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THE "TERMINATOR" PATENT AND ITS DISCONTENTS: RETHINKING THE NORMATIVE DEFICIT IN UTILITY TEST OF MODERN PATENT LAW

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In the popular narrative, the tale of patents is the stirring saga of a legal mechanism devoted to the promotion of socially useful inventions. In this endless epic, which is often retold with little critical ability, the patent system is depicted as the valiant protector of ingenious minds from the nefarious activities of pilferers, imitators, and free riders. Implicit in this idealized narrative of patents is the notion that only inventions that are socially useful are protectable by the patent system. The converse position is that inventions that are "immoral" or "dangerous" cannot be the proper subject of patents. This romantic notion of patents and patentability is so pervasive in the popular imaginings of patents that patented inventions that seem "immoral" or "dangerous" are visited with dismay, incredulity, and sometimes, outrage by members of the public. Implicit in this emerging feeling of discomfort with patents on inventions of questionable usefulness to society is the policy direction, or lack thereof, of the major patent systems of the world.

In recent times, biotechnological inventions such as genetically modified life forms have rekindled the debate on whether ethical, environmental and social criteria ought to play a role in determining the patentability or otherwise of an invention. Amidst this debate, no other criterion of patentability has suffered as much misconception and misunderstanding as the requirement of utility. Upon a careful examination of the issues, it would seem that public outrage or indignation with patents issued to biotechnological inventions that challenge the boundaries of morality and ethics, stems in part from a popular misapprehension or ignorance of the jurisprudence on utility in contemporary patent law. In effect, public misapprehension of the concept of utility in patent law is a function of the conflation of what a patent is with what a patented invention ought to achieve for society. In other words, members of the public seem to have a non-technical and antiquated understanding of the criterion of

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utility in the determination of whether a particular invention is fit for patent protection or not. Put simply, in the popular parlance, utility of inventions is often understood as social usefulness.

Arguably, no other biotechnological invention has been excoriated with so much confused rhetoric on "utility" as the invention relating to Genetic Use Restriction Technologies ("GURTs"), patented in the United States, Canada, Australia, Belgium, Bulgaria, Denmark and many other countries.[1] Otherwise known by their rather inflammatory nickname of "terminator patents," GURTs have become the lightning rod for both technophiles and Luddites.[2] At the heart of the controversy is a misunderstanding of the changed meaning of the concept of utility in patent law. This paper argues that while the public understanding of utility as social usefulness is well grounded in the history of patent law, modern development in the jurisprudence of utility has not been stagnant. To the contrary, utility in patent law has moved from puritanical notions to its current articulation as the ability of an invention to do what it promises to do as per the disclosure filed with the patent office.

In other words, the test of utility is no longer anchored on whether the alleged invention is socially useful or ethically permissible. Rather, the overriding criterion in modern patent law is whether the alleged invention performs or fulfils what it predicts to do as per its disclosure. In order to appreciate this shift, it has to be borne in mind that across the centuries, courts in various jurisdictions have evolved in their conception of what utility means in patent law. From an original focus on social usefulness with a puritanical slant, utility has moved to a struggle between social usefulness and mechanical operability and now to mechanical predictability. Consequently, I argue in this paper that a fundamental misconception in the recent criticisms against the utility or otherwise of "terminator" technologies is that utility is mistaken for its original notion of social usefulness. The present reality is that utility of inventions has

1. The "terminator patent" has been issued in France, Germany, Greece, Hungary, Italy, Liechtenstein, Luxembourg, Netherlands, Republic of Korea, Romania, South Africa, Spain, Sweden, Switzerland, Turkey, and United Kingdom. Similar applications are pending in Brazil, Israel, Japan, New Zealand, Norway and Slovak Republic. *See Defend Food Sovereignty: Terminate Terminator*, ETC GROUP 1, Jan. 2002, *available at* http://www.etcgroup.org /documents/terminatorbrochure02.pdf (last visited Sept. 12, 2004) [hereinafter "*Defend Food Sovereignty: Terminate Terminator*"].

2. In 1811 Nedd Ludd led a rebellion in the English Midlands against the introduction of machines in the British textile industry. Since then, the term "Luddites" has become a pejorative term reserved for those opposed to new technologies, particularly biotechnologies. *See Y9 Luddites*, *at* http://www.pages.zdnet.com/stanleytech/publicwork/id9.html (last visited Sept. 12, 2004).

weaned itself from the high-minded impulses of the Venetian patent system and the British Statute of Monopolies.

Using the terminator technology as a case study, I argue that the social deficit implicit in an overly technical conception of utility leaves much to be desired. If the patent system desires to reclaim its original intent of including social relevance as part of the criteria for the protection of inventions, it must rethink its excessive focus on mechanical operability of inventions. The consequences of an excessive deference to technical wizardry manifested in inventions, especially in the context of environmental protection and biodiversity promotion, are too enormous. Modern patent systems need to outgrow their pretense that social and ecological factors are not legitimate factors for determining utility of inventions.

Towards reclaiming its original social focus, clear and unambiguous legislative provisions or criteria must be put in place to ensure that society does not subsidize inventions that are harmful to the environment or unnecessarily imperil other life forms. Every patent is a sort of subsidy to the inventor. It is hardly prudent for the state, as a social entity, to subsidize inventions that enrich an inventor while excessively endangering genetic diversity and ecological integrity.

At the philosophical level, the major question addressed in this paper is the propriety of granting patent protection to technologies that undermine the conceptual foundation of the patent system and frustrate the intended goal of rewarding inventors of socially useful inventions. Regrettably, debates on the compatibility of patent protection with GURTs, and the implications of these technologies for genetic diversity and sustainable agriculture, have largely been of a rhetorical nature, thus beclouding the serious intellectual property rights questions and environmental challenges posed by the application of GURTs to plant biodiversity and agriculture.

GURTs represent an extremely powerful form of control or ownership and exploitation of life forms beyond the contemplation of the policies underlying the patent system. While patents are designed to transfer valuable information to the public after the duration of the patent term, GURTs ensure that the ultimate control of the genetic traits of the patented life forms remains perpetually in the hands of the patent holder. This is an unusual form of monopoly that stretches the ambits of the patent system beyond the limits generally intended by most patent systems.

While the technology may become part of the public domain after the expiration of the patent term, the peculiar nature of the technologies ensures that farmers are permanently tied to seed merchants. Another

worrisome aspect of this is the impact such technologies have on farmers' recognized privilege or "right" to replant saved seeds. The end users of GURT-patented products depend on the holders of the technologies for the continued supply of new seeds and activation of desired traits long after the formal expiration of the patent term. There is in substance no real recourse to the public domain, at least not in the immediate view, since all the regulatory controls and triggers associated with GURTs are biologically driven and outlast the patent term.[3] Consequently, I argue in this paper that the application of patents to GURTs flies in the face of the fundamental policy justification of the patent system as a mechanism for the regulated release of valuable information and benefit to the public.

More importantly, the probable negative impact of GURT patents on plant and agro-biodiversity raises serious issues concerning sustainable use of plant biodiversity. Within this context, I examine the anti-public domain ramifications of GURTs, and engage with conceptual and/or policy arguments against the granting of patent protection on GURTs. I argue that although GURTs and related technologies are, technically speaking, inventions, whether they are socially useful is a matter of debate. Consequently, there is a compelling need to explore other procedures or prescriptions needed to mitigate the negative implications of patented GURTs on sustainable agriculture and genetic diversity. In the main, this article explores the issue of whether current patent law on utility of inventions has lost its original social impulse, and thus is in need of a rethink.

For clarity of analysis, this article is divided into three parts. In the first part, I introduce the technologies of GURTs and their main characteristics. In the second part, I examine the origins and policy foundations of the patent system, particularly how the courts in various jurisdictions have defined the concept of utility. The second part also explores the evolution of the requirement of utility and its contemporary emergence as a secular, technical test with emphasis on mechanical operability of inventions. The third part of this article explores the nature of GURT patents *vis-à-vis* their compatibility with the stated policy imperatives of the patent regime. In addition, the third part evaluates the propriety of GURT patents in the context of international law on biodiversity protection and the precautionary approach to release of genetically modified life forms into the environment.

3. Derek Eaton et al., *Economic and Policy Aspects of 'Terminator' Technology*, 49 BIOTECHNOLOGY AND DEVELOPMENT MONITOR 19-22, *available at* http://www.biotech-monitor.nl/4907.html (last visited Sept. 12, 2004) [hereinafter Eaton].

