Fordham Intellectual Property, Media and Entertainment Law Journal

Volume 21 *Volume XXI*
Number 2 *Volume XXI Book 2*

Article 10

2011

Tacit Knowledge Transfer with Patent Law: Exploring Clean Technology Transfers

Margaret McInerney
Fordham University School of Law

Tacit Knowledge Transfer with Patent Law: Exploring Clean Technology Transfers

Cover Page Footnote

J.D. Candidate, Fordham University School of Law, 2011; B.S. Civil Engineering, University of Virginia, 2006; U.S. Green Building Council, LEED® Accredited Professional. Thank you to my family for their support and encouragement and to Professor Gregg Macey for his guidance

Tacit Knowledge Transfer with Patent Law: Exploring Clean Technology Transfers

Margaret McInerney*

A PDF version of this Note is available online at http://iplj.net/blog/archives/volumexxi/book2. Visit http://iplj.net/blog/archives for access to the IPLJ archive.

* J.D. Candidate, Fordham University School of Law, 2011; B.S. Civil Engineering, University of Virginia, 2006; U.S. Green Building Council, LEED® Accredited Professional. Thank you to my family for their support and encouragement and to Professor Gregg Macey for his guidance.

INTRODUCTION

> [T]echnology transfer takes place within a broader context of technological change. A useful image is a drop of water (the transferred technology) hitting the surface of a pond. The pond represents the technological capacity of the country receiving the transferred technology. In the long term, it is the ripples that spread across the pond as a result of the transferred technology that are the most important consideration. These ripples represent the impact of the transfer of low carbon technologies on the overall technological capacity of recipient countries.[1]

All it took was a flash of lightning—a flash of lightning and some rain to disrupt the movement of six wind turbines in the Czech Republic.[2] Five years after installation, the wind turbines of the Jeseník/Ostružna wind farm[3] stopped spinning.[4] The failure of

---

[1] DAVID OCKWELL ET AL., UK-INDIA COLLABORATIVE STUDY ON UHE TRANSFER OF LOW CARBON TECHNOLOGY: FINAL REPORT 10 (2007), http://www.sussex.ac.uk/sussexenergygroup/documents/uk_india_full_pb12473.pdf [hereinafter OCKWELL, PHASE I FINAL REPORT].

[2] OLE RATHMANN ET AL., DANISH-CZECH WIND RESOURCE KNOW-HOW TRANSFER PROJECT, INTERIM REPORT 2002 6 (2003), http://130.226.56.153/rispubl/VEA/veapdf/ris-r-1322.pdf [hereinafter RATHMANN, INTERIM REPORT]; *see also* OLE RATHMANN ET AL., DANISH-CZECH WIND RESOURCE KNOW-HOW TRANSFER PROJECT, FINAL REPORT 7 (2004), http://130.226.56.153/rispubl/VEA/veapdf/ris-r-1447.pdf [hereinafter RATHMANN, FINAL REPORT].

[3] Wind farms consist of multiple wind turbines, which are used to supply electricity to utilities. Electricity is created when the wind turns the generators in the wind turbines and is transmitted through the power grid along power lines. Because electricity should be sent to the grid at a constant load, modern turbines have accounted for variation in

the wind farm highlighted the need for the local engineers to have tacit knowledge (equipment know-how and worker expertise)[5] to repair the wind turbines and to keep them operational.[6]

The Danish Environmental Protection Agency ("DEPA") investigated the problem and provided the Jeseník/Ostružna wind farm engineers the technical training to advance the tacit knowledge of wind energy at the wind farm.[7] Specifically the DEPA organized two three-day training workshops for the Czech scientists, engineers, and project developers working on the wind farm.[8] The DEPA taught the workers the process for operating a wind turbine site with hands-on teaching sessions and gave the Czech workers spare parts for common malfunctioning components of a wind turbine.[9] This Danish-Czech wind transfer project is an example of a tacit knowledge transfer which transfers skills and information from a source to a recipient. Specifically, tacit knowledge is the information embodied in skills, insights, intuitions and experiences that provide an engineer with the ability to make and use the technology.[10] Thus, when a source shares tacit knowledge, the recipient gains the capabilities to improve, manufacture, and operate the transferred technology on its own.[11] After the DEPA transferred tacit knowledge to the Czech workers, for example, the wind turbines became and remained operational.[12]

Improving the sustainable use and manufacturing of clean technologies in developing countries is important for the economic and technological growth of developing countries as well as the

wind speed. However, when lightning strikes the grid it can cause low voltage on the grid, which can damage the power converter of a wind turbine. *See* Certain Variable Speed Wind Turbines and Components Thereof, Inv. No. 337-TA-641, USITC Pub. 4202 (Dec. 2010) (Final), *available at* http://www.usitc.gov/publications/ 337/pub4202.pdf.

4 RATHMAN, INTERIM REPORT, *supra* note 2, at 6.

5 Jeremy Howells, *Tacit Knowledge, Innovation and Technology Transfer*, 8 TECH. ANALYSIS & STRATEGIC MGMT. 91, 92–93 (1996).

6 RATHMAN, INTERIM REPORT, *supra* note 2, at 5, 6.

7 *Id*. at 5.

8 *Id*. at 10–11.

9 *Id*. at 5; *see also* RATHMAN, FINAL REPORT, *supra* note 2, at 10–11.

10 RATHMAN, INTERIM REPORT, *supra* note 2, at 5.

11 TAKAHIRO UENO, TECHNOLOGY TRANSFER TO CHINA TO ADDRESS CLIMATE CHANGE MITIGATION 5–6 (2009), http://www.rff. org/RFF/Documents/RFF-IB-09-09.pdf.

12 *Id*. at 11.

reduction of global carbon emissions.[13] Clean technologies are technologies that generate fewer carbon emissions than current technologies.[14] Carbon emissions in developing countries are growing at a staggering rate and developing countries need to use clean technologies to stabilize global carbon emissions.[15] While many developing countries are increasing their manufacturing of clean technologies,[16] "the bulk of technological innovation" still comes from industrialized economies.[17] Thus, many developing countries must receive technologies from other countries and then adapt those technologies to their communities.

This process of a source delivering equipment, product know-how, or skills to a recipient is called a technology transfer. Technology transfer helps to curb global carbon emissions because when participating in a technology transfer, a recipient saves some of the time and resources needed to create clean technologies by using already-developed technologies. A recipient of a technology transfer can thus leapfrog over the technology development process including the time and resources spent on research, development and commercialization.[18]

Often a source has an incentive to transfer equipment to a recipient in a foreign country[19] because the source can profit from selling the equipment to a new market.[20] However, the incentive to transfer tacit knowledge (generally skills and product know-

---

13 *See* Keith E. Maskus, *Using the International Trading System to Foster Technology Transfer for Economic Development*, 2005 MICH. ST. L. REV. 219, 219–20 (2005).

14 *See* Cristina Tebar Less & Steven McMillan, Achieving the Successful Transfer of Environmentally Sound Technologies: Trade-Related Aspects 4 (OECD Trade and Environment Working Paper No. 2005-02 2005), *available at* http://www.oecd.org/dataoecd/44/20/ 35837552.pdf.

15 *See, e.g.*, INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE XXVII, CLIMATE CHANGE 2007: SYNTHESIS REPORT, AN ASSESSMENT ON THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE (2007), *available at* http://www.ipcc.ch/pdf/assessment-report/ar4/syr/ar4_syr.pdf.

16 *See, e.g.*, *Global Intelligence Alliance, China to Lead Global Wind Energy Development?*, RENEWABLE ENERGY FOCUS.COM (Feb. 15, 2010), http://www.renewableenergyfocus.com/view/7283/china-to-lead-global-wind-energy-development.

17 OCKWELL, PHASE I FINAL REPORT, *supra* note 1, at 9.

18 *See* Kelly Sims Gallagher, *Limits to Leapfrogging in Energy Technologies? Evidence from the Chinese Automobile Industry*, 34 ENERGY POL'Y 383, 383 (2006).

19 *See* Less & McMillan, *supra* note 14, at 9.

20 *See id*. at 12–13.

how) is not as apparent because when a source transfers tacit knowledge, the source loses some of its competitive advantage vis-á-vis the recipient. Tacit knowledge cannot necessarily be exploited in a new market because tacit knowledge is often more valuable if kept confidential. Since a source's motive to transfer equipment to a developing country is often driven by profit, the source has less incentive to transfer tacit knowledge and lose its competitive advantage.

In addition, tacit knowledge is not as easily transferred as equipment. Tacit knowledge is often referred to as "sticky" or hard to transfer because its transfer requires extensive resources and causes the source to incur additional costs.[21] Furthermore, tacit knowledge can be difficult to transfer because the transfer may require interactions between the source and the recipient, such as the training sessions and troubleshooting assistance which the Czech workers received at the Jeseník/Ostružna wind farm.[22] Tacit knowledge transfer can also be resource intensive because the transfer is more effective when there is a dynamic relationship of observation and instruction between the source and the recipient.[23]

While clean technology transfer promises great strides, a technology transfer is only successful if the recipient can adapt to and effectively use the equipment that is part of the technology transfer.[24] A recipient can only sustainably use the equipment when it has acquired sufficient tacit knowledge (i.e., skills and product know-how) to understand, operate and repair the equipment without outside assistance. Tacit knowledge should therefore be a part of any technology transfer, but as shown in the Jeseník/Ostružna wind farm example, sometimes tacit knowledge is either not transferred to the recipient or not absorbed by the recipient.

