTING & THE LAW 10, 11 (2013) "Determining when there is collaboration that gives rise to joint inventorship can be difficult. This issue has been vigorously litigated in many cases.").

[304] *But cf.* Matt, *supra* note 263, 274-86 (offering to amend the joint inventorship rule under section 116, as oppose to most proposals that have focused on procedural solutions or on the law of joint ownership under section 262).

[305] *See* Ponchek (2015), *supra* note 270, at 98-112, for a discussion of networks and their place on the continuum of joint activities (Networks are "informal relationships [between institutions] that denote lack of any form of organization"). *Id*. at 99.

C. Is it Time for a New Property Regime?

In this Part, I take a step back from the various sections of the Patent Act and provide a bird's eye view of the property regime. So far I postulated that the Act does not provide sufficient incentives to initiate collaboration and establish an innovative entity. The establishment of such entity is necessitated by the creation and development of new innovations. This Part reviews the property regime at the basis of the Patent Act. I claim here that the lack of incentives is not only the result of the wording of the Act, but more importantly the libertarian property regime of the Act.

Patents are property.[306] The Patent Act itself clearly and unambiguously states that. Section 261 affirms as follows: "Subject to the provisions of this title, patents shall have the **attributes of personal property**."[307] The point I wish to make here is that the property regime under U.S. patent system is Libertarian. Libertarianism was developed in the seventeenth century as an answer to monarchs and aristocrats reign, who lived off the productive labor of other people. Libertarians defended the right of people to keep the fruits of their labor.[308] John Locke,[309] Adam Smith,[310] David Hume,[311] Thomas Paine[312] and Thomas Jefferson are prominent examples of Libertarians thinkers.[313] The purpose of this Part is not to provide a comprehensive survey of the development of the concept of Libertarianism. Instead, I stress a single point: Our current understanding of property is of ownership by a single individual, whereas what we should be discussing is a non-specific, inclusive collaborative ownership.[314]

David Boaz explains that libertarianism is "the view that each person has the right to live his life in any way he chooses so long as he respects the equal rights of others . . .[Libertarianism] defend each person's right to life, liberty, and property—rights that people possess naturally . . . ."[315] The concepts of property and liberty are closely tied, if not intertwined.[316] Libertarianism is a different concept than liberalism. Unlike liberals, libertarians believe in individual freedom and limited government consistently.[317] The notion of individual freedom is based on the view of the *individual* as the basic unit of social analysis. Only individuals make choices and are responsible for their actions. Libertarians accept the basic rights that liberals do – individual liberties, individual rights and individual freedom. They add to the mix

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[306] Greive, *supra* note 16, at 1346 ("A patent or patent application has the attributes of personal property and is thus freely assignable").

[307] 35 U.S.C. § 261 (emphasis added).

[308] DAVID BOAZ, LIBERTARIANISM: A PRIMER 17-18 (1997).

[309] *See supra* Part III.

[310] ADAM SMITH, THE WEALTH OF NATIONS (1976); ADAM SMITH, THE THEORY OF MORAL SENTIMENTS (1976).

[311] DAVID HUME, A TREATISE OF HUMAN NATURE (1769), https://www.gutenberg.org/files/4705/4705-h/4705-h.htm.

[312] THOMAS PAINE, RIGHTS OF MAN (1791).

[313] Boaz, *supra* note 308, at 17. Though at their respective time, they were each considered a liberal. *Id.* at 40.

[314] The term collaborative here denotes to the levels of commitment between the partners. *See supra* note 280 and accompanying text.

[315] Boaz, *supra* note 308, at 2.

[316] HANOCH DAGAN, PROPERTY ON A CROSSROAD 37 (2005) [Hebrew].