PART ONE

"LADIES AND GENTLEMEN, BEHOLD THE TERMINATOR!"

In early 1998, a U.S. based corporation, Delta and Pine Land Company, in conjunction with the United States Department of Agriculture, was awarded U.S. Patent number 5,723,765 *in re*: Control of Plant Gene Expression.[4] The biological control of seed fertility, that is, Genetic Use Restriction Technology, otherwise known by the inflammatory nickname of "terminator," refers to plants that are genetically engineered[5] to produce sterile seeds. These seeds are different from hybrid seeds because hybrid seeds are not sterile and offer, at least in theory, the benefits of "improved agronomic performance."[6] The essence of the claims in the patent application filed by Delta and Pine Land Company is that plant genes were engineered to kill their own seeds in the second generation.[7] Terminator technologies thus refer to those biotechnological innovations designed to suppress true-to-type second-generation seeds (genetic copy propagation).[8] In simple terms, "terminator technology" fosters the containment of outright germination of seeds and/or deliberate control of customized genetic traits thereof.

An immediate consequence of such technologies is that farmers cannot replant genetically modified crops by merely saving seed. This is an enormous leap from the previous regime on ownership of the means of controlling plant genetic expression. As Alejandro Segarra and Jean Rawson explain, "[t]his patent gives the holders rights for the use of three new gene sequences that block the production of fertile seeds in genetically engineered plants."[9] The technology involves "complex genetic transformations that insert a genetic 'on-off switch' in plants to prevent the

4. Martha Crouch, *How The Terminator Terminates: An Explanation for the Non-Scientist of a Remarkable Patent for Killing Second-Generation Seeds of Crop Plants*, EDMONDS INSTITUTE, (Revised ed. 1998), *available at* http://www.edmonds-institute.org/crouch.html (last visited Sept. 12, 2004) [hereinafter Crouch].

5. *Id.* (Genetic engineering may be defined as the process in which the arrangement or patterns of proteins in an organism is artificially manipulated to yield novel results. The process of moving one gene to another within the same species is known as transformation).

6. *Defend Food Sovereignty: Terminate Terminator*, *supra* note 1, *available at* http://www.etcgroup.org/documents/terminatorbrochure02.pdf (last visited Sept. 12, 2004).

7. Crouch, *supra* note 4.

8. Alejando Segarra, et al, *The 'Terminator Gene' and Other Genetic Use Restriction Technologies (GURTs) in Crops*, CRS REPORT FOR CONGRESS, October 21, 1999, *available at* http://www.ncseonline.org/NLE/CRSreports/Agriculture/ag-83.cfm (last visited Sept. 12, 2004) [hereinafter Segarra].

9. *Id.*

unauthorized use of genetic characteristics contained within."[10]

Following the 1998 joint patent application granted to Delta and Pine Land Company and the United States Department of Agriculture, terminator technologies have generated significant debates, if not controversy, in many circles and among stakeholders in agro-biotechnology, especially, farmers.[11] A possible explanation for the outpouring of concern is that the use of terminator seeds would prevent farmers from replanting genetically modified crops by merely saving the patented seed. It would, however, be unfair to examine the controversy surrounding terminator patents from the narrower standpoint or perspective of farmers and environmental activists. Farmers are not the only stakeholders in this technology. Inventors and investors in such technologies have legitimate interests in GURTs too. In the opinion of the patent holders, terminator patents would ensure intellectual "property protection for investments in genetic engineering and help create incentives to develop new plant varieties that satisfy changing market demands."[12]

What is the science behind GURTs? At the practical level, GURTs foster control of seeds at two principal levels, namely: specific seed variety, otherwise known as V-GURTs,[13] and specific trait(s), otherwise known as T-GURTs.[14] The former denies unlicensed access to an entire plant variety while the latter is designed to restrict access at the trait level.[15] The biological mechanisms of terminator technologies are often complicated and somewhat difficult to explain to those not steeped in the arcane world of molecular biology. However, a crude summary which may be offered to explain the way terminator technologies work is that plant seeds are genetically engineered in such a manner that the affected plants grow normally but at the point of maturation, when seeds are to be produced, a toxin would be produced to kill the seed without otherwise affecting other characteristics of the plant.

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10. *Id.*

11. *Id.*

12. *Id.*

13. Eaton, *supra* note 3 at 19-22. An example of the V-GURT is the 1998 patent granted to the United States Department of Agriculture and Delta & Pine Land Corp. Similar patents have been issued to Novartis Corp., and Monsanto Corp., respectively. (U.S. Patent No. 5650505, (Issued July 22, 1997)).

14. *Id.* According to Segarra and Lawson, examples of T-GURT patents are Zeneca Ltd's (UK), entitled "Cysteine protease promoter from oil seed rape and a method for the containment of germplasm" issued on October 2, 1997; and Purdue Research Foundation's "Selective Expression of Genes in Plants" patent issued on March 11, 1999. *See* Segarra, *supra* note 8.

15. Convention on Biological Diversity, *Report of the Fourth Meeting of the Subsidiary Body of Scientific, Technical and Technological Advice*, Montreal, June 21-25, 1999, at 4.6.

In effect, the second generation of the plant is eliminated.[16] Using cotton as a hypothetical example, Martha Crouch explains that the process of a terminator technology would operate as follows:

> The system has three key components: 1. A gene for a toxin that will kill the seed late in development, but that will not kill any other part of the plant. 2. A method for allowing a plant breeder to grow several generations of cotton plants, already genetically-engineered to contain the seed-specific toxin gene, without any seeds dying. . . . 3. A method for activating the engineered seed-specific toxin gene after the farmer plants the seeds, so that the farmer's second generation will be killed. These three tasks are accomplished by engineering a series of genes, which are all transferred permanently to the plant, so that they are passed on via the normal reproduction of the plant.[17]

It is important to note that the essence of terminator technologies is to make a lot of toxic proteins in the embryo of the seed that will kill the cells of the plant's seeds. The preferred toxin used by molecular biologists to achieve this end seems to be a ribosome inhibitor protein ("RIP") obtained from the *Saponaria Officinalis* plant.[18] As Martha Crouch explains, this protein works in small quantities as it stops the synthesis of all other proteins.[19] In the absence of crucial proteins needed for other life processes, the embryonic cells die quickly. The supreme benefit in using the ribosome inhibitor protein (RIP) is that it is non-toxic to organisms other than plants.[20] More subtly, the toxic protein is limited or confined to the seeds.

In order to achieve this objective, plant genetic engineers desirous of creating a terminator gene and expressing it in a plant, for example, cotton, would "take the promoter from a gene normally activated late in seed development . . . and to fuse that promoter to the coding sequence[21] of a protein that will kill an embryo going through the last stages of development." The authors use a promoter from a cotton LEA (Late Embryogenesis Abundant) gene.[22] This gene is one of the last to be activated.[23] In order to activate the toxin gene, the germinating seeds would be treated with the antibiotic, tetracycline, before the seeds are sold

16. Crouch, *supra* note 4.
17. *Id.*
18. *Id.*
19. *Id.*
20. *Id.*
21. The coding sequence is that part of a DNA which contains the 'code' for the order of amino acids in the protein.
22. Crouch, *supra* note 4.
23. *Id.* The promoter is that part of a DNA responsible for interacting with the cell or the environment.

to farmers.[24] As Martha Crouch further explains:

> The tetracycline would interact with the repressor protein, keeping it from interfering with production of recombinase.[25] Recombinase would be made, cutting out the blocking DNA from the toxin gene. The toxin gene would now be capable of making toxin, but would not actually do so until the end of seed development. The next generation would thus be killed.[26]

This biotechnological intervention practically confers on the seed producer, the power to determine when to set the so-called terminator in motion and, at least in theory, protect the variety in perpetuity, even after the expiration of the patent grant. The point here is that as soon as the transgenic plant completes its life cycle and turns on to actual seed development, the development of the plant is brought to a genetically programmed end. The immediate consequence, at least for farmers, is that they are deprived of the ability to harvest viable seeds from the plant. The farmer is thus compelled to return to the seed merchant every farming season if he/she intends to remain in the business. Although V-GURTs account for a majority of such patents issued, both forms of genetic use restriction technology ultimately achieve the same result. The question that arises is whether such inventions meet the requirement of utility in patent law. In order to answer this question, it is necessary to carefully examine the origins, rationale, and evolution of the utility requirement in patent law.