---

[21] *See, e.g.*, Gabriel Szulanski, *The Process of Knowledge Transfer: A Diachronic Analysis of Stickiness*, 82 ORG. BEHAV. & HUM. DECISION PROCESSES 9, 10 (2000).

[22] *See* Dan L. Burk, *The Role of Patent Law in Knowledge Codification*, 23 BERKELEY TECH. L.J. 1012, 1014–16 (2008); *see also supra* note 9.

[23] *See id.* at 1015.

[24] *See* David M. Haug, *The International Transfer of Technology: Lessons that East Europe Can Learn from the Failed Third World Experience*, 5 HARV. J.L. & TECH. 209, 209 (1992).

This Note suggests that patent law could disclose tacit knowledge to facilitate tacit knowledge transfer to developing countries. Patent law aims to "promote the Progress of Science and useful Arts."[25] In doing so, patent law requires extensive disclosure of technical knowledge to the public in exchange for a patent which is an exclusive right to prohibit others from using the technology.[26] Recipients often have the patents associated with the transferred equipment. In addition, basic wind energy technology is in the public domain and developing countries have access to the equipment and public disclosures in wind energy patents.[27] Patent law also allows an inventor to transfer her rights in a patented invention to another user. This allows the other user hands-on experience with the transferred equipment. Thus, patent law could be a natural vehicle to transfer tacit knowledge to developing countries.[28] Yet, patent law aims to transfer technical knowledge and does not require tacit knowledge disclosure.

Patent law should consider requiring at least some tacit knowledge disclosures because such a requirement could mitigate some of the difficulties associated with tacit knowledge transfer and in turn facilitate technology transfer. Part I of this Note provides background information on technology transfer, tacit knowledge, and patent law's doctrines of technical knowledge disclosure. Part II outlines the concern that technology transfers are less successful when they lack tacit knowledge transfer which is required for implementation of technology. This Part also explores how patent law's technical knowledge doctrines fail to

---

25 U.S. CONST. art. I, § 8, cl. 8.

26 *See* Jeanne C. Fromer, *Patent Disclosure*, 94 IOWA L. REV. 540, 548–50 (2009); *see also* Katherine T. Durak, *Technology Transfer and Patents: Implications for the Production of Scientific Knowledge*, 15 TECH. COMM. Q. 315, 315 (2006).

27 SPRU & TERI, UK-INDIA COLLABORATIVE STUDY ON THE TRANSFER OF LOW CARBON TECHNOLOGY: PHASE II FINAL REPORT 120 n.309 (2009), http://www.sussex.ac.uk/sussexenergygroup/documents/decc-uk_india_carbon_technology-web.pdf [hereinafter PHASE II FINAL REPORT].

28 *See* Fromer, *supra* note 26, at 554 ("Much of the information contained in—or that ought to be in—patents is not published elsewhere."). *But see id.* (noting that other scholars argue that reverse engineering and experimental use of the technology helps to disseminate knowledge); *id.* at 561 (noting that inventors spend little time reading patents and patents may not be looked at for knowledge transfer because people obtain knowledge somewhere else).

consider tacit knowledge. The final Part proposes that patent law could consider facilitating tacit knowledge with patent documents and patent transfers.

I. BACKGROUND

A. Technology Transfer

Technology transfer, in a broad sense, is the process by which equipment, skills, product know-how or resources transfer from a source to a recipient.[29] Equipment refers to any tools, machines, buildings, or other goods transferred;[30] and skills include the professional expertise associated with using and operating the equipment.[31] Lastly, product know-how is any formula or specific information used for operating and commercializing the technology.[32] Clean technologies transfer both horizontally (internationally) and vertically (within an organization).[33] For purposes of this Note, technology transfer refers to the horizontal flow of equipment, skills, and product know-how between developed countries (sources) and developing countries (recipients).[34]

---

[29] *See* PHASE II FINAL REPORT, *supra* note 27, at 23–24; Haug, *supra* note 24, at 211–12. The Intergovernmental Panel on Climate Change defines technology transfer as "the broad set of processes covering the flows of know-how, experience and equipment and is the result of many day-to-day decisions of the different stakeholders involved." *See* INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *Summary for Policymakers*, in IPCC SPECIAL REPORT: METHODOLOGICAL AND TECHNOLOGICAL ISSUES IN TECHNOLOGY TRANSFER 3 (2000) [hereinafter IPCC REPORT], *available at* http://www.ipcc.ch/pdf/special-reports/spm/srtt-en.pdf.

[30] *See* Haug, *supra* note 24, at 210 n.6.

[31] *See id.*

[32] *See, e.g.*, RESTATEMENT (FIRST) OF TORTS § 757 cmt. b (1939); PHASE II FINAL REPORT, *supra* note 27, at 25.

[33] Vertical technology transfer is the transfer of technologies from the research and development stage through to commercialization and horizontal technology transfer is the transfer of technology from one geographical location to another. The main transfer activities include the sale of goods, licensing sale of designs, collaborative research, exchange of scientific and technical personnel, education and training personnel, and acquisition of knowledge from shows, literature, and conferences. *See* PHASE II FINAL REPORT, *supra* note 27, at 25.

[34] *See* Chair of the Expert Group on Technology Transfer, *Recommendations on Future Financing Options for Enhancing the Development, Deployment, Diffusion and*

Technology transfer involves many actors including private corporations, governments, and multinational agencies.[35] Private multinational corporations carry out most international technology transfers.[36] Within these private mechanisms the equipment, skills and product know-how can be transferred at different levels through trade, investments, and contracts.[37] For example, a source could trade techniques (e.g., operating skills for efficient home appliances), equipment, designs, and patterns (e.g., equipment to produce ozone-friendly refrigerators), technical information (e.g., business models on the maintenance of wind turbines) or a source could send a skilled expert to directly teach the recipient.[38] Also, instead of transferring ownership to the recipient a source could retain ownership of the technology and invest in developing the machinery necessary to manufacture the equipment without transferring much corresponding tacit knowledge.[39]

Lastly, the technology can pass from a source to a recipient through various contracts including patent license agreements, technical assistance agreements, and knowledge agreements.[40] Patent license agreements include grants for use of a specific process or for methods of manufacturing the patented invention. Technical assistance agreements "involve the supply of scientific and engineering assistance, training, and management assistance." Knowledge agreements include the exchange of specific tacit

Transfer of Technologies Under the Convention, ¶¶ 46–47, *delivered to the Subsidiary Body for Diffusion*, U.N. Doc. FCCC/SB/2009/2 (May 26, 2009). Under the UNFCCC art. X, technology transfer refers to technology transfer between Annex I and non-Annex countries. The IPCC also recognizes that developing countries have the potential to transfer technologies to other developing countries.

35 *See* Haug, *supra* note 24, at 212–18.

36 Keith E. Maskus, Address at the Duke University Law School Symposium: International Public Goods and Transfer of Technology and TRIPs, Patent Rights and International Technology Transfer through Direct Investment and Licensing (April 4–6, 2003) (noting that multi-national corporations transfer blueprints, formulas, management techniques, customers lists, tacit knowledge, information gained from experience, and contractual obligations such as payments, territorial restrictions, conditions on use, profit-sharing, tax liabilities); *see* Haug, *supra* note 24, at 212–13.

37 *See* Haug, *supra* note 24, at 214–15.

38 *See* Less & McMillan, *supra* note 14, at 11; Haug, *supra* note 24, at 214.

39 *See* Haug, *supra* note 24, at 213–14.

40 *See id*. at 213.

knowledge and technical knowledge that may otherwise not be available to the recipient of the technology.[41]

Often a technology transfer can incorporate multiple exchange modes.[42] These common channels of technology transfer are effective at transferring the equipment; however, sometimes the skills and product know-how needed to make and use the equipment are left behind.

B. Tacit Knowledge Transfer

For purposes of this Note, knowledge transfer generally refers to conveying knowledge (product know-how, skills, and technical information) from one person or one situation to another person or a different situation.[43] Knowledge transfer is often thought of as a process, and not just a single act.[44] Critical stages of the knowledge transfer process are initiation (the source's preparation of the knowledge for transfer to the recipient) and implementation (the recipient's use and adoption of the knowledge).[45] A

---

41 *See id*.

42 *See* Less & McMillan, *supra* note 14, at 13–14 ("[T]ransactions between parent firms and their subsidiaries in royalty and license fees account for more than 80 per cent of international technology transactions, implying that [investment] and licensing often go hand in hand.").

43 *See* Ann Majchrzak et al., *Knowledge Reuse for Innovation*, 50 MGMT. SCI. 174, 174 (2004); *see also* Szulanski, *supra* note 21, at 10. Most of the literature regarding knowledge transfer focuses on knowledge transfer in the firm context because multinational corporations are an efficient source of knowledge transfer. Yet, knowledge moves at many different levels and between individuals or groups of people (e.g., "transfer of knowledge between individuals, from individuals to explicit sources, from individuals to groups, between groups, across groups, and from the group to the organization"). *See* Alavi, *infra* note 49, at 119; Song, *infra* note 164, at 352 (noting that knowledge will be transferred better within a firm than outside a firm); *see also* Anil Gupta & Vijay Govindarajan, *Knowledge Flows within Multinational Corporations*, 21 STRATEGIC MGMT. J. 473, 473 (2000) ("[E]very firm constitutes a bundles of knowledge. As a corollary of the 'resource-based view of the firm' this observation is now so widely accepted as to have become almost axiomatic." (citation omitted)); Stefano Brusoni et al., *infra* note 129 (looking at the boundaries of knowledge within a firm).