[317] Boaz, *supra* note 308, at 21; *see id.* at 22, for helpful figure.

more liberties, namely, absolute freedom of contract and of property. However, given the absolute terms in which libertarians define these rights, as Samuel Freeman articulates, libertarians come to occupy a predominant position and in effect eliminate any need (in libertarians' minds) for basic rights and for liberal institution.[318] Freeman explains that the problem is these added liberties, when combined with the libertarian account of self-ownership, undermine the idea of basic liberties. For what libertarian self-ownership ultimately means is all rights are conceived as property rights. Rights to liberties then become just one among several kinds of rights that persons own and have at their disposal. Basic liberties are of no greater moral or in comparison to other kinds of property rights.[319]

Libertarian thought emphasizes the dignity of each individual, which entails both rights and responsibility. Because individuals are moral agents, they have a right to be secure in their life, liberty, and property.[320] These rights are not granted by government or by society; they are inherent in the nature of human beings. Of course libertarians support the formation of a government, however, as government is a dangerous institution, it is limited in nature—to protect individuals' rights. Libertarianism does not a claim that people can do anything they want to. Rather, as Boaz explains, libertarianism proposes a society of liberty under law, in which individuals are free to pursue their own lives so long as they respect the equal rights of others.[321] The rule of law means that individuals are governed by generally applicable and spontaneously developed legal rule, not by arbitrary commands, and that those rules should protect the freedom of individuals to pursue happiness in their own ways, and not aim at any particular result or outcome.[322] Libertarians also contend that to survive and to flourish, individuals need to engage in economic activity. Libertarians believe that people will be both freer and more prosperous if government intervention in people's economic choices is minimized. Free markets are the economic system of free individuals, and they are necessary to create wealth.[323]

Libertarianism is considered to be a basic framework for societies in which free individuals can live together in peace and harmony, pursuing constant improvements, advance science, technology, and standard of living.[324] The problem, however, is that the notion of every person as a unique individual who owns himself or herself led to the negation of other ownership possibilities besides self-ownership.

A property right is a human right of an individual to use and dispose of property that he has justly acquired. These rights stem from the one fundamental right of self-ownership, our ownership of our own bodies.[325] This does not coincide with the emergence of the innovative entity. The focus remains on the individual, though decisions are made on the entity level. The unit of decision making is now the entity and not the individual, which is comprised from several organizations and their personnel. Libertarians recognize that humans are social beings and that being part

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[318] Samuel Freeman, *Illiberal Libertarians: Why Libertarianism Is Not a Liberal View*, 30 PHIL. & PUB. AFFAIRS 105, 123 (2001).

[319] *Id.* at 131.

[320] Boaz, *supra* note 308, at 16.

[321] HANOCH DAGAN, PROPERTY ON A CROSSROAD 37 (2005) [Hebrew].

[322] *Id.* at 17.

[323] *Id.*

[324] *Id.* at 57.

[325] *Id.* at 68.

of society has its benefits.[326] Individuals benefit greatly from their interactions with other individuals. Libertarians refer to this as 'cooperation.'[327] However, their understanding of cooperation is limited to entering contracts with others,[328] whom they live and work with, which is a basic human right resulting from the individual's self-ownership.[329] Boaz describes the problem, that for libertarians, the basic unit of social analysis is the individual.[330] It cannot be anything else as individuals are, in all cases, the source and foundation of creativity, activity, and society. According to this, libertarian line of thinking, groups do not have plans or intentions. For this reason, only individuals are seen as capable of choice, in the sense of anticipating the outcomes of alternative courses of action and weighing the consequences. Though individuals create and deliberate in groups at times, the individual mind is still, according to libertarianism, responsible for the choices made, because only individuals can take responsibility for their actions.[331]

As stated above, the *individual* is the unit of value, and the liberty of the individual is the essential precondition for human flourishing. Libertarianism is based on this notion and thus, negates the possibility of collaborative ownership.[332] The U.S. Patent Act fulfills this libertarian objective of individual's self-ownership. Locke explains to a T the point I try to make here through the following examples:

> And the taking of this or that part **doesn't depend on the express consent of all the commoners**. Thus when my horse bites off some grass, my servant cuts turf, or I dig up ore, in any place where I have a right to these in common with others, the grass or turf or ore becomes my property, **without anyone's giving it to me or consenting to my having it**. My labour in removing it out of the common state it was in has established me as its owner. If the explicit consent of every commoner was needed for anyone to appropriate to himself any part of what is given in common, children

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[326] *Id.* at 96 (referring to the benefits of what Adam Smith called the Great Society, the complex and productive society made possible by social interaction).