PART TWO

2.1: THE EVOLVING CONCEPT OF SOCIAL USEFULNESS AND THE NORMATIVE DEFICIT IN PATENT UTILITY TEST

From a careful historical development of case law and academic commentaries on the requirements of patentability, it would seem that in patent law, utility has not been a stagnant, fixed concept; rather, its attributes have shown remarkable flux, malleability, and change. In articulating the evolution of the test of "utility" in patent law, I argue that three historical stages are evident from case law analysis. First, utility was originally a socio-economic concept anchored on puritanical notions. Second, and more importantly, utility became a technical concept with an eye on a secular notion of social usefulness. At the third stage of its development, utility has been largely constructed as a purely technical

24. *Id.*
25. *Id.*
26. *Id.*

concept with little or no regard for public morality, ethics, or social usefulness of inventions. In the history of patent law, these three stages tell the story of the evolution of the professionalization of the patent examination process.

Are terminator patents useful? It is hardly deniable that terminator seeds are not the irredeemable evil they are often made out to be by their discontents. To the contrary, terminator seeds confer some economic, and perhaps agronomic, benefits to the users and to their patentees. More specifically, terminator seeds have been known to increase productivity from improved inputs due to increased research and development investment. Similarly, plant breeders also benefit from increased appropriation of research benefits from new products. On the side of the government, it could be argued that benefits are derived from reduced investment requirements in breeding and fewer enforcement costs for plant variety protection ("PVP"). For the larger society, it could be contended that benefits take the form of increased agricultural productivity. If terminator seeds were absolutely useless, they would not sell in the marketplace.

On the flip side, however, the question is whether there are serious risks involved with the use of terminator seeds. Certainly there are serious risks with terminator seeds. First, there is the obvious risk of misuse of the monopoly by plant breeders. There is also a danger of corporate vertical integration of the means and processes of agriculture. Third, terminator seeds increase the risk of seed insecurity and impede access to genetic improvements. Fourth, given the increasing trend of genetic monocultures and extinction of species across the globe, there is little doubt that terminator seeds exacerbate a worrying situation arising from genetic pollution and sterilization of otherwise fertile seeds.

Leaving aside, briefly, the question of environmental and ecological risks posed by the use of terminator seeds, the central issue is whether terminator seeds are useful in the context of utility patent law. In order to give a correct answer to this question, reference must be made to the juridical characteristics of the utility requirement in patent law and how the criterion of utility has evolved over the years across many jurisdictions.

2.2: THE ORIGINS AND DEVELOPMENT OF UTILITY TEST IN PATENT LAW

The origins and development of the patent system are often the subject of ideological reconstruction of history.[27] Although the most

27. Ikechi Mgbeoji, *The Juridical Origins of the International Patent System: Towards a*

common narrative, perhaps myth, of the origins of patents is that patents arose from the British Industrial Revolution.[28] Legal historians with a less ideological disposition are virtually unanimous in their conclusion that modern patents actually originated in medieval Florence and Venice. The modern system of patents, and in it the seeds of utility test, is based on the confrontation between the medieval architect, builder and artist, Filippo Brunelleschi and the city of Florence.[29] In 1421, Brunelleschi built a sea-craft, christened *el Badalone*, and refused to disclose the invention to the city of Florence unless a patent was issued to him. Yielding to his threats of non-disclosure of the invention,[30] the city of Florence, by a public letter dated 19 June 1421, granted him a limited monopoly on the use of the sea-craft. Given the seminal nature of the letter, particularly its conception of utility of patented inventions, a translated version of the letter is reproduced *in extenso*:

> The Magnificent and Powerful Lords, Lords Magistrate, and Standard Bearer of Justice:
>
> Considering that the admirable Filippo Brunelleschi, a man of the most perspicacious intellect, industry, and invention, citizen of Florence, has invented some machine or kind of ship, by means of which he think he can easily, at any time, bring in any merchandise and load on the river Arno and on any other river or water, for less money than usual, and

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Historiography of the Role of Patents in Industrialization, 5 J. HIST. OF INT'L L. 399, 399-418 (2003).

28. For example, H.G. Fox wrongly enthused that "it was not by accident that the patent system had its origin in England, nor that the industrial revolution was the inevitable consequence." *See* ERIC SCHIFF, INDUSTRIALIZATION WITHOUT PATENTS-THE NETHERLANDS, 1869-1912, SWITZERLAND, 1850-1907 9 (Princeton University Press, 1971). Despite the absence of both historical and empirical support, one reason many patent attorneys prefer to locate the origin of patents in the British industrial revolution is to make the assertion that the institutionalization of patents is necessary for the industrialization of states. Be that as it may, an overwhelming majority of the most reputable inquiry into the issue have failed to find any organic or causative link between patents and industrialization. *See generally*, Fritz Machlup, *An Economic Review of the Patent System*, Senate Subcomm. on Patents, Trademarks, and Copyrights of the Senate Comm. of the Judiciary, 85th Cong. at 79 (1958); T.S. ASHTON, THE INDUSTRIAL REVOLUTION, 1760-1830 (Oxford University Press, 1948); PHYLLIS DEANE, THE FIRST INDUSTRIAL REVOLUTION (Cambridge University Press, 1980). Interestingly, the British industrial revolution took off nearly 150 years after the enactment of the Statute of Monopolies (the first genuine British Patent law). Similarly, industrialization in medieval Italy was nearly 200 hundred years old before any patent law was enacted in the region. However, for a typical rhetoric on the alleged causative links between patents and industrialization, *see* Robert Sherwood, et al, *Promotion of Inventiveness in Developing Countries Through a More Advanced Patent Administration*, 39 J.L. & TECH. 473, (1999) Robert Sherwood, *Human Creativity for Economic Development: Patents Propel Technology* 33 AKRON L. REV. 1 (2000).

29. Owen Lippert, *One Trip to the Dentist is Enough*, *in* COMPETITIVE STRATEGIES FOR THE PROTECTION OF INTELLECTUAL PROPERTIES 131 (Owen Lippert ed., 1999).

30. *Id.*

> with several other benefits to merchants and others; and that he refuses to make such machine available to the public, in order that the fruit of his genius and skill may not be reaped by another without his will and consent; and that, if he enjoyed some prerogative concerning this, he would open up what he is hiding and would disclose it to all;
>
> And desiring that this matter, so withheld and hidden without fruit, shall be brought to light, to be of profit to both said Filippo and our whole country and others, and that some privilege be created for said Filippo, as hereinafter described, so that he may be animated more fervently to even higher pursuits and stimulated to more subtle investigations, deliberated on 19 June 1421:
>
> That no person alive, in being, and of whatever status, dignity, quality, and grade, shall dare or presume, within three years next following from the day when the present provision has been approved in the Council of Florence, to commit any of the following acts on the river Arno, any other river, stagnant water or swamp, or water running or existing in the territory of Florence: (a) to have, hold, or use in any manner, be it newly invented or made new in form, a machine or ship or other instrument designed to import ship or transport on water any merchandise or any things or goods, except such ship or machine or instrument as they may have used until now for similar operations, or (b) to ship or transport, or to have shipped and transported any merchandise or goods on ships, machines, or instruments for water transport other than such as were familiar and usual until now; and further that any such or newly shaped machine, etc. shall be burned;
>
> Provided however that the foregoing shall not be held to cover, and shall not apply to, any newly invented of newly shaped machine, etc. designed to ship, transport or travel on water, which may be made by Filippo Brunelleschi or with his will and consent; also, that any merchandise, things or goods which may be shipped with such newly invented ships within three years following, shall be free from imposition, requirement or levy of any new tax not previously imposed.[31]

As per the Florentine patent issued to Filippo Brunelleschi, it is clear that the policy imperative underlying the issuance of the patent was to encourage Brunelleschi and similarly talented persons to make socially beneficial and useful inventions.[32]

There is little question among patent historians that Brunelleschi's patent was a real and legally valid patent, as "good in subject matter as any

31. *See generally* Frank Prager, *Brunelleschi's Patent*, 28 J. PATENT OFFICE SOC'Y 109 (1946); GUSTINA SCAGLIA, BRUNELLESCHI: STUDIES OF HIS TECHNOLOGY AND INVENTIONS (Cambridge Press 1970); *see also* ULF ANDERFELT, INTERNATIONAL PATENT LEGISLATION AND DEVELOPING COUNTRIES (Martinus Nijhoff ed., The Hague 1971) [hereinafter Anderfelt].