44 *See* Szulanski, *supra* note 21, at 5. The knowledge transfer process aims to recreate a source's routines in the recipient's new setting. *Id.* (noting that "[k]nowledge transfer is seen as a process in which an organization recreates a complex, casually ambiguous set of routines in a new setting and keeps it functioning").

45 *See id*. at 11–16 (noting that there are two stages to the knowledge transfer process, initiation and implementation, and further breaking down the implementation stage to

recipient's acquisition of knowledge does not always cause knowledge implementation.[46] To achieve a successful knowledge transfer, the knowledge has to be implemented, adopted and used by the recipient.[47]

Knowledge transfer can be divided into two categories: tacit knowledge and explicit knowledge. Tacit knowledge is often viewed as being the opposite of explicit knowledge.[48] Explicit knowledge is product know-how or technical information typically articulated in products, such as training manuals, prior research, drawings, analytical results, or scientific journal articles.[49] Since

"(a) the initial implementation effort, (b) the ramp-up to satisfactory performance, and (c) subsequent follow-through and evaluation efforts to integrate the practice with other practices of the recipient").

[46] *See* Majchrzak, *supra* note 43, at 174–75 ("Knowledge transfer can generally be subdivided into knowledge sharing (the process by which an entity's knowledge is captured); and knowledge reuse (the process by which an entity is able to locate and use shared knowledge.")).

[47] L. Felipe Monteiro, *Knowledge Flows within Multinational Corporations: Explaining Subsidiary Isolation and Its Performance Implications*, 19 ORG. SCI. 90, 91 (2008) (noting that it is also important to look at the initiation stage of knowledge transfer); *see also* Paul Attewell, *Technology Diffusion and Organizational Learning: The Case of Business Computing*, 3 ORG. SCI. 1, 1–2 (1992) (defining diffusion as a process of communication and influence where users are informed of new technology and are persuaded to adopt it).

[48] *See generally* Bruce Kogut and Udo Zander, *Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology*, 3 ORG. SCI. 383, 386 (1992) (looking at knowledge embedded in machines, organizations, individuals, or skills and noting that there is a difference between information and knowledge—information is for dissemination (what something means) and know-how is how to do something); Udo Zander & Bruce Kogut, *Knowledge and the Speed of the Transfer and Imitation of Organizational Capabilities: An Empirical Test*, 6 ORG. SCI. 76, 77 (1995) (noting that knowledge is divided into tacit knowledge and information). This is an appropriate categorization for this discussion since explicit and tacit knowledge express how knowledge is communicated and transferred. *See* Erica Gorga, *Knowledge Inputs, Legal Institutions and Firm Structure: Towards a Knowledge-Based Theory of the Firm*, 101 NW. U. L. REV. 1123, 1142–45 (2007) (noting that tacit knowledge can be looked at for its means of being codified, taught and observed); Andrew C. Inkpen & Adva Dinur, *Knowledge Management Processes and International Joint Venture*, 9 ORG. SCI. 454, 456 (1998).

[49] *See* Maryam Alavi, *Review: Knowledge Management and Knowledge Management Systems: Conceptual Foundations and Research Issues*, 25 MIS Q. 107, 110 (2001) ("An example is an owner's manual accompanying the purchase of an electronic product. The manual contains knowledge on the appropriate operation of the product."); Majchrzak, *supra* note 43, at 174, (2004).

explicit knowledge is by definition expressed, it is fairly easy to transfer in a manual, computer program or article.[50]

By contrast, tacit knowledge is the product know-how and skills which are uncodified and non-communicated.[51] This knowledge is not in manuals and articles, but instead is embodied in a person's experiences and individual routines.[52] For example, tacit knowledge includes the craft employed by a ship pilot to safely dock a ship[53] and the intuition of a sales clerk in knowing the best approach for selling an item to a customer.[54] Tacit knowledge includes insights, intuition, and implied assumptions.[55] Tacit knowledge comes from a person's experiences or learned habit.[56] People develop their craft over a period of time and develop tacit knowledge after a "long experience working within a particular local context."[57] Often this knowledge simply becomes habit after someone works in the field for a long time.

---

50 *See* Inkpen & Dinur, *supra* note 48, at 456.

51 *See* Gorga, *supra* note 48, at 1144. *But see* Inkpen & Dinur, *supra* note 48, at 456 ("Tacit knowledge is separated into three subtypes: conscious, automatic, and collective. Individual tacit knowledge can be either conscious or automatic. Automatic knowledge is implicit knowledge that "happens by itself" and is often taken for granted. Conscious knowledge may be codified, perhaps as a set of notes, and is potentially available to other people. Collective knowledge is tacit knowledge of a social or communal nature.").

52 *See* Alavi, *supra* note 49, at 110. ("[Tacit knowledge] is comprised of both cognitive and technical elements. The cognitive element refers to an individual's mental models consisting of mental maps, beliefs, paradigms, and view-points. The technical component consists of concrete know-how, crafts, and skills that apply to a specific context.").

53 *See* Gorga, *supra* note 48, at 1144 ("What the pilot knows are the local tides and currents along the coast and estuaries, the unique features of local wind and wave patterns, shifting sandbars, unmarked reefs, seasonal changes in microcurrents, local traffic conditions, the daily vagaries of wind patterns off headlads and along straits, how to pilot in these waters at night, not to mention how to bring many different ships safely to berth under variable conditions."); *see also* Xavier Martin & Robert Salomon, *Tacitness, Learning, and International Expansion: A Study of Foreign Direct Investment in a Knowledge-Intensive Industry*, 14 ORG. SCI. 297, 298 (2003).

54 *See* Alavi, *supra* note 49, at 110.

55 *See* Majchrzak, *supra* note 43, at 174.

56 Bernard L. Simonin, *Ambiguity and the Process of Knowledge Transfer in Strategic Alliances*, 20 STRATEGIC MGMT. J. 595, 598 (1999).

57 *See* Gorga, *supra* note 48, at 1144; Simonin, *supra* note 56, at 598–99; *see also* Howells, *supra* note 5, at 92 (describing tacit knowledge as the "non-codified, disembodied know-how that is acquired via the informal take-up of learned behavior and procedures").

A source can articulate and codify tacit knowledge through examples such as metaphors or visuals. But, unlike explicit knowledge, tacit knowledge can be hard to articulate on paper and is seldom written down.[58] Accordingly, most tacit knowledge is transferred through human interactions and through specific descriptions of experiences.[59] Tacit knowledge is seldom in a portable form and thus is hard to transfer. Patent law could ease some of these difficulties by requiring inventors to disclose experiences and skills along with the technical knowledge of an invention.

C. Patent Law Transfers Technical Knowledge

Patent law transfers technical knowledge of a technology through disclosures in the patent document and through trades of patent rights during patent transfers.[60] An objective of United States patent law is to spur innovation by disseminating technical knowledge to the public.[61] To transfer technical knowledge of an invention to the public, patent law requires an inventor[62] to disclose technical knowledge of a patented invention in a public patent document through its specification and drawing requirements.[63] An inventor must describe her invention in a clear and concise manner to meet the specification requirement and must

---

58 *See id.*

59 *See* Gorga, *supra* note 48, at 1145; Inkpen & Dinur, *supra* note 48, at 456–57; Kogut & Zander, *supra* note 48, at 384.

60 *See* Burk, *supra* note 22, at 1017–18. While it is beyond the scope of this Note, patents also play an increased role in clean technology transfers with compulsory licensing. Compulsory licensing gives a government the authorization to allow it or other manufacturers to produce a patented technology without the patent holder's permission. *See TRIPS and Health: Frequently Asked Questions*, WORLD TRADE ORG., http://www.wto.org/english/tratop_e/trips_e/ public_health_faq_e.htm (last visited Oct. 15, 2010) .

61 *See* Fromer, *supra* note 26, at 542; *see also* Note, *The Disclosure Function of the Patent System (Or Lack Thereof)*, 118 HARV. L. REV. 2007, 2011, 2022 (2005) [hereinafter *Disclosure Function*] (explaining that courts often note that disclosure is the justification for the patent system, while scholars think it is the encouragement of innovation).

62 For clarity this Note will refer to the patent applicant, the original patent owner, and the inventor collectively as the "inventor."

63 *See, e.g.*, Kewanee Oil Co. v. Bicron Corp., 416 U.S. 470, 480–81(1974); W.L. Gore & Assocs. v. Garlock, Inc., 721 F.2d 1540, 1550 (Fed. Cir. 1983).

submit schematics if necessary to clarify the invention to fulfill the drawing requirement.[64] In return for this disclosure, patent law grants the patent owner an exclusive right to make, use, and sell the invention for approximately twenty years.[65] Patent law thereby gives the public access to technical knowledge of the invention and allows the public to learn from the inventor's disclosure.[66] Through this disclosure patent law encourages new inventions, adds innovative thought to the public domain.[67]

In addition, United States patent documents can reduce repetitive research efforts by providing foreign engineers with technical information.[68] Patent documents are typically published and generally contain a great deal of technical knowledge about the patented invention. Patent documents transfer easily across national boundaries,[69] and thus, technical knowledge in the patent document can be transferred across national boundaries as well. Many engineers find that "reading a patent application . . . has

---

64 *See supra* Part I.C.2.

65 *See* 35 U.S.C. § 154(a) (2006); *see also* Fromer, *supra* note 26, at 545.