[327] Though I do not go into details, in Part **Error! Reference source not found.**, I discuss the difference between joint and collaboratively. Cooperation does not describe accurately neither libertarians understanding of the role of society nor the essence of an inventive entity as I further discuss.

[328] Boaz, *supra* note 295, at 132 ("The result is a complex network of free association in which people voluntarily assume and fulfill obligations and contracts . . . The result is that diverse and unfamiliar people come together in fellowship"). The loose and voluntary notion of these arrangements deny the recognition of any collaboration, as collaboration requires high levels of commitment between partners. *See supra* note 280 and accompanying text.

[329] It is this complete contract freedom that Nozick warns about, and gives the extreme example of a person to sell himself into slavery as it is a system that support freedom of entering into contracts as part of the individual self-ownership. ROBERT NOZICK, ANARCHY, STATE, AND UTOPIA 283, 331 (1974). This is closely related to concerns raised by Freeman. *See supra* note 300 and accompanying text; Freeman, *supra* note 318, at 132-34.

[330] Boaz, *supra* note 308, at 95.

[331] *Id.*

[332] Locke discusses "common ownership" and explains how property that is held in common does not realize the notion of individual liberties. LOCKE, *supra* note 140, at § 28-29 ("taking any part of what is common and removing it from the state nature leaves it in creates ownership; and if it didn't, the common would be of no use.").

> couldn't cut into the meat their father had provided for them in common without saying which child was to have which portion.[333]

If we read section 262 again, we see that it raises the same point Locke was making in the above paragraph. Section 262 provides that in the absence of previous agreement between the partners, one partner can invoke her property right in the patent without requiring the other partner's consent. Furthermore, case law has extended section 262 to include the situation in which each partner licenses the invention without recourse to the other partners, effectively precluding the grant of an exclusive license in cases of joint ownership unless all the partners agree not to grant any further licenses or to work the invention themselves.[334] Similarly, one partner has the right to impede the other partner's ability to sue infringers by refusing to voluntarily join in such a suit.[335] The problem is that while Locke provides a rationale for the need to bestow individuals with private property, section 262 governs the relationship between joint owners. Nonetheless, the resemblance between each of these different texts support and strengthen the point I wish to make in this article. Section 262 does not incentivize collaboration which is required in order to incentivize the creation of an innovative entity, as it actually denotes an individual's self-ownership. If this section had established a requirement to receive the other partners' prior consent, it would not have gratified the principles of libertarianism.

One should also draw her attention to the fact that some libertarians reject natural rights as a basis for their views. They base their notion of self-ownership on utilitarian theory.[336] This, however, does not influence the point I wish to make. First, even the libertarian-utilitarians reach the same conclusion with regard to private property. Second, utilitarian theory is used to justify the need for a patent system and the incentive it provides the inventor/innovator.

Granted, the discussion in this Part is only relevant as long as there is no prior agreement between the partners that governs their collaborative relationship. However, an agreement, as elaborate as it may be, cannot foresee all possible situations that may arise. Thus, the letter of the law may prevail. Furthermore, science is still the realm of scientists and not attorneys. In some cases, the legal team joins in a later stage, after the collaboration was already established, or only when a dispute arises between the parties. These are also situations in which the letter of the law dictates the outcome. Finally, and most importantly, the law is used by policymakers to signal practitioners which strategies they should adopt to increase innovation production.

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[333] *Id.* § 28-29 (emphasis added).

[334] *See, e.g.*, Willingham v. Star Cutter Co., 194 U.S.P.Q. 249 (6th Cir 1977).