32. Anderfelt, *supra* note 31.

of those dealt with in 1947 by the British patent office"[33] or by any modern patent office for that matter. Although the Badalone sank on its debut on Lake Arno there is no doubt that its Venetian successor was anchored on the economic and social usefulness of inventions. The express words of the celebrated Venetian patent statute of 1474 are crystal clear on the need for patents to have social and public relevance and utility.[34] The Venetian patent act is reproduced as follows:

> [T]here are in this city, and also there come temporarily by reason of its greatness and goodness, men from different places and most clever minds, capable of devising and inventing all manner of ingenious contrivances. And should it be provided, that the works and contrivances invented by them, others having seen them could not make them and take their honor, men of such kind would exert their minds, invent and make things which would be of no small utility and benefit to our State. Therefore, decision will be passed that, by authority of this Council, each person who will make in this city any new ingenious contrivance, not made heretofore in our dominion, as soon as it is reduced to perfection, so that it can be used and exercised, shall give notice of the same to the office of our Provisioners of Common. It being forbidden to any other in any territory and place of ours to make any other contrivance in the form and resemblance thereof, without the consent and license of the author up to ten years. And, however, should anybody make it, the aforesaid author and inventor will have the liberty to cite him before any office of this city, by which office the aforesaid who shall infringe be forced to pay him the sum of one hundred ducates and the contrivance immediately destroyed. Being then in liberty of our Government at his will to take and use in his need any of the said contrivances and instruments, with this condition, however, that no others than the authors shall exercise them.[35]

Indeed, the British Statute of Monopolies, erroneously characterized as the *Magna Carta* of inventors, clearly recognized that not all inventions would necessarily benefit society.[36] Hence, according to the Statute of Monopolies of 1624, patents were not to be granted to inventions that were "mischievous to the State, by raising prices of commodities at home, or hurt of trade, or generally inconvenient" to society.[37]

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33. *Id.*

34. *Id.*

35. *Id.*; *See also* Ikechi Mgbeoji, *Patents and Traditional Knowledge of the Uses of Plants: Is a Communal Patent Regime Part of the Solution to the Scourge of Biopiracy?*, 9 IND. J. GLOBAL LEGAL STUD. 163 (2001).

36. David Vaver, *Intellectual Property Today: Of Myths and Paradoxes*, 69 CAN. B. R. 28 (1990).

37. English Statute of Monopolies, 1623, 21 Jac. 1, c. 3, sched. 6 (Eng.). *But see* AGNEW, AGNEW ON PATENTS (1974) (arguing that "this condition is not imposed by the Statute of

These legal provisions offer support for the view that patents were originally designed to be responsive to social and public welfare.[38] For inventions to be patentable, they "must perform some function of positive benefit to society."[39] It was within this understanding of the concept of utility that courts in the United States, United Kingdom, *et cetera*, invalidated inventions, which from a puritanical point of view were immoral, "mischievous" or could be used for "immoral" or "mischievous" purposes.[40] Such inventions, for example, gambling machines or contrivances, were deemed "useless" and thus unpatentable.

Parke, B., in *Morgan v. Seaward* warned that "an invention which is altogether useless may well be considered as mischievous to the state, to the hurt of trade, or generally inconvenient."[41] Patents on inventions, which were merely taken out for the purpose of impeding subsequent improvements or to prevent the introduction of other inventions adapted to the particular subject to which it was applicable, were invalidated on the grounds that they lacked utility.[42] And in the instances or cases where inventions were deemed to be harmful to society, the patent office was not obliged to grant patents to such inventions.[43]

Consequently, in the second stage of the evolution of the concept of utility, the test or criterion of utility of inventions rested on a tripod, namely, the operability and use of the alleged invention, achievement of some limited human purpose, and finally, achieving a human purpose that is not illegal, immoral or contrary to public policy.[44] More importantly, mischievous and immoral inventions, no matter how ingenious or operable, were not worthy subjects of patent protection.[45] The pertinent test was on the utility of the purpose of the invention, rather than a utility of means.

Monopolies . . . but it is a condition required by the common law) [hereinafter AGNEW ON PATENTS]. With all due respect, Agnew is wrong. Patents are statutory creatures, not products of the common law.

38. This test stipulates that an invention "must not be a mere curiosity, a scientific process exciting wonder yet not producing physical results, or a frivolous or trifling article or operation not aiding in the progress nor increasing the possession of the human race." DONALD CHISUM, A TREATISE ON THE LAW OF PATENTABILITY, VALIDITY AND INFRINGEMENT § 4-02 (1992) [hereinafter Chisum on Patents] (citing W. ROBINSON, TREATISE ON THE LAW OF PATENTS OF USEFUL INVENTIONS 463 (1890)). *See also* Lowell v. Lewis, 15 F. Cas. 1018, 1019 (D. Mass. 1817).

39. Chisum on Patents, *supra* note 38.

40. Morgan v. Seaward, 1 Webs. P.R. 197 (1837).

41. *Id.*

42. Agnew, *supra* note 37 at 74.

43. *See, e.g., Lowell*, 15 F. Cas. at 1018.

44. *Id.*

45. *Id.*

However, this test was applied in such a manner that took into serious consideration society's conception of social usefulness. In the early stages of the development of the law, social conception of usefulness had a puritanical and stern perspective.[46]

For example, in his instruction to the jury in the case of *Lowell v. Lewis*, Justice Story of the U.S. Supreme Court advised that "[a]ll that the law requires is, that the invention should not be frivolous or injurious to the well-being, good policy, or sound morals of society.[47] The word 'useful,' therefore, is incorporated into the act in contradistinction to mischievous or immoral."[48] Giving examples of inventions that fall within the category of "immoral" or "mischievous" and hence lacking in utility, Justice Story posited that "invention[s] to poison people, or to promote debauchery, or to facilitate private assassination" were outside the pale of 'useful' inventions.[49] Any such inventions were unpatentable, no matter how efficiently they worked.

Remarkably, these judicial constructions of utility were wrought in the United States where the patent system was relatively aggressive and prided itself as a value-neutral institution.[50] Yet, American courts tended to follow Justice Story's ethical and moralistic construction of utility requirement in patentability of inventions.[51] Within this construct of utility, various inventions relating to gambling devices or processes or products useful only for the perpetration of fraud were denied patent protection for lacking utility.[52]

Thus, public policy, and more importantly, a puritanical perspective on utility influenced a lot of the cases involving "mischievous" or "immoral" inventions. However, public policy, indeed puritanical notions, hardly remain constant. They evolve, morph, and ultimately impact on how the concept of utility is construed. In addition, the professionalization

46. Reliance Novelty v. Dworzek, 80 F. 902 (N.D. Cal. 1897) (rejecting a gambling device).

47. *Id.* at 1019.

48. *Id.* Reiterating this position of law in *Bedford v. Hunt*, Justice Story explained that the "law does not look to the degree of utility; it simply requires, that it shall be capable of use, and that the use is such as *sound morals and policy do not discountenance or prohibit*." 3 F. Cas. 37 (D. Mass. 1817) (emphasis added).

49. *Id.*

50. For an excellent analysis of this trend *see* John Golden, *Biotechnology, Technology Policy, and Patentability: Natural Products and Invention in the American System*, 50 EMORY L. J. 101 (2001).

51. *See, e.g.*, Bremer v. Manson, 383 U.S. 519, 533 n. 20 (1966).