66 *See* Fromer, *supra* note 26, at 548–49 (noting that disclosure of inventions can stimulate productivity by allowing the public to use the invention after the patent term, and to design around and improve upon the invention during the patent term); *cf.* Dale Carlson et al., *Patent Linchpin for the 21st Century?—Best Mode Revisited*, 45 IDEA 267, 269 (2005) ("Any third party wishing to improve on an invention cloaked in secrecy generally needs to reverse engineer an embodiment of the invention appearing in the marketplace to provide a baseline for improving upon that invention.").

67 *See Disclosure Function*, *supra* note 61, at 2008–09. "[A] patent serves the public good because the disclosure of the invention in the patent document brings new ideas and technologies to the public and induces inventive activity." Sean B. Seymore, *The Teaching Function of Patents*, 85 NOTRE DAME L. REV. 621, 621 (2010).

68 *See* 35 U.S.C. § 112. This Note recognizes that patent law was established to promote innovation in the United States and that the purpose of United States patent law is not necessarily to incentivize innovation abroad. However, with the current global economy, technology and inventive concepts move across borders at rapid speed. Foreign applicants are allowed to file patents with the United States Patent and Trademark Office and United States firms are allowed to license their technologies to foreign markets. So while this Note in no way attempts to broaden the scope of United States patent law, it does try to highlight an efficient possibility to encourage adoption of clean technologies in foreign countries.

69 *See* Ajay Agrawal & Rebecca Henderson, *Putting Patents in Context: Exploring Knowledge Transfer from MIT*, 48 MGMT. SCI. 44, 45 (2002); *see also* Fromer, *supra* note 26, at 542, 544–66 (arguing that patent disclosure should be central to stimulating innovation while noting that the some scholars suggest that patent disclosures are of little importance to innovation).

practical advantages" since "every patent application contains a complete description of someone's technology."[70] By reading a patent document, an engineer does not have to struggle to solve a technical problem already answered and does not have to spend the time and resources that may be needed to figure out how an invention works by reverse engineering the invention.[71]

The reader of the patent document is not allowed to make and use the patented invention during the patent term. However, technical knowledge disclosed in the patent document can be used by the public to improve on a patented invention or applied to the patented invention once the patent expires.[72] Technical knowledge in patent documents can therefore encourage future innovation, reduce wasteful duplicative research, and lead to more efficient investments in innovation.[73]

Patent law encourages the development and transfer of technical knowledge through other mechanisms as well. The law allows an inventor to develop hands-on skills by experimenting with an invention before filing a patent application and permits a patent owner to transfer her exclusive right to make and use the invention once the patent issues.[74] The rest of this Section will outline patent law's existing technical knowledge transfer mechanisms.

---

70 CRAIG ALLEN NARD, THE LAW OF PATENTS 50 (2008).

71 *See id.*; Fromer, *supra* note 26, at 544–63; *see also supra* note 66.

72 Diane Leenheer Zimmerman, *Is There a Right to Have Something to Say? One View of The Public Domain*, 73 FORDHAM L. REV. 297, 303 n.23 (2004); *see also* Kewanee Oil Co. v. Bicron, 416 U.S. 470, 481 (1974) ("When a patent is granted and the information contained in it is circulated to the general public and those especially skilled in the trade, such additions to the general store of knowledge are of such importance to the public weal that the Federal Government is willing to pay the high price of 17 years of exclusive use for its disclosure, which disclosure, it is assumed, will stimulate ideas and the eventual development of further significant advances in the art.").

73 *Disclosure Function*, *supra* note 61, at 2010 (noting that a user may discover a new way to use the patent that the patent holder did not think to use it). *But see* Mark A. Lemley, *Ignoring Patents*, 2008 MICH ST. L. REV 19, 22 n.16 (2008) ("[R]esearch suggests that scientists do not in fact gain much of their knowledge from patents, turning instead to other sources.").

74 *See infra* Part I.C.3, 4.

1. Audience

Inventors draft patent applications to demonstrate that they have a sufficient grasp on an invention as to enable others to make and use the inventions. While patent law mandates disclosure of a patented invention to the "public,"[75] it defines the "public" as the category of *persons having ordinary skill in the art* ("PHOSITA").[76] In drafting this requirement, Congress attempted to create a standard audience for patent documents.[77] A person having ordinary skill in the art is a fictional person who has typical skill in the same technical field as the patented invention. Factors considered by the courts and the United States Patent and Trademark Office ("USPTO") in determining ordinary skill in the art are: the education level of the inventor and workers in the field, problems of the industry, prior art solutions to the problems, speed of innovation, and sophistication of invention.[78] For example, a person having ordinary skill in the art with respect to a wind technology would be a person with a Bachelor of Science "degree in electrical engineering, or an equivalent degree program with two to three years of experience in power electronics and, or, electronic machines."[79] Patent law assumes that this is the "typical" patent reader.

2. Disclosure Requirements

In addition to showing a grasp of the invention, patent law also requires specific disclosures in the patent document. Section 112 of the Patent Act articulates that the inventor must describe her invention in writing and include a clear and concise claim of the

---

[75] *See* Fromer, *supra* note 26, at 553.

[76] *See* Envtl. Designs, Ltd. v. Union Oil Co. 713 F.2d 693, 696–97 (Fed. Cir. 1983), *cert. denied*, 464 U.S. 1043 (1984).

[77] *See* Kimberly-Clarke Corp. v. Johnson & Johnson, 745 F.2d 1437, 1454 (Fed. Cir. 1984); *see also* 35 U.S.C. § 103(a) (2006).

[78] *See Envtl. Designs, Ltd.*, 713 F.2d at 696–97.

[79] Certain Variable Speed Wind Turbines and Components Thereof, Inv. No. 337-TA-641, Pub. 4202 (Dec. 2010) (Final), *available at* http://www.usitc.gov/publications/337/pub4202.pdf (discussing the background for the initial determination of General Electric's claims against Mitsubishi for violating importation laws when it imported and sold 2.4MW wind turbines in the United States which infringed three of General Electric's patents).

subject matter of the invention for which she seeks a patent.[80] The specification requirement asks an inventor to furnish a written description of the invention, to enable others to make and use the invention without undue experimentation, and to provide the best mode for using and practicing the invention.[81]

Section 112 requires the patent document to "contain a written description of the invention,"[82] to ensure that an inventor has possession of the invention, and to foster further research and improvement of the patented invention.[83] The written description requirement in the patent document thus helps to guide future engineers in making and using the invention. In *In re Rushchig*,[84] the Court of Customs and Patent Appeals (now the Court of Appeals for the Federal Circuit) described the written description as a guide for other inventors to find their way through a forest of possible solutions to allow them to make the patented invention.[85]

Inventors' descriptions help to foster patent law's policy goal of increasing the public's technical knowledge regarding an invention.[86] Yet, the written description is meant for a person having ordinary skill in the art, not for the general public. For

---

[80] *See* 35 U.S.C. § 112 (2006) ("The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same, and shall set forth the best mode contemplated by the inventor of carrying out his invention."); *see also* Orthokinetics, Inc. v. Safety Travel Chairs, 806 F.2d 1565, 1575–76 (Fed. Cir. 1986).

[81] Fromer, *supra* note 26, at 546 (noting that "written description, enablement, and best mode . . . are best understood as obliging disclosure of certain content within the specification"); *see also Disclosure Function*, *supra* note 61, at 2013 ("[T]he written description 'serves a teaching function, as quid pro quo'"(quoting Univ. of Rochester v. G.D. Searle & Co., 358 F.3d 916, 922 (Fed. Cir. 2004))).

[82] 35 U.S.C. § 112.

[83] Christina McDougal, Comment, *The Split Over Enablement and Written Description: Losing Sight of the Purpose of the Patent System*, 14 INTELL. PROP. L. BULL. 123, 123 (2010).

[84] 379 F.2d 990 (C.C.P.A. 1967).

[85] *Id.* at 994–95 ("It is an old custom in the woods to mark trails by making blaze marks on the trees. It is no help in finding a trail or in finding one's way through the woods where the trails have disappeared—or have not yet been made, which is more like the case here—to be confronted simply by a large number of unmarked trees. . . . We are looking for blaze marks which single out particular trees.").

[86] *See* McDougal, *supra* note 83.

example, part of the specification of a patent for a wind turbine reads:

> As will be understood by those familiar with the art, the invention may be embodied in other specified forms without departing from the spirit or essential characteristics thereof. . . . The generator need not be a three-phase squirrel-cage induction generator, but may be any multiphase generator, including a synchronous generator.[87]

This specification does not describe nor list any of the other multiphase generators. During an infringement action involving this patent, the United States International Trade Commission ("ITC") held that the claim met the written description requirement even though it did not describe the induction generators other than the squirrel-cage generator that could have been used to make the invention.[88] The ITC held that a patentee does not have to describe all aspects of a patented technology if parts of the technology are well known and have been used in prior inventions.[89] Thus, the written description requirement transfers technical knowledge to others in the public who have the background knowledge to understand the patent.

The next requirement of § 112, enablement, requires the inventor to describe the invention clearly enough so that one skilled in the art of the invention can make and use the invention without "undue experimentation."[90] Undue experimentation includes many factors such as the likely expense of making the invention, the amount of direction presented, the presence of a working example, the nature of invention, and the relative skill of those in the art.[91] This requirement does not teach the public to

---

87 U.S. Patent No. 5,083,039 col. 19 ll. 3–15 (filed Feb. 1, 1991) (issued Jan. 21, 1992).

88 Certain Variable Speed Wind Turbines and Components Thereof, Inv. No. 337-TA-641, USITC Pub. 4202 (Dec. 2010) (Final), *available at* http://www.usitc.gov/publications/337/pub4202.pdf.