[335] *See, e.g.*, Schering Corp v. Roussel-UCLAF SA, 104 F3d 341, 41 U.S.P.Q. 2d 1359 (Fed Cir 1997); Israel Bioengineering Project v. Amgen Inc., 81 U.S.P.Q. 2d 1558 (Fed. Cir. 2007). A refusal to join in suit against an infringer can result in the de facto grant of a license even without positive action. *See STC.UNM v. Intel Corp.*, No. 13-1241 (Fed. Cir. 2014).

[336] Boaz, *supra* note 308, at 87. These include Jeremy Bentham and the economist Ludwig von Mises. *Id.* at 82-83.

VI. SUMMARY AND CONCLUSIONS

This article sets out to examine if, in light of the development innovation production theories have undergone, the patent system still achieves its goal. The Patent Act is a means to a socially desired end. To encourage innovation, the state grants the inventor a monopoly right to manufacture, use, and sell his creation. The research question is examined in light of the change in the innovator's image—from an individual to an innovative entity. To answer this question, the article takes us back in time to pre-legislation England, through American colonies and the federal enactment of the U.S. Patent Act, including the arguments in support of inventors' private rights.

The legal and theoretical basis for the patent system was established by the seventeenth century English common-law Courts and Parliament, in the midst of their successful struggle against monopolies, following the indiscriminate use of letters patent mainly by Queen Elizabeth I. Such grants were forbidden on the grounds that they suppressed that freedom of trade which was "the birthright of every subject."[337] The establishment of the American federal patent system gave rise to the image of the heroic inventor. The patent system itself perpetuates and reifies the myth of the individual inventor.[338] With the establishment of the federal system, the patentee was no longer the craftsman who practices his skills, but the intellectual inventor who creates and discloses information.[339] The development of civil rights, property rights, justifications based on the natural rights, and Lockean perspectives, led to the rise of a new framework: the inventors as owners vision. This framework was manifested in the federal patent system. The patent system provides these genius individuals, creating new ideas, control over their informational output in the form of ownership.[340] The mechanism by which the patent system achieves its policy objectives, to foster and incentivize invention and innovation, is through the allocation of private property rights to individuals. The patent system is concerned with identifying the individual inventor, or patentee, to whom it can assign exclusive rights.[341]

Innovation has become the central driver of national and global economic well-being and the competitiveness of nations.[342] This is particularly true with the emergence of the knowledge-based economy. While the patent system remained focused on the individual, the twentieth century brought along winds of change to innovation production theories. Innovation theories recognized the importance of collaboration to the innovation process. It however became the focal point of innovation theories only during 1980s.[343]

The Acts' view of innovation, as an individual endeavor, is based on the fourteenth century identity of the privilege grantee. The fact that views from five centuries ago

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[337] Alfred E. Kahn, *Fundamental Deficiencies of the American Patent Law*, 30 AM. ECON. REV. 475, 476 (1940). *See supra*, Part II.A

[338] Lee, *supra* note 151, at 27.

[339] Bracha (2009), *supra* note 14, at 374.

[340] *Id.*

[341] Lee, *supra* note 151, at 27.

[342] ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT (OECD), The Measurement of Scientific and Technological Activities: Using Patent Data as Science and Technology Indicators 11 (1994), available at: http://www.oecd.org/sti/inno/2095942.pdf.

[343] *See, e.g.*, Marinova & Phillimore, *supra* note 193, for a comprehensive review of the theories.

still shape policymakers' way of thinking about innovation in the twentieth century raises concerns. The risk is that the main tool used to foster innovation may not do so as effectively as before, as it ignores the emergence of the innovative entity. The sections of the Act that are seemingly designed to attain the need to incentivize the establishment of an innovative entity denote a libertarian property regime which does not sit with the fact that the innovative entity is actually a net of cross-organizational collaborations. Libertarians' view of property is of self-ownership. Other forms of ownership are not accepted.[344] "The U.S. patent laws, which are designed to promote innovation, should facilitate and not hinder the vehicles for progress, such as . . . collaboration. With these principles in mind, the question of the impact of patent protection on collaborative behavior warrants a closer scrutiny of the law governing inventorship."[345]