52. *See, e.g.*, Nat'l Automatic Device Co., v. Lloyd, 40 F. 89 (N.D. Ill. 1889) (gambling device rejected); *Dworzek*, 80. F. 902 (N.D. Cal. 1897) (another gambling device rejected); Richard v. Du Bon, 103 F. 868 (2d Cir. 1900); Hall v. Duart Sales Co., 28 F. Supp. 838 (N.D. Ill. 1939).

of the corps of patent examiners is a contributory factor to the evolution of the test of utility as a secular concept. It is for these combined reasons that one may argue that inventions hitherto questioned on the grounds of immorality or mischief to public benefit may today pass the test of utility. It is worth detailing that the courts have, over the years, avoided applying subjective ideas of morality and "mischief." In *Ex Parte Murphy*,[53] a patent claim for a gambling device known as the 'one-armed bandit,' the court warned that "while some may consider gambling to be injurious to public morals and the good order of society, we cannot find any basis in 35 U.S.C. 101 or related sections which justify a conclusion that inventions which are useful only for gambling ipso facto are void of patentable utility."[54] Commenting on the fluid and evolving nature of public morality as relating to what may or may not be considered useful inventions, Choate observes that:

> Courts have in some instances talked of 'morals, health, and good order of society' in determining utility. Anyone whose life has spanned a decade or two in the 20th Century has witnessed how moral standards can change in a period of a few years. Gambling devices, frowned upon early in the century, are legalized in several states; racetracks and lotteries are now used to generate substantial amounts of income in many states. Birth control devices, in a period of thirty to forty years, have come from a position of illegality to where they are welcomed by some as a means of curbing a population explosion. Thus, in determining 'utility' based on public mores, the courts should apply a test which will not penalize an inventor who may be prescient enough to be anticipating basic needs of a society changed by forces yet unrecognized by the general public.[55]

In the development of the jurisprudence on utility, the rule or distinction emerged over the years that unless an invention was solely 'useful' for fraudulent or illegal activities, it could be patented. Such 'dual use' or 'multiple use' inquiry into the uses of inventions meant that inventions could not be debarred from patentability merely because one of their many uses pertains to immoral or mischievous purposes. In other words, a patent with several claims cannot be invalidated merely because one of the claims relates to an immoral object. If an invention is useful for one or more socially useful purposes, it passes the test of utility. In any event, morality and public policy could be janus-headed or chameleonic concepts. Commenting on this problematic aspect of patent law, Judge

53. 200 U.S.P.Q. 801 (Patent & Trademark Office Bd. App. 1977).

54. *Id.* at 802.

55. Chisum on Patents, *supra* note 37 at 4-17 (quoting ROBERT CHOATE, PATENT LAW-CASES & MATERIALS 380 (1973)).

Baker of the U.S. Seventh Circuit, quoting Walker, wryly reasoned that:

> [A]n important question, relevant to utility in this respect, may hereafter arise and call for judicial decision. It is perhaps true, for example, that the invention of Colt's revolver was injurious to the morals, and injurious to the health, and injurious to the good order of society. That instrument of death may have been injurious to morals, in tending to tempt and to promote the gratification of private revenge. It may have been injurious to health, in that it is very liable to accidental discharge, and thereby to cause wounds, and even homicide. It may also have been injurious to good order, especially in the newer part of the country, because it facilitates and increases private warfare among frontiersmen. On the other hand, the revolver, by furnishing a ready means of self-defense, may sometimes have promoted morals and health and good order.[56]

Ultimately, in the second stage of the development of the test of utility in patent law, the hypothesis was that utility meant everything useful within the meaning of the law, if it was adapted to accomplish a good result, even though it may often be used to accomplish disagreeable or bad objectives. In contemporary times, however, the refinement and technicalization of the utility requirement now compels patent applicants to ensure that the invention works as detailed in the disclosure with little or no regard to public policy. This development may be attributed to the secularization of science, the deregulation of morality, and diminished role of religious bodies in articulating public policy. These factors have combined to produce a conception of utility of inventions that leans in favor of technical operability, while diminishing or even ignoring ethical or moral issues arising from the claims of the patent application.

In modern patent law, thus, puritanical concerns or even the environmental implications of the alleged invention are of no significance. The central or dispositive question today in most patent systems across the world is whether the invention works as predicted in the disclosure. It is immaterial that the machine is impractical from a commercial viewpoint. An ingenious device for making saltwater at great cost, which would not have commercial use in the Dead Sea, is not invalid for inutility. Provided the invention performs as indicated in the disclosure, it does not matter that the Dead Sea is heavy with brine and that saltwater could be obtained from a cheaper or more efficient device.[57]

As already noted, the overwhelming preponderance at the Patent

56. ARTHUR M. SMITH, PATENT LAW: CASES, COMMENTS AND MATERIALS 412 (rev. ed. 1964).

57. *See, e.g.*, P. NARAYANAN ON PATENT LAW 1057-1074 (2d ed. 1975).

Examiner's Office of persons trained in the sciences has increasingly led to a regime of greater emphasis on the scientific and technical aspects of the utility of an invention. Patent examiners are not hired for their expertise in ethics or morality. Virtually all patent examiners, whether employed full-time by the government or hired on a retainer or consultancy basis are scientists trained in the physical sciences. It is therefore to be expected that in the discharge of their functions, their preoccupation would be with the scientific and operational aspects of alleged inventions rather than with the possible ethical or moral problems that may arise from the use of the inventions.

Although most claims in patent applications are couched in non-revealing words such as "improvements in apparatus for electric lighting" or "improvements in methods of fermenting liquors,"[58] it would seem that stripped of the studied and deliberate opacity which claims are often known for, patent examiners ultimately search for the operability of the alleged invention when ascertaining the utility, or lack thereof, of an invention. Shorn of the institutionalized vagueness which modern patent claims have become notorious for, the determinative question often posed by patent law on utility is whether the alleged patent is useful for the basic purposes or purpose that the inventor alleges in his or her specification?[59] Put simply, patent examiners are not trained nor required to pass moral judgments on inventions.[60]

However, a strict application of this doctrine of law would unduly punish inventors for every imprudent puffing statement in a specification. For this reason, courts in several jurisdictions have drawn a distinction between material and non-material misrepresentation or false suggestion contained in a specification. Patents are invalidated for inutility where there is evidence of material misrepresentation.[61] Care must, however, be taken not to equate misrepresentation with utility. The important point to note here is that in modern patent law, insofar as the alleged invention performs its vaunted or predicted task, even if some aspects of its performance are "illicit" or ethically questionable, the test of utility would

58. CHARLES J. BANNON, AUSTRALIAN PATENT LAW 63 (Butterworths, 1984).

59. *Tetra Molectric Ltd's Application* [1977] RPC 290; *see also In re* Alsop's Patent (1907) 24 R.P.C. 733 at 753; dictum approved by the House of Lords in Hatmaker v. Joseph Nathan & Co. Ltd., 36 R.P.C. 231 (1919).

60. *Ex Parte* Murphy, 200 U.S.P.Q. 801 (Patent and Trademark Office Bd. of App., 1977); *see also* ROBERT CHOATE & WILLIAM FRANCIS, CASES AND MATERIALS ON PATENT LAW 378 (2d ed., 1981).

61. *See* Rex v. Arkwright, 1 Carp. P.C. 53, 61 (K.B. 1785). *See also* F. FETHERSTONHAUGH, THE LAW AND PRACTICE OF LETTERS PATENT OF INVENTION IN CANADA 339 (Carswell, 1926) [hereinafter Fetherstonhaugh].

be satisfied by the mere act of compliance with the specified objects.[62] In effect, it is apparent that over the years, patent law on utility has gradually diminished the role of puritanical or moral considerations in the determination of utility. In modern patent law, utility of invention depends upon whether, by following the directions of the patentee, the results which the patentee predicted to produce can in fact be produced.[63]

In addition to judicial (re)interpretations of utility, in some cases, however, express legislation has been put in place to debar the patentability of some inventions on grounds of public policy.[64] For example, inventions in the atomic energy and space and aeronautic fields are generally not patentable, even in the United States.[65] Inventions deemed to be detrimental to the national security of states are often excluded from patentability and may be kept secret or withheld by the state on grounds of "national security."[66] Similar exceptions are created by sections 22, 20 (17) of the Canadian Patent Act.[67] In some cases, states may confiscate inventions deemed to be dangerous if placed in the public domain.

In effect, notwithstanding various judicial attempts at diminishing the social dimension of inventions, virtually all patent systems across the globe

62. Interestingly, Canadian courts have not been invited to adjudicate a case of inventions with an illicit purpose. However, the Canadian patent office has been known to refuse patents covering oleomargarine compounds due to the prohibition of the manufacture or sale of such contained in the Criminal Code. *See* Fetherstonhaugh, *supra* note 61 at 351.

63. *See* Lane-Fox v. Kensington and Knightsbridge Elec. Lighting Co. Ltd., 9 R.P.C. 417 (1892).

64. *See infra* note 65.

65. *See, e.g.*, The Atomic Energy Act, 42 U.S.C. § 2181(a) (1988) (providing that "no patent shall hereafter be granted for any invention or discovery which is useful solely in the utilization of special nuclear material or atomic energy in an atomic weapon."); *see also* National Aeronautics and Space Act of 1958, 42 U.S.C. 2457; Virginia Geoffrey, *Do the Atomic Energy Act and the NASA Act Promote Adequate Advancement?*, 43 J. PAT. & TRADEMARK OFF. SOC'Y 624 (1961).