89 *See id.*

90 *See* 35 U.S.C. § 112 (2006); *In re* Wands, 858 F.2d 731, 736–37 (Fed. Cir. 1988) (holding that enablement means giving the PHOSITA enough information to practice the invention without undue experimentation).

91 *See Wands*, 858 F.2d at 737.

make the invention without additional effort; it merely reduces the amount of experimentation that must go into it.[92] The enablement requirement does not require examples or embodiments of the invention. It only requires disclosure of the invention. In fact, the invention does not have to have been made to meet this requirement.[93]

Again the public policy of encouraging disclosure of an invention to the public is manifested in the enablement requirement. In *Grant v. Raymond*,[94] Chief Judge Marshall held that a description of the technology was needed "in order to give the public, after the [monopoly] privilege shall expire, the advantage for which the privilege is allowed."[95] If an inventor claims an invention too broadly and does not disclose the necessary information to the public to warrant the monopoly of the patent, the patent can be held invalid.[96]

As illustrated by the written description of the wind turbine patent referenced above, a patent only has to enable a person of ordinary skill in the art to make and use the invention.[97] While it may be known that there are other possible means to make an invention, the inventor does not have to disclose them in the patent application if a person having ordinary skill in the art can practice the invention using those means without any further undue experimentation.[98]

Another one of patent law's disclosure requirements is the best mode requirement which holds that the inventor must disclose to

---

92 *See* Seymore, *supra* note 67, at 625–26; *see also Wands*, 858 F.2d at 736–37 ("Enablement is not precluded by the necessity for some experimentation such as routine screening. However, experimentation needed to practice the invention must not be undue experimentation. The key word is 'undue,' not 'experimentation.'" (citations omitted)).

93 *In re* Chilowsky, 229 F.2d 457, 461 (C.C.P.A. 1956).

94 31 U.S. (6 Pet.) 218, 219 (1832).

95 *Id.*

96 O'Reilly v. Morse, 56 U.S. (15 How.) 62, 135 (1854).

97 U.S. Patent No. 5,083,039 col. 19 ll. 3–15 (filed Feb. 1, 1991) (issued Jan. 21, 1992); *see also* Certain Variable Speed Wind Turbines and Components Thereof, Inv. No. 337-TA-641, USITC Pub. 4202 (Dec. 2010) (Final), *available at* http://www.usitc.gov/publications/ 337/pub4202.pdf.

98 Certain Variable Speed Wind Turbines and Components Thereof, Inv. No. 337-TA-641, USITC Pub. 4202 (Dec. 2010) (Final), *available at* http://www.usitc.gov/ publications/337/pub4202.pdf.

the public the best mode for practicing the invention,[99] and the most effective embodiment for carrying out the invention.[100] This requirement "mandates the inventor to effectively make sure that the quality of disclosure contained in the patent application is indeed the best that she can provide."[101] The purpose of the best mode requirement is to encourage a particular kind of disclosure: a clear recipe for making the invention.[102]

The best mode requirement is different than the enablement disclosure in that enablement only requires that a patent application be sufficiently detailed for others skilled in the art to practice the invention without undue experimentation.[103] However, unlike the enablement requirement, the best mode doctrine requires disclosure of a working example.[104] The inventor needs to articulate the best way to make and use the invention.[105] The best mode requirement prevents inventors from keeping preferred modes unarticulated and for themselves.[106]

In addition to the specification requirements, patent law also requires inventors to present a drawing of the invention to the USPTO if it is necessary to illustrate the invention.[107] As the

---

99 35 U.S.C. § 112 (2006).

100 *See, e.g.*, Fromer, *supra* note 26, at 547.

101 Carlson, *supra* note 66, at 270.

102 The best mode requirement is viewed from the inventor's perspective and encourages "new inventions by affording clearer 'recipes' to the subject invention." *Id.* "A clearer picture of the subject invention facilitates the fleshing-out of new inventions by third parties reading the patent or published patent application." *Id.*

103 *See id.* at 272–73.

104 *See id.* at 272.

105 *See id.* at 272–73.

106 *See* Amgen, Inc. v. Chugai Pharm. Co., 927 F.2d 1200, 1209–10 (Fed. Cir. 1991) ("The best mode requirement thus is intended to ensure that a patent applicant plays 'fair and square' with the patent system. It is a requirement that the *quid pro quo* of the patent grant be satisfied. One must not receive the right to exclude others unless at the time of filing he has provided an adequate disclosure of the best mode known to him of carrying out his invention."); Carlson, *supra* note 66, at 272–73 ("It goes without saying that, absent the best mode disclosure obligation, the primary purpose of the patent system would be frustrated because the inventor would be permitted to retain the details of his or her invention as trade secrets while gaining the benefit of the patent monopoly."); *see also* Christianson v. Colt Indus. Operating Corp., 870 F.2d 1292, 1308 n.8 (7th Cir. 1989) ("[T]he best mode requirement is intended to allow the public to compete fairly with the patentee following the expiration of the patents.").

107 35 U.S.C. § 113 (2006); *see also* Fromer, *supra* note 26, at 546.

purpose of such drawings is to "elucidate the invention,"[108] it represents an important disclosure tool and most patents include a drawing even if it is a schematic drawing. In addition, the patent document includes a description of the preferred embodiment of the invention along with the drawing, such as:

> Referring now to FIG. 1, the windpower system or wind turbine shown . . . comprises a frame support . . . secured to the top of the tower . . . by way of a rotary mounting . . . which permits the support to swivel and yaw.[109]

3. Experimental Use Exception

While patent law's disclosure requirements seek to enrich the public domain by flushing out an inventor's knowledge, patent law supports the policy goal of developing a rich public domain of technical knowledge in the exact opposite way as well: by permitting inventors to keep their inventions to themselves. Generally, patent law bars any inventor from filing for a patent in the United States if the patent was in public use or on sale more than one year prior to the filing date of the patent application in the United States.[110] Yet, under the Patent Act, an inventor's experimentation does not count as public use if an inventor is conducting a bona fide experiment under her control.[111] A bona fide experiment is any effort to "perfect the invention or to

---

[108] Fromer, *supra* note 26, at 546.

[109] U.S. Patent No. 4,490,093 col. 6 ll. 38–43 (filed July 13, 1981) (issued Dec. 25, 1984).

[110] 35 U.S.C. § 102(b).

[111] *See* Allen Eng'g Corp. v. Bartell Indus., Inc., 299 F.3d 1336, 1353 (Fed. Cir. 2002) ("These factors include: (1) the necessity for public testing, (2) the amount of control over the experiment retained by the inventor, (3) the nature of the invention, (4) the length of the test period, (5) whether payment was made, (6) whether there was a secrecy obligation, (7) whether records of the experiment were kept, (8) who conducted the experiment, . . . (9) the degree of commercial exploitation during testing[,] . . . (10) whether the invention reasonably requires evaluation under actual conditions of use, (11) whether testing was systematically performed, (12) whether the inventor continually monitored the invention during testing, and (13) the nature of contacts made with potential customers." (quoting EZ Dock v. Schafer Sys., Inc., 276 F.3d 1347, 1357 (Fed. Cir. 2002) (Linn, J., concurring))); City of Elizabeth v. Am. Nicholson Pavement Co., 97 U.S. 126, 134 (1878).

ascertain whether it will answer its intended purpose."[112] Once the invention is reduced to practice and the inventor knows that the invention works for its intended purpose, any further work no longer qualifies as experimental use.[113] The experimental use exception helps to transfer technical knowledge by allowing an inventor the time to work on an invention and the opportunity to gain personal hands-on experience with the invention before filing the patent application in which this knowledge will be articulated.[114]

While experimental use allows an inventor time to understand the invention, it is not required before an inventor files a patent application. An inventor only has to show a reduction to practice before filing the patent application.[115] An inventor's reduction to practice can either be an actual reduction to practice (wherein the inventor makes and uses the invention) or it can be a constructive reduction to practice (wherein the inventor sufficiently discloses in the patent application how to make and use the invention).[116] Since a constructive reduction to practice requires only a sufficient disclosure in the patent application of how to make and use the invention, an inventor does not have to actually experiment with the invention let alone make the invention before filing a patent application. This causes significant variation in the quality of the disclosure in the patent document because some inventors simply experiment more and understand their inventions better.

4. Patent Transfers

Beyond the patent document, patent law transfers technical knowledge by allowing inventors to transfer their patented

---

112 LaBounty Mfg. v. U.S. Int'l Trade Comm'n, 958 F.2d 1066, 1071 (Fed. Cir. 1992).

113 *See* RCA Corp. v. Data Gen. Corp., 887 F.2d 1056, 1061 (Fed. Cir. 1989).