The Act only applies to situations in which the partners do not have a prior agreement that dictates the relationship between them.[346] Nevertheless, the importance of the discussion stems from the simple fact that not every interaction is governed by an agreement between partners working jointly, though usually people assume so. More importantly, as the patent system is the main policy tool used to advance innovation, it serves as an instrument by policymakers to signal actors operating in the innovation ecosystem of policymakers' state-of-mind which are the measures that should be taken to foster innovation.[347] I maintain that though policymakers try to signal that collaborations are needed to generate more innovation, under the current Act it is done inadequately.[348] The lack of appropriate signal also stems from the distinction between 'collaboration' and 'joint work,' or 'joint activities.' This is an important distinction as sections 116 and 262 refer to a joint activity not collaboration. Joint activities vary, and collaboration is one of them. Unlike other joint activities, collaboration requires higher levels of partners' commitment. As collaboration is the joint activity we wish to foster, policymakers should address the meaning of collaboration and the difference between collaboration and other joint activities within the Patent Act. Policymakers should also strive to incentivize the initiation of cross-organizational collaborations and the establishment of an innovative entity aimed at developing inventions and innovations. The Act should adopt a

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[344] Ravi Iyer, et al., *Understanding Libertarian Morality: The psychological roots of an individualist ideology*, 7 PLOS ONE 1, 16-7 (2012), https://webfiles.uci.edu/phditto/peterditto/Publications/Iyer%20et%20al%202012.pdf (Reaching the conclusion that libertarians are individualistic and are less prone to support the initiation of collaboration based on a large web-based survey of libertarians).

[345] Sung, *supra* note 242, at 422.

[346] CRS REPORT FOR CONGRESS, supra note 300, at 16 ("Given the ability of joint researchers to "contract around" the patent statute's inventorship standards, changes to current rules may not be a high priority for Congress").

[347] W. Fritz Fasse, *The Muddy Metaphysics of Joint Inventorship: Cleaning Up After the 1984 Amendments to 35 U.S.C. § 116*, 5 HARV. J.L. & TECH. 153, 207 ("Because a mutual exchange of ideas and information among inventors results in increased aggregate innovation, a collaboration requirement of this nature serves to further a fundamental policy goal of the patent laws.").

[348] For empirical evidence of the innovative powers of cross-organizational collaborations, *see* Ponchek (2016), *supra* note 5.

standard[349] of collaboration that will incorporate the high levels of commitment between the partners to the common mission, through pooling and jointly securing resources, shared rewards and products.[350] "[T]o achieve the goal of maximum innovation, the patent system should foster actual collaboration among researchers. This collaboration will lead to more joint inventive work and the development of more patentable inventions."[351] To do so, and in order to catch up with innovation production theories, the Act should address the issue of joint ownership, and set a clear rule that takes into account the non-specific nature of the joint inventorship that leads to an inclusive joint ownership right.[352] If the patent system does not succeed in achieving its goal, actors operating in the innovation ecosystem may opt to use (to use to a greater extent than they have been doing so far) trade secrets. The main problem of trade secrets is they "do not enrich the collective knowledge of society."[353] This means that society at large would be on the losing side, and the rate of innovation production would slow down, as secrecy and collaboration do not sit together.

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[349] Sung, *supra* note 242, at 420 ("the degree of such collegiality [such as collaboration] rests upon the ability of members of these communities to agree and adhere to recognizable standards of conduct that promote collaborative behavior.").

[350] *See supra* note 280 and accompanying text.

[351] Fasse, *supra* note 347, at 159-60.

[352] *But cf.* Tigran Guledjian, *Teaching the Federal Circuit New Tricks: Updating the Law of Joint Inventorship in Patents*, 32 LOY. L. A. L. REV. 1273, 1299 (1999) (concluding that only fractionating the patent into its claims produces the most equitable outcome for joint inventors.); and CRS REPORT FOR CONGRESS, *supra* note 300, at 19-20.

[353] CRS REPORT FOR CONGRESS, supra note 300, at 5.