66. Section 181 of the United States Patent Act provides *inter alia*:

> [W]henever the publication or disclosure of an invention by the granting of a patent, in which the Government does not have a property interest might, in the opinion of the Commissioner, be detrimental to the national security, he shall make the application for patent in which such invention is disclosed available for inspection to the Atomic Energy Commission, the Secretary of Defense, and the chief officer of any other department or agency of the Government designated by the President as a defense agency of the United States. . . . If, in the opinion of the Atomic Energy Commission, the Secretary of a Defense Department[,] . . . the publication or disclosure of the invention by the granting of a patent therefor would be detrimental to the national security, the Atomic Energy Commission, the Secretary of a Defense Department . . . shall notify the Commissioner and *the Commissioner shall order that the invention be kept secret and shall withhold the grant of a patent* for such a period as the national interest requires . . . .

35 U.S.C. § 181 (2000) (emphasis added).

67. Canadian Patent Act, R.S.C., c. P-4 (1993 Can.).

recognize that society is not obliged to issue patents to inventions merely because the invention's manifest genius. Indeed, at international law, Article 27 (3) of the Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPs),[68] notwithstanding its very liberal provisions, provides for public policy considerations in granting patents to inventions that constitute a danger to society. Article 27 (3) provides as follows: "[s]ubject to the provisions of paragraphs 2 and 3, patents shall be available for any *inventions*, whether *products* or *processes*, in all fields of technology, provided that they are new, involve an inventive step and are capable of industrial application."[69]

The exceptions stated in paragraphs 2 and 3 are that:

> 2. Members may exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect *ordre public* or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by [their] law.
>
> 3. Members may also exclude from patentability:
>
> (a) diagnostic, therapeutic and surgical methods for the treatment of humans or animals:
>
> (b) Plants and animals other than micro-organisms, and essentially biological processes for the production of plants or animals other than non-biological and micro-biological processes. However, Members shall provide for the protection of plant varieties either by patents or by an effective *sui generis* system or by a combination of thereof.[70]

In other words, there is overwhelming historical and juridical support for the position championed by some scholars of patents that patent offices are not necessarily obligated to issue patents on all manner of new contrivances or inventions merely because those inventions are workable and are products of genius. As a society, we may be right to require that inventors demonstrate the social value of their inventions as part of the requirements for patentability of inventions. In effect, the patent system has historically shown itself responsive to social needs and sensitivities.

If the argument that the test of utility is neither an exercise in puritanical inquisition nor an amoral worship at the altar of technical

68. Agreement on Trade-Related Aspects of Intellectual Property Rights, Apr. 15, 1994 Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, Legal Instruments—Results of the Uruguay Round, Vol. 31, 33 I.L.M. 81 (1994) [hereinafter TRIPs].

69. *Id.* at Art. 27 (emphasis added).

70. *Id.*

efficiency, it follows that modern biotechnological inventions which have a high probability of endangering society should be legitimate targets of scrutiny, care, and deliberation. Within this context, the question becomes whether genetic user restriction technologies or the so-called terminator patents fall within the rubric of inventions lacking utility. As some critics have pointed out, the essence of sterilized seeds is to offer seed companies the opportunity to maximize their profits by tying the hands of farmers in their ability to replant second generation seeds from sterilized seeds. Through genetic manipulation, the technologies in issue cause the affected plants to become sterile at the point of harvest.

In effect, every growing season, farmers would be compelled to return to commercial seed corporations to purchase new planting seeds rather than save "and replant their own seed as farmers have done for 12 millennia."[71] This has been likened by a leading non-governmental organization to "bio-serfdom."[72] Naturally, this biological "ever-greening" of a patented technology raises significant questions about the role of patents in a competitive world economy and more importantly, whether a purely mechanical conception of the test of utility is outdated.

PART THREE

THE UTILITY OR LACK THEROF OF TERMINATOR PATENTS: A MATTER OF PERSPECTIVE?

Part of the attraction GURTs hold for biotechnological seed merchants is that they dispense with the need for license agreements and end-user contracts between seed merchants and farmers. In this sense, it can be argued that terminator patents serve a useful purpose to seed developers such as Cargill, Aventis, or Monsanto. Over the years, seed

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71. Press Release, ETC Group, Trait*or* Resolutions? (June 25, 1999), *available at* http://www.etcgroup.org/documents/news_traitor.pdf [hereinafter Traitor Resolutions].

72. ETC GROUP, TERMINATOR BROCHURE 2002 1, *available at* http://www.etcgroup.org/documents/terminatorbrochure02.pdf [hereinafter Terminator Brochure].

According to the ETC Group,

> [O]ver 1.4 billion people - mostly the rural poor - depend on farm-saved seeds as their primary seed source. If a farmer loses the ability to save her seed, she cannot select plants that are best adapted to local conditions and needs. Communities that lose control over their seeds risk losing control of their farming systems and becoming dependent on outside sources of seeds and the inputs they require. Without an agricultural system adapted to a community and its specific ecosystem, national food security is impossible. History makes it clear that poor countries cannot rely upon rich nations to secure their food nourishments. The use of food as a political weapon - even as a form of economic biological warfare - continues even today.

Id.

producers such as Monsanto have found themselves embroiled in lawsuits with farmers over alleged violations of agreements designed to prevent the saving of patented seeds for replanting.[73] Typically, seed companies license their biotechnology products to interested farmers. A general clause in such a license contract requires farmers to use the genetically-engineered seeds for only one season of planting and not to save and replant saved seeds the next season. Needless to say, the major seed producers have had to sue many farmers for alleged violations of this important clause. The litigation involving a Saskatchewan farmer and Monsanto Corporation readily comes to mind.[74] Hence, in the absence of an effective and reliable monitoring of how patented seeds are used by farmers, biological control of patented seeds holds undoubted attraction for seed developers.

Patentees of terminator patents have thus acknowledged "that the real purpose of the technology is not agronomic but economic - to force farmers to become repeat customers."[75] According to a full page advertorial run by Monsanto Corporation in 1997,

> [i]t takes millions of dollars and years of research to develop the biotech crops that deliver superior value to growers. And future investment in biotech research depends on companies' ability to share in the added value created by these crops. Consider what happens if growers save and replant patented seed. First, there is less incentive for all companies to invest in future technology, such as the development of seeds with traits that produce higher-yielding, higher-value and drought-tolerant crops .... In short, these few growers who save and replant patented seed jeopardize the future availability of innovative biotechnology for all growers. And that's not fair to anyone.[76]

However, beyond a biological control of the traits in the affected seeds, GURTs heavily impact on the environment and global agriculture in a variety of ways, hence, the widespread alarm and condemnation from several social activist groups, scientific bodies, international organizations, and many segments of the civil society.[77] For example, the Consultative

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73. *See* Traitor Resolutions, *supra* note 71.

74. Monsanto v. Schmeiser, [2001] F.C.T. 256 (Can.).

75. *See* Traitor Resolutions, *supra* note 71.

76. *See* Crouch, *supra* note 4.