114 U.S. PATENT & TRADEMARK OFFICE, U.S. DEP'T OF COMMERCE MANUAL OF PATENT EXAMINING PROCEDURE § 2133.03 (e) (8th ed., 8th rev. 2010) [hereinafter MPEP]. Experimentation must be the primary purpose for the inventor to be using the technology in public before filing for a patent application. *Id.*

115 MPEP, *supra* note 114, § 2138.05.

116 *See* Hyatt v. Boone, 146 F.3d 1348, 1351 (Fed. Cir. 1998); Kawai v. Metlesics, 480 F.2d 880, 886 (C.C.P.A. 1973).

inventions.[117] A patent transfer naturally transfers technical knowledge about the invention to someone other than the inventor because it permits others to use and experiment with the patented invention. A patent owner (or for clarity, the "inventor") has the exclusive right to "make, use, offer to sell, [and] sell" the patented invention.[118] Yet, "[p]atents are transferable assets"[119] and patent law allows for an inventor to create an invention and exploit it for money either by selling it or licensing it to another person.[120]

Generally a patent holder can exploit her patent either through assignment of the patent or by licensing the patent.[121] A license is a legal contract in which a licensor grants the patent right to a licensee.[122] An assignment is different from a license in that it involves a sale and transfer of ownership.[123] An assignment can only be made through writing.[124] Thus, a patent can either be transferred by sale for a lump sum, or the right to use the invention can be licensed to another in exchange for royalty payments. Royalty payments are typically paid to the inventor for the life of a patent.[125]

While an engineer may create an invention, patent law has allowed for others to manufacture and sell the invention either through assignment or licensing. The transfer of the right to manufacture and sell the patented technology also transfers the technical knowledge to make and use the patented technology. Even though patent law transfers technical knowledge, there are still several overlooked chances to improve technology transfers because patent law does not transfer tacit knowledge.

---

117 For U.S. patent protection see 35 U.S.C. § 154 providing for "a grant to the patentee . . . of the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States." 35 U.S.C. § 154 (2006).

118 35 U.S.C. § 271.

119 *A Market for Ideas*, ECONOMIST, http://www.economist.com/node/5014990.

120 *See* Philip Mendes, *To License a Patent—or, to Assign it: Factors Influencing the Choice*, WORLD INTELL. PROP. ORG., http://www.wipo.int/sme/en/documents/license_assign_patent.htm (last visited Feb. 15, 2011).

121 *See id.*

122 *See id.*

123 *See id.*

124 35 U.S.C. § 261.

125 *See* Mendes, *supra* note 120.

II. MISSED OPPORTUNITIES

This Note addresses missed opportunities in three areas: technology transfer, tacit knowledge transfer, and patent law technical knowledge transfer. Tacit knowledge is needed for technology transfer to be successful. However, tacit knowledge is difficult to transfer and while patent law aims to transfer technical knowledge of a patented invention it does not consider tacit knowledge.

A. Technology Transfer Needs Tacit Knowledge

Even though tacit knowledge is harder (or even impossible in some instances) to transfer,[126] it is necessary to enable a recipient to use the technology in a new environment for the long-term. As mentioned above, the definition of technology transfer does not just refer to the transfer of equipment but includes the transfer of professional skills and product know-how as well. Trade, investments, and contracts are channels for equipment transfer.[127] While these channels may sometimes also transfer skills and product know-how, they often fail at transferring tacit knowledge. Even when skills and product know-how are transferred along with the equipment, they may not be absorbed by the recipient. The difficulty of tacit knowledge transfer therefore "places major constraints on the extent to which [technology] can be transferred abroad."[128]

Without tacit knowledge, technology adaption is stifled and can be a barrier for local communities during technology transfer initiatives.[129] Conversely, when tacit knowledge is transferred, a

---

[126] *See* Gorga, *supra* note 48, at 1144.

[127] *See* Haug, *supra* note 24, at 213–17.

[128] *See* Martin Khor, *Rethinking Intellectual Property Rights and TRIPS*, *in* GLOBAL INTELLECTUAL PROPERTY RIGHTS: KNOWLEDGE, ACCESS AND DEVELOPMENT 201, 297 (Peter Drahos & Ruth Mayne eds., 2002).

[129] *See* Less & McMillan, *supra* note 14, at 25–26; *cf.* Stefano Brusoni et al., *Knowledge Specialization, Organizational Coupling, and the Boundaries of the Firm: Why Do Firms Know More Than They Make?*, 46 ADMIN. SCI. Q. 597, 598 (2001) ("The emergence of multi-technology firms that deliver increasingly complex products would not be a cause for analytical concern if specific bodies of technological knowledge could be mapped tidily on to well-identified components and subsystems . . . ."). Tacit

recipient receives the requisite skills to manufacture and properly use the technology. Incorporating tacit knowledge into the technology transfer process could therefore greatly improve the quality of use and application of the transferred equipment.[130]

Yet, simply transferring tacit knowledge is not enough; there must be absorption of the tacit knowledge by the technology recipient. A recipient has to learn how to use local skills and resources to make and use the technology.[131] "Such learning processes are fundamental for the creation of tacit knowledge and skills."[132] Once a recipient develops the ability to use local resources to operate and manufacture a technology, it can locally manufacture the technology and independently operate the technology. This adaption to equipment leads to "technological capacity building." Technological capacity building refers to a recipient's development of tacit knowledge, resources, personnel, product know-how and skills.[133] Without this technological capacity, a recipient cannot use local resources to troubleshoot the equipment and cannot independently use and manufacture the equipment.[134] This technological capacity at the local level helps a recipient use and manufacture advanced technologies on its own and decreases a recipient's reliance on a source for long-term assistance.

B. Tacit Knowledge Transfer Is Difficult

The success of technology transfer depends on tacit knowledge transfer, but tacit knowledge transfer is difficult.[135] Tacit knowledge transfer is often described as "sticky" or difficult to transfer.[136] Stickiness refers to the difficulty and resource

knowledge may be a key barrier in the diffusion to technological innovation. *See, e.g.*, Simonin, *supra* note 56, at 598.

130 *See* UENO, *supra* note 11, at 5.

131 *See* Gallagher, *supra* note 18, at 383; *see* Haug, *supra* note 24, at 211–12.

132 *See* PHASE II FINAL REPORT, *supra* note 27, at 5.

133 *See* Haug, *supra* note 24, at 210–12 ("[D]efinition requires not only technology transfer but technology diffusion where the technology becomes absorbed into the local recipient community."); *see also* PHASE II FINAL REPORT, *supra* note 27, at 26.

134 *See, e.g.*, UENO, *supra* note 11, at 5–6.

135 *See* Simonin, *supra* note 56, at 597.

136 *See* Szulanski, *supra* note 21, at 10; *see, e.g.*, Simonin, *supra* note 56, at 597.

intensiveness associated with transferring tacit knowledge.[137] Generally, tacit knowledge can be difficult to transfer over international borders because these transfers often involve a number of people interpreting the knowledge along the way and tacit knowledge transfer is stifled when multiple people along the transfer chain have to interpret the knowledge.[138] Conversely, physical proximity can increase the rate of knowledge transfer simply because communication and interests are shared within the geographic area.[139] While a large geographical distance might slow tacit knowledge transfer, international distance does not necessarily prohibit it.[140] Tacit knowledge transfer difficulties can be further exacerbated by (a) the lack of familiarity between the source of knowledge and its recipient, (b) the inability of the source to share tacit knowledge through experiences and routines, and (c) the threat of industry competition.

1. Familiarity of the Parties

A lack of familiarity between the source and the recipient greatly adds to the difficulty of tacit knowledge transfer and can result as much from cultural and linguistic barriers as from geographical distance.[141] Since tacit knowledge is developed through experiences it can vary for a specific technology depending on the time, place and use.[142] Tacit knowledge is more easily transferred long distances when the source and the recipient belong to the same professional field or share a common technical language.[143]

---

137 *See* Simonin, *supra* note 56, at 597; Szulanski, *supra* note 21, at 10–11.

138 *See* Szulanski, *supra* note 21, at 11–14.

139 Stephen Tallman & Anupama Phene, *Leveraging Knowledge Across Geographic Boundaries*, 18 ORG. SCI. 252, 258 (2007).

140 *See id.* at 252–53 ("Knowledge appears to be sticky, both nationally and in regional clusters. However, while knowledge may tend to stick to its geographical origin . . . clearly it does get transferred, both intentionally and unintentionally, across cluster and national boundaries.").

141 *See id.* at 252–53, 257 (noting that a common technological culture can reduce the stickiness of knowledge transfer across long domestic distances).

142 *See* Howells, *supra* note 5, at 96–97.

143 *See* Ray Reagans & Bill McEvily, *Network Structure and Knowledge Transfer: The Effects of Cohesion and Range*, 48 ADMIN. SCI. Q. 240, 263 (2003) ("Strong interpersonal connections within a dense network cluster ensure that knowledge will diffuse quickly

International tacit knowledge transfer can be complicated by a distance in culture between the source and the recipient;[144] often the source and the recipient might use a different technical language and encounter a communication gap.[145] However, this gap can either be bridged by sharing the same technical field or through frequent interactions. Indeed, a strong tie (i.e., a relationship between the source and the recipient within the same organization, industry, or technical field) can help bridge any technical gaps between the source and the recipient.[146] When the source and the recipient are part of the same technical field, they share a common bond which fosters common ideas and increases collaboration.[147]

In addition, frequency of interactions can help to decrease a communication gap. In order for the source to teach tacit knowledge to the recipient, the source and the recipient might have to develop a code or a language so that when the source articulates its routines, the recipient is better able to understand the source's intent.[148] This code can be developed over time and can be derived from collective experiences despite cultural differences if the source and the recipient interact frequently and become familiar

within that cluster."); *see also* Kogut & Zander, *supra* note 48, at 389 ("Personal knowledge can be transmitted because a set of values are learned, permitting a shared language by which to communicate.").

144 Tallman & Phene, *supra* note 139, at 252–53 ("[I]ntellectual breakthroughs must cross hallways and streets more easily than oceans and continents.").

145 *See* Szulanski, *supra* note 21, at 14.

146 Daniel Levin & Rob Cross, *The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer*, 50 MGMT. SCI. 1477, 1478 (2004); *see also* Kogut & Zander, *supra* note 48, at 389 ("By shared coding schemes, personal knowledge can be transmitted effectively within close-knit groups."). *But see* Reagans & McEvily, *supra* note 143, at 264 ("Tacit knowledge is more likely to transfer across a structural hole when the individual . . . has a strong tie across the hole or has a diverse network.").

147 *See* Kogut & Zander, *supra* note 48, at 389.

148 *Id.* ("[I]t is the sharing of a common stock of knowledge, both technical and organizational, that facilitates the transfer of knowledge within groups."); *id.* at 386 (noting that scholars investigate routines and blueprint of routines favors description of information not tacit knowledge); *id.* ("Knowing how to do something is much like a recipe."); *id.* at 387 ("Codifiability is a question of the degree that there exists an implied theory by which to identify and symbolically represent knowledge. A theory may be as lacking for information as for know-how."); *see also* Burk, *supra* note 22, at 1013.

with one another.[149] This familiarity takes time and resources to establish. For example, after the training sessions at the Jeseník/Ostružna wind farm, the Czech engineers had numerous encounters and training sessions with the Danish engineers.[150] Such encounters develop a relationship between the source and the recipient[151] because of the frequency of interactions and the common technical language developing.

Familiarity either through numerous interactions and collaboration or through a common technical field improves tacit knowledge transfer because the recipient and the source can develop a shared code.[152] This allows tacit knowledge to be more easily transferred across national boundaries.[153] However, these relationships are difficult to develop as they only develop over time and through multiple interactions.

2. Ability to Share Experiences

Tacit knowledge is also challenging to transfer because tacit knowledge is often transferred through the sharing of personal experiences which can be hard to articulate.[154] Tacit knowledge is

---

149 *See* Zander & Kogut, *supra* note 48, at 78.

150 RATHMAN, INTERIM REPORT, *supra* note 2, at 10–11.

151 *See* Howells, *supra* note 5, at 96; Reagans & McEvily, *supra* note 143, at 262–64. While the development of strong relationships between scientists and engineers of the same field helps to bridge the communication and technical gap, relationships across technologies and industries may provide other benefits. The development of relationships across technical fields can carry a "spark" of knowledge from one area of industry to another as previously disconnected groups receive new information. *See* Morten T. Hansen, *The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge Across Organization Subunits*, 44 ADMIN. SCI. Q. 82, 82 (1999).

152 *See* Kogut & Zander, *supra* note 48, at 389 ("The teaching of know-how and information requires frequent interaction within small groups, often through the development of a unique language or code."); Reagans & McEvily, *supra* note 143, at 263 ("[A]n individual is more likely to exert greater effort to transfer knowledge to a close personal contact, and an individual who is surrounded by a diverse network is better able to transfer knowledge.").

153 *See* Kogut & Zander, *supra* note 48, at 389.

154 *See* Gorga, *supra* note 48, at 1142 ("[W]here knowledge is tacit relocating individuals to the site where such learning takes place may be necessary to achieve knowledge transfer."). In other instances, a sharing of experiences is not required to transfer tacit knowledge because the source of the tacit knowledge moves with the technology. Tacit knowledge can transfer when an individual with knowledge moves, transfers firms, or teaches in another country. But note that while most knowledge is

embodied in an individual's skills and experiences and to transfer tacit knowledge, these experiences must be shared either through written form or with direct teachings.[155] Tacit knowledge can be transferred either by a source articulating experiences and skills or by a source directly teaching the recipient.

Unsurprisingly, tacit knowledge tends to be less sticky if the source of the knowledge is able to describe her skills and experiences.[156] Moreover, there are some aspects of tacit knowledge that can be articulated and converted to explicit knowledge.[157] Tacit knowledge can be converted to explicit knowledge (through direct observation or a shared language, such as meetings, manuals, and training).[158] Also a source can articulate tacit knowledge by describing routines or specific experiences encountered through "metaphors, analogies, narratives, or visuals."[159] This articulation of tacit knowledge may require resources from the source to express knowledge in a suitable form, but it is possible and may be useful in many situations.[160]

transferred by a person sharing experiences, a recipient can also gain on-the-job training from using the equipment. Knowledge can move from a machine or physical object to a person (i.e., person-to-machine-to-person transfer). For example, an engineer may get a new idea for an innovation by working with a machine and seeing how the machine operates. The tacit knowledge is in essence transferred from the machine to the person. *See id.* at 1146–47.

155 This Note assumes that tacit knowledge can be articulated in some cases and transferred in written form. There are tangible assets of tacit knowledge than can be codified and transferred. *See* Kogut & Zander, *supra* note 48, at 384–85; *see also* Margit Osterloh & Bruno S. Frey, *Motivation, Knowledge Transfer, and Organizational Forms*, 11 ORG. SCI. 538, 546 (2000) ("[T]acit knowledge can be amplified and crystallized in the form of routines."). The extent to which tacit knowledge can be codified is not addressed in this paper. For a discussion on the extent to which tacit knowledge can be codified and the costs associated with its codifications see Burk, *supra* note 22 at 1014–16.

156 *See Z*ander & Kogut, *supra* note 48, at 77 ("[T]he degree to which capabilities are codifiable and teachable influences the speed of their transfer."). Some scholars suggest that when tacit knowledge is codified into a machine or articulated on paper that it becomes explicit knowledge. *See* Howells, *supra* note 5, at 94. While this may be true in the definitional sense, the essence of the tacit knowledge is still being transferred for the purposes of this Note and successful technology transfer.

157 *See* Kogut & Zander, *supra* note 48, at 384.

158 *Id.*; *see also* Burk, *supra* note 22, at 1015.

159 Osterloh & Frey, *supra* note 155, at 546; *see also* Howells, *supra* note 5, at 95, 103.

160 *See* Osterloh & Frey, *supra* note 155, at 546; *see also* Howells, *supra* note 5, at 95, 103.

Actually, tacit knowledge transfers better when it interacts with explicit knowledge.[161] The more explicit-tacit knowledge mixing taking place, the more likely that tacit knowledge will transfer.[162] The speed and scale of knowledge transfer increases as tacit and explicit knowledge interact. For example, one of the main problems with the Jeseník/Ostružna wind farm was that the Czech engineers did not understand how to estimate the daily wind energy potential of the wind farm. Ultimately, the Danish workers transferred this knowledge by delivering software and also by training the engineers "in using modern software in performing such estimating analyses."[163]

A source is also able to share her experiences when she directly teaches a recipient through on-the-job training.[164] On-the-job training allows for the recipient to work with the technology while the source is present. When an individual is able to work with the equipment, that individual can start to absorb the technology and understand some of the skills that the source is teaching the recipient.

3. Industry Competition

While articulation of tacit knowledge and on-the-job training help to transfer tacit knowledge, tacit knowledge is also sticky because some sources are reluctant to share tacit knowledge for fear of market competition in the industry.[165]

---

161 *See* Inkpen & Dinur, *supra* note 48, at 456.

162 *Id.*

163 RATHMANN, FINAL REPORT, *supra* note 2, at 8.

164 *See* Jaeyong Song et al., *Learning-by-Hiring: When is Mobility More Likely to Facilitate Interfirm Knowledge Transfer?*, 49 MGMT. SCI. 351, 352 (2003); *see also* Howells, *supra* note 5, at 95, 97; *Know-how Transfer*, SOLATERM, http://www.solaterm.eu/en/components/knowhow_transfer (last visited Oct. 25, 2010). Solaterm is a know-how transfer project of solar thermal heating systems between the European Union and Mediterranean countries. It transfers know-how directly "through an exchange of researchers and experts for marketing and project development." *Id.*

165 *See* Howells, *supra* note 5, at 98 ("The very strength and importance of tacit knowledge is that it is often very difficult for competitor firms to imitate it."); Zander & Kogut, *supra* note 48, at 87; *see also* Song, *supra* note 164, at 353 ("[F]irms that hold state-of-the-art technology are often reluctant to allow such transfer to other firms because the tacit nature of this knowledge can provide an important source of competitive advantage.").

In many instances, sources do not want to transfer tacit knowledge because it gives the source a competitive advantage over others in the industry. The burden of keeping tacit knowledge a secret thus falls on the owner.[166] Because companies wish to protect their investments, they will often choose not to disclose documents, customer contacts, designs, strategies, or plans.[167] Sources wishing to protect their investments may not share experiences, either through documents or on-the-job training.[168]

It can be hard to protect tacit knowledge once it is disclosed.[169] After all, it is impossible to wipe a recipient's brain of the transferred knowledge. Equipment expertise is highly specialized[170] and is very resource intensive to develop so a leak of tacit knowledge may be very harmful to the owner.[171] A source might be more willing to transfer tacit knowledge when the source trusts the recipient or does not fear market competition.[172] For

---

[166] *See* Howells, *supra* note 5, at 98 ("The very strength and importance of tacit knowledge is that it is often very difficult for competitor firms to imitate it."); Song, *supra* note 164, at 353 ("[F]irms that hold state-of-the-art technology are often reluctant to allow such transfer to other firms because the tacit nature of this knowledge can provide an important source of competitive advantage.").