77. For example, the FAO's Panel of Eminent Experts on Ethics in Food and Agriculture noted that, "[t]he Panel unanimously stated that the 'terminator seeds' generally are unethical, finding it unacceptable to market seeds, the offspring of which a farmer cannot use again because the seeds could not germinate." FAO'S PANEL OF EMINENT EXPERTS ON ETHICS IN FOOD AND AGRICULTURE, First Session, Rome, 26-28 September 2000. Similarly, Dr. M.S. Swaminathan, former independent chairman of the FAO Council and recipient of the World Food Prize, warned

Group on International Agricultural Research ("CGIAR") in its policy adopted on 30 October 1998 warned that,

> The CGIAR will not incorporate into its breeding materials any genetic systems designed to prevent seed germination. This is in recognition of (a) concerns over potential risks of its inadvertent or unintended spread through pollen; (b) the possibilities of sale or exchange of viable seed for planting; (c) the importance of farm-saved seed, particularly to resource-poor farmers; (d) potential negative impacts on genetic diversity; and (e) the importance of farmer selection and breeding for sustainable agriculture.[78]

Condemning terminator seeds, the Director General of the Food and Agriculture Organization ("FAO"), Dr. Jacques Diof warned, "[w]e are against [terminator genes]. We are happy to see that in the end some of the main multinationals which have been involved in implementing these terminator genes have decided to backtrack."[79]

Acting on these warnings, some countries such as India, Ghana and Panama have taken steps to place a moratorium on the so-called terminator seeds technology in their own countries.[80] However, seed companies counter that GURT seeds enable farmers to activate or deactivate genetic traits such as disease resistance by applying a prescribed chemical to their plants or seeds.[81] It has also been argued that engineered seed sterility would minimize genetic pollution arising from genetically modified plants. According to this argument, engineered sterility offers an in-built safety feature for genetically modified plants "because if genes from a terminator crop cross-pollinate with related plants nearby, the seed produced from unwanted pollination will be sterile . . . ."[82]

Given the widespread use of genetically modified crops in many parts of the world, this argument on its face seems quite seductive.[83] As a matter

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that "in India where there are nearly 100 million operational holdings, denial of plant-back rights or the use of the terminator mechanism will be disastrous for the socio-economic and biodiversity points of view, since over 80 percent of farmers plant their own farm-saved seeds.' *See* M.S. Swaminathan, *Farmers' Rights and Plant Genetic Resources*, 36 BIOTECHNOLOGY & DEVELOPMENT MONITOR 6-9 (1998), *available at* http://www.biotech-monitor.nl/3603.htm.

78. *See* Terminator Brochure, *supra* note 71.

79. *Id.* In the same vein, Dr. Gordon Conway, President of the Rockefeller Foundation, in his speech to the Monsanto company Board of Directors in June 1999, counselled that "the agricultural seed industry must disavow use of the terminator technology to produce seed sterility . . . the possible consequences, if farmers who are unaware of the characteristics of terminator seed purchase it and attempt to reuse it, are certainly negative and may outweigh any social benefits of protecting innovation." *See* Segarra, *supra* note 8.

80. *See* Traitor Resolutions, *supra* note 68.

81. Eaton, *supra* note 3, *available at* http://www.biotech-monitor.nl/4907.htm.

82. *See* Segarra, *supra* note 8.

83. There are, however, other new techniques of genetic modification that do not allow the

of fact, with the increasing use of genetically modified crops in agriculture, there is a growing body of evidence supporting the fear of genetic pollution arising from escaped genes. For example, the Mexican Ministry of Environment confirmed in January 2002 that indigenous farmers' maize varieties in Oaxaca and Puebla "have been contaminated with DNA from genetically modified maize."[84]

While supporters of terminator technology have argued that the technology may in fact be deployed to prevent genetic pollution arising from stray transgenic matter, critics of the technology have countered that because of the vagaries of farming and the phenomenon of "gene silencing," terminator technology may not be an effective antidote to genetic pollution.[85] As Martha Crouch has observed, it is very unlikely that tetracycline treatment of terminator seeds will be 100% effective.[86] In her words:

> [S]ome seeds may not respond, or take up enough tetracycline to activate recombinase. In such cases, the plants growing from the unaffected seeds would look just like all the others, but would grow up to make pollen carrying non-functional toxic gene. The pollen would also carry the genetically-engineered protein supposedly being protected by terminator, such as herbicide-tolerance. If this pollen fertilized a normal plant, the seed would not die, because no toxin would be made, but the seed would now have the herbicide-tolerance gene and could pass that on. Thus a trait from the [genetically modified organism] would have escaped through the pollen.[87]

Secondly, the phenomenon of gene silencing could wreck the permutations of the molecular biologist.[88] Tests and experiments have shown that in some cases, previously active genes may suddenly stop working.[89] In other words, if the phenomenon of gene silencing occurs in respect to terminator seeds (and there is no reason why it may not occur), plants containing the silenced "toxin gene could grow and reproduce,

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transfer of genes through pollen. An example is chloroplast engineering.

84. *Fear-Reviewed Science: Contaminated Corn & Tainted Tortillas—Genetic Pollution in Mexico's Centre of Maize Diversity*, ETC GROUP, (Jan./Feb. 2002), *available at* http://www.etcgroup.org/article.asp?newsid=287 (last visited Sept. 12, 2004); *See also* D. Quist & I. Chapela, *Transgenic DNA Introgressed into Traditional Maize Landraces in Oaxaca, Mexico*, 414 NATURE 541, 541-43 (Nov. 29, 2001).

85. Timo Goeschl & Timothy Swanson, The Development Impact of Genetic use Restriction Technologies: A Forecast Based on the Hybrid Crop Experience (unpublished manuscript to appear in *Environment and Development Economics*, on file with the author).

86. Crouch, *supra* note 4.

87. *Id.*

88. *Id.*

89. *Id.*

perhaps for several generations."[90] Clearly, one cannot rely on terminator technology as the panacea for the escape of transgenic material into the environment. The instability and unreliability of genetically engineered seeds make them the unlikely candidate for the vanguard of a new world of scientific experimentation.[91]

"In Canada, the escape of transgenes from [genetically modified (GM)] canola is a menace for organic farmers who cannot certify their canola crops as GM-free."[92] Indeed, as the ETC Group has argued, "the rationalization that terminator technology is beneficial as a biosafety tool that will prevent the spread of GM genes is a tacit admission that genetically engineered crops are not environmentally safe."[93] However, the ETC Group further argues: "Food security for poor people must not be sacrificed to solve the industry's genetic pollution problems."[94] The ETC Group has further argued that:

> It is erroneous and irresponsible to suggest that agriculture is dependent on genetic seed sterilization as a method for containing unwanted pollution from GM plants. This is like bringing home a tiger to catch a house mouse. In promoting terminator as a "green" solution to GM pollution, industry is pushing its most profitable and monopolistic option by off-loading the whole GM burden on farmers while increasing corporate control. If GM seeds are unsafe they should not be used. If they have polluted, clean-up costs should rest with the companies.[95]

Fears of genetic pollution arising from terminator seeds are not unfounded and must be taken seriously. In some cases, the polluted plants cannot be distinguished by mere sight. Only when they are replanted and fail to germinate would the affected realize that his or her farm seeds had been unintentionally sterilized. Hence, farmers whose crops are exposed to farms using terminator seeds stand a probable risk of genetic pollution and seed sterilization. It is very difficult to manually prevent against pollen cross-fertilization and the consequential sterilization arising from such contamination with genetically engineered plants.

Another real hazard with terminator seed patents is that the seeds of

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90. *Id.*

91. MAE-WAN HO, GENETIC ENGINEERING: DREAM OR NIGHTMARE? THE BRAVE NEW WORLD OF BAD SCIENCE AND BIG BUSINESS, (Gateway Books; Bath, UK 1998)

92. *Sterile Harvest: New Crop of Terminator Patents Threatens Food Sovereignty*, ETC GROUP, (Jan. 31, 2002), *available at* http://www.etcgroup.org/article.asp?newsid=290 (last visited Sept. 12, 2004) [hereinafter Sterile Harvest].

93. *Id.*

94. *Id.*

95. *Id.*

such crops such as cotton may not be edible to both humans and animals because of the increased toxicity of the seeds. There are potential changes to the nutritional contents and value of the seeds that have had several proteins in them destroyed by artificially induced toxic agents. There are lots of unknowns relating to the functional properties of proteins at several stages of a plant's development and it would be presumptuous to assume that the induced toxicity of the seeds would merely stop at the seeding or germination stage.

Apart from risks to humans, it is common knowledge that birds, other animals, *et cetera*, forage on some of the affected crops. Given the cyclical nature of consumption, terminator seeds pose a severe and clear risk not only to humans, but other living factors in the food chain. More troubling, again, is the issue of allergy to humans. Although the toxins in question may not be directly poisonous to animals, it is possible that they may cause allergenic reactions, particularly, if they are mixed up in the general food supply chain without adequate warning or notice to the public. A report from the Secretariat of the Convention on Biological Diversity has advocated caution in the deployment of terminator seeds.[96]

Another unresolved problem with terminator seeds is the potential difficulty with storage. As Martha Crouch queries, "[w]ill the dead seeds be more or less easy to store?"[97] Perhaps they will respond differently to changes in humidity, or to infection with bacteria and fungi.[98] "If dead seeds do behave differently, even a few 'bad apples may spoil the barrel,' and the problem of partial killing of neighbor's crops may be even be more of an issue."[99] Arguing further in the same breath, Martha Crouch raises the difficult question of the impact of use of tetracycline to set the cascade of gene-toxin activation in motion.[100] In her words,

> If seed companies do indeed use tetracycline . . . then they will have to soak a very large amount of the seed in the antibiotic. . . . [E]very seed planted by the farmer will have to be so treated. How many pounds of cottonseed or wheat seed are needed to plant an acre, and how many acres will be put in? . . . At any rate, even at low concentrations there will be a lot of tetracycline to handle and dispose of, and large-scale agricultural uses of antibiotics are already seen as a threat to their medical uses. Further, the increased tolerance of bacteria, residual or

96. Convention on Biological Diversity, *Consequences of the Use of the New Technology for the Control of Plant Gene Expression for the Conservation and Sustainable Use of Biological Diversity*, May 17, 1999, UNEP/CBD/SBTTA/4/9/Rev.1.

97. Crouch, *supra* note 4.

98. *Id.*

99. *Id.*

100. *Id.*

waste antibiotics may also have a harmful effect on soil ecology.[101]

Another interesting angle to the debate on terminator seeds is the impact of such technologies on farmers' rights to save and replant farm-saved seeds. It is interesting to note that over the centuries, farmers across the globe have labored under the impression that they have a right to use saved seeds. Contemporary international law on ownership of seeds has acknowledged the existence of a farmers' privilege on the subject.[102] Article 9 of the new FAO International Treaty on Plant Genetic Resources for Food and Agriculture, reiterates the right of farmers to use farm-saved seeds.[103] The end result of terminator seeds is to frustrate the exercise of this right. Remarkably, most scholars of international law on the ownership of seeds and plants have not addressed this question.[104] Virtually all studies and research by the Food and Agriculture Organization of the United Nations conclude that terminator patents will diminish, if not truncate, Farmers' Rights if such seeds are widely used.[105]

These are legitimate and serious concerns that should compel the attention of advocates of terminator seeds, policy-makers, and the legislature. The myriad and complex interactions between microorganisms, plants, animals, *et cetera*, are clearly affected by the deployment of terminator seeds.[106] How and in what scale this experiment in ecological engineering will play out in the larger scheme of things is at best a matter of speculation, but all available evidence suggests that caution should be the watchword.[107] Beyond cautionary approaches to environmental integrity and sustainable agriculture, terminator patents also implicate rights recognized in international law and which states are obliged to enforce in domestic law.[108]

Despite the trenchant criticisms that have assailed terminator seeds,

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101. *Id. See also* JANE RISSLER & MARGARET MELLON, THE ECOLOGICAL RISKS OF ENGINEERED CROPS (The MIT Press, 1996).

102. International Treaty on Plant Genetic Resources for Food and Agriculture, Nov. 2001, *available at* http://www.fao.org/Legal/treaties/033t-e.htm (last visited on Apr. 8, 2004) [hereinafter Treaty].

103. *Id.*

104. *See Ad Hoc Technical Expert Group Meeting on the Potential Impacts of Genetic Use Restriction Technologies on Smallholder Farmers, Indigenous and Local Communities and Farmers Rights*, Montreal, 19-21 Feb. 2003, UNEP/CBD/AHTEG-GURTS/1/1/Add.1, (Feb. 13, 2003) [hereinafter Farmer's Rights].

105. *See generally Potential Impacts of GURTS on Agricultural Biodiversity and Agricultural Production Systems: Technical Study,* Commission on Genetic Resources for Food and Agriculture, Ninth Regular Session, CGRFA-9/02/17 Annex. E, Rome (Oct. 14-18 2002).

106. *Id.*

107. Farmer's Rights, *supra* note 104 at 6-7.

108. Treaty, *supra* note 102.

the biotechnology industry and some public institutions are aggressively acquiring new terminator patents and deploying the patented seeds in the fields.[109] The major owners of patents on terminator seeds include Syngenta, Pharmacia (Monsanto), DuPont, BASF, Delta & Pine Land, USDA, Cornell, Purdue, and Iowa State Universities.[110] With the merger of Monsanto and AstraZeneca with some other companies involved in the deployment of terminator seeds, there is little doubt that the initial promises of the original patentees of terminator not to deploy terminator seeds has been overtaken by new realities.[111] To date, Syngenta, "the world's largest agri-business firm, holds the largest arsenal of Terminator patents . . ."[112] with at least seven patents.

The profound implications of these technologies, and the conflicts they create with other rights and interests in society, have not been lost on activists, policy experts, farmers and other segments of the civil society with interests in food security, patent law policy, and environmental integrity.[113] The question thus arises as to whether these technologies are useful inventions within the context of modern patent law on utility.

In resolving this conundrum, it has to be borne in mind that utility in patent law is a technical word. However, its technicality has not completely dispensed with elements of its original reference to social usefulness. Ideally, patent law on utility must resolve the issue of social relevance and technical predictability in equal measure. The extraordinary, indeed perpetual, control over seeds vested in the hands of the GURT patent holders renders patent protection redundant save for the purposes of

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109. Press Release, New Terminator Patents Threaten Food Security, Mar. 8, 2002, *available at* http://www.panna.org/resources/panups/panup_20020308.dv.html (last visited Sept. 12, 2004).

110. ETC Group, *New Terminator Patent Goes to Syngenta*, *available at* http://www.etcgroup.org/article.asp?newsid=94) (last visited Sept. 4, 2004).

111. Sterile Harvest, *supra* note 92. Two new terminator patents that were applied for and issued after the promises were made include: US Patent 6,297,426, issued October 2, 2001 and US Patent 6,228,643, issued May 8, 2001. According to the ETC Group, the former describes

> "the identification and inactivation of a native gene critical to female fertility. This gene is cloned, linked to an inducible promoter and inserted into the plant. The result is a plant that is functionally female sterile with inducible female fertility. This approach involves chemical control of female fertility and its extension to other seed lines . . . ."

Id. Another concern about terminator patents is that they probably help to consolidate the seed industry in a few powerful conglomerates such as Monsanto, Mycogen, Novartis. However, there is considerable debate on whether such consolidation is necessarily harmful to society. *See* U.S. Patent No. 6,297,426 (issued Oct. 2, 2001); U.S. Patent No. 6,228,643 (issued May 8, 2001).

112. Sterile Harvest, *supra* note 92. *See also*, Press Release, Broken Promise? Monsanto Promotes Terminator Seed Technology, *available at* http://www.etcgroup.org/documents /monsantopromise.pdf (last visited Sept. 12, 2004).

113. *See generally*, Farmer's Rights, *supra* note 104 at 1-2.

corralling infringers of the technology. In sum, while GURT patents meet the technical arm of the requirement on utility, there is little doubt that in the overall scheme of societal benefits, GURT patents push patent law to extreme limits, requiring sober deliberation and debate by all interested persons in society.[114]

CONCLUSION

This article has shown how the concept of social usefulness was indeed the driving force behind the institutionalization of the patent system. In addition, at the early stages of patent law, social usefulness assumed a puritanical and preaching tone. The courts and the patent offices visited inventions that were deemed immoral or mischievous with the wrath of rejection. However, as more scientists were appointed to the patent offices as examiners, the moralistic aspect or perspective of the patent office in the construction of utility of inventions began to diminish. The pre-eminent consideration in the test of utility became mechanical operability rather than debatable questions of ethics or immoral uses to which an invention could be deployed. Nevertheless, social usefulness never really withered away entirely from the jurisprudence on utility. It lay dormant and was largely supplanted with legislative provisions expressly debarring certain inventions from patentability.

With respect to terminator technologies, the question is whether, in the absence of clear statutory exception from patentability, the criterion of utility may be invoked to impugn such patents. The answer seems to be in the negative. This response is largely a reflection of the disengagement by the patent office with issues surrounding the environmental implications of inventions to be patented by inventors. Put simply, the modern patent office is designed to patent as many inventions as possible unless there are clear statutory bars to the patentability of such inventions. If the patent system is to be accountable for how it deals with controversial inventions, public inquiry and concern should be channelled to the legislative arm of the government. The test of utility can no longer be relied on to deal with inventions lacking in social usefulness or that push the boundaries of what is morally acceptable, even when such inventions, as for example, terminator seeds, clearly violate other established rights such as farmers' rights.

114. *See Potential Impacts of GURTS on Agricultural Biodiversity and Agricultural Production Systems*, CGRFA/WG-PGR-1/01/7, Rome (July 2-4, 2001).