[167] *See* Gallagher, *supra* note 18, at 391.

[168] *See id.*; *cf.* Eric von Hippel, *Cooperation Between Rivals: Informal Tacit Knowledge Trading*, 16 RES. POL'Y 294 (1986).

[169] CHRIS WOLD ET AL., CLIMATE CHANGE AND THE LAW, 477 (2009).

[170] The greater the number of firms with a competitive technology, then the more likely that technology is more generally available, and can therefore be acquired at lower cost. The most difficult and hence costly technology to transfer is characterized by very few previous applications, a short elapsed time since development, and limited diffusion. *See* Khor, *supra* note 128, at 247.

[171] *See id.*

[172] *See* Szulanski, *supra* note 21, at 11–12; *see also* Daniel Levin & Rob Cross, *The Strength of Weak Ties You Can Trust: The Mediating Role of Trust in Effective Knowledge Transfer*, 50 MGMT. SCI. 1477, 1483 (2004) ("[T]he more that a knowledge transfer involved tacit knowledge, the more crucial it was if the knowledge received was to be of any use—that the knowledge receiver trust the competence of the source."). A recipient's trust of the source is also very important to encourage the recipient to take the time to change habits and learn the new skills, and a lack of motivation by the recipient to absorb and use the tacit knowledge can stifle knowledge transfer. *See* Szulanski, *supra* note 21, at 11–12, 14–17. Uncertainty of the source's skills will also cause inefficient knowledge transfer because the tacit knowledge may not be reused or adopted. *See* Simonin, *supra* note 56, at 597; *see also* Gupta & Govindarajan, *supra* note 43, at 489 (noting that the five elements of knowledge transfer are: perceived value of the source's unit knowledge; motivational disposition of the source; existence and richness of

example, a case study on the technology transfer to China revealed that:

> U.S. auto manufacturers have transferred products, but not much knowledge, to China. Based on this finding, it seems more likely that U.S. firms might help . . . through product transfer rather than knowledge transfer. In other words, there is no evidence so far that U.S. firms will teach their Chinese counterparts how to develop and manufacture energy-efficient, clean automobiles. Understandably, the U.S. firms are reluctant to spawn future competitors in the world market.[173]

This lack of know-how being transferred harms developing nations with limited technology capacity by forcing them to rely on experience and skills from the developed world to build their clean energy infrastructure.[174] In short, tacit knowledge encounters several difficulties in technology transfer and while patent law helps to transfer technical knowledge of the invention, it does not consider tacit knowledge transfer.

C. Transfer of Technical Knowledge, but Not Tacit Knowledge

Patent law allows for technical knowledge of a patented invention to transfer to others by requiring a patent owner to disclose a patented invention to the public and by permitting a patent owner to transfer her patented rights to another person.[175] These mechanisms transfer technical knowledge of the invention. However, patent law does not consider experiential and personal knowledge associated with making, using, and operating a patented invention. While tacit knowledge transfer can be sticky, patent law could serve as a useful tool to transfer tacit knowledge. The rest of this Section identifies areas in which patent law aims to transfer technical knowledge, but does not transfer tacit knowledge. Part

transmission channels; motivational disposition of the receiving unit; and the absorptive capacity of the receiving unit).

173 *See, e.g.*, Gallagher, *supra* note 18, at 391.

174 *See id.*

175 *See* Burk, *supra* note 22, at 1021.

III will suggest some ideas for improving patent law's transfer of tacit knowledge.

1. Communication Gaps

Patent law requires an inventor to describe her invention in the patent document to the public,[176] but patent law's definition of "the public" does not consider that tacit knowledge transfers best when the source and the recipient share a familiarity of expressions. Tacit knowledge is personal knowledge developed in a person's specific use of an invention in a particular context.[177] While patent documents are written for readers in the same technical field, this still creates a communication gap between the source and the recipient of a patent document.

Simply because people share the same technical background does not mean that they share a familiarity to allow for an easy tacit knowledge transfer.[178] A patent document is written more generally for a PHOSITA (e.g., any engineer with an electrical engineering degree and requires the reader to fill in the gaps).[179] Patent law assumes that these fictional persons share a common technical language and a common body of scientific knowledge (i.e., all graduates from a college level electrical engineering program may share a basic technical language),[180] but tacit knowledge transfer requires more familiarity than a shared technical degree. As noted in the Czech wind study, the turbine could not be trouble-shooted even though the Czechs had decent technical backgrounds regarding wind turbines.[181]

The patent document is written for a fictional person and not necessarily for a familiar reader, such as a colleague or a collaborative technical community. Instead of a shared technical background, tacit knowledge requires common experiences and

176 *See* 35 U.S.C. § 112 (2006); Burk, *supra* note 22, at 1017.

177 *See* Howells, *supra* note 5, at 96–97.

178 *See* Szulanski, *supra* note 21, at 12.

179 *See supra* Part I.C.1; *see also* Burk, *supra* note 22, at 1020–21 ("But neither is the inventor likely to, or required to, include tacit knowledge that is not commonly held.").

180 *See supra* Part I.C.1.

181 *See supra* pp. 450–51.

routines to transfer.[182] Shared experiences between the source and the recipient help to develop a shared language of not only technical vocabulary, but also of common practices and customs. Once a source and a recipient become more familiar with one another the source can describe not only what something means, but also what the source feels, senses, and sees when using the invention. The recipient must understand on a detailed level how the source operates the invention so that the recipient can adapt to the invention and claim the technology as her own. Thus, patent law's assumption that a common language is implicit in a common technical background may be flawed and may thwart an opportunity to develop a shared language and transfer tacit knowledge.

In addition, while patent documents are written for persons having ordinary skill in the art,[183] these fictional persons are not necessarily the only people reading the patent documents. Patent law assumes that the PHOSITA is the typical patent reader;[184] inventors write patent documents without providing full technical knowledge disclosure and the PHOSITA is expected to fill in the gaps.[185] In the case of a wind turbine patent, the technical knowledge could be anything learned when obtaining an electrical engineering degree or during job training after graduation. Any reader without an electrical engineering degree could spend a great deal of effort reading and understanding the patent document to fill in the technical knowledge gaps.[186]

2. Inadequate Disclosures in the Patent Document

Patent law requires disclosures in the patent document,[187] but the patent document does not articulate experiential and personal knowledge to the public. The written description requirement asks

---

182 *See* Kogut & Zander, *supra* note 48, at 386.

183 *See* 35 U.S.C. § 112.

184 *See supra* Part I.C.1.

185 *See* Seymore, *supra* note 67, at 626; *see also* AK Steel Corp. v. Sollac, 344 F.3d 1234, 1244 (Fed. Cir. 2003) ("[T]he specification [need not] necessarily describe how to make and use every possible variant of the claimed invention, for the artisan's knowledge of the prior art and routine experimentation can often fill gaps . . . .").

186 *See* Seymore, *supra* note 67, at 624–26.

187 *See* 35 U.S.C. § 112; *see also supra* Part I.C.2.

an inventor to guide the public on how to make the invention by describing the invention. Using as an example U.S. Patent No. 4,490,093 for a wind turbine, the patent document attempts to describe the invention in detail.[188] The patent document illustrates all the components of the invention and explains the figures accompanying the patent document.[189]

As much as the document describes the invention adequately, the patent document fails to articulate any skills associated with the invention. For example, the patent document notes, "[t]o start the system *assuming* the turbine blades are in the fully feathered position, a signal from a remote site control station is applied by way of a control cable extending through tower to the controller's processor."[190] This disclosure does little to advance a recipient's skills needed to use a wind turbine with an advance pitched system nor does it articulate experiential knowledge such as what can be done if the turbine blades are not in the fully feathered position.

In addition, patent law's enablement requirement asks the inventor to enable one to make and use the invention without any undue experimentation.[191] While the description of patent '093 is extensive, it does not communicate any skills or instructions for making the invention. Tacit knowledge tends to be less sticky if the source codifies the knowledge to some extent and tries to articulate the skills needed to make the invention.[192]

Patent law requires that an inventor describe the best method for making an invention and not withhold technical knowledge.[193] This forces an inventor to articulate some of the tacit knowledge involved in manufacturing the invention. However, the best mode described can often be archaic or may represent one of many best modes needed to manufacture the patent.[194] While an inventor to some extent codifies her tacit knowledge in preparing the patent

188 U.S. Patent No. 4,490,093 (filed July 13, 1981).
189 *See id.*
190 *Id.* (emphasis added).
191 *See* Nat'l Recovery Techs., Inc. v. Magnetic Separation Sys., Inc., 166 F.3d 1190, 1195 (Fed. Cir. 1999).
192 *See* Szulanski, *supra* note 21, at 11.
193 *See* Fromer, *supra* note 26, at 547.
194 *See id*. at 583 n.198.

documents, she may not be codifying the most important tacit knowledge. For example, the Czech engineers needed tacit knowledge such as the methods for finding the best wind turbine location and a process for connecting wind energy to an electric grid to use the energy.[195] They needed more than just the preferred embodiment of the invention. Moreover, even if the inventor develops tacit knowledge by using and making the invention over time, patent law does not require the patent holder to update the best mode of practicing the invention.[196] Patent law does not encourage the final patent disclosure to change in any meaningful way as tacit knowledge develops.

The drawing requirement also falls short of its potential to incorporate tacit knowledge. In early patent law, inventors were required to submit models to the USPTO for approval of a patent application.[197] These models served as guides for the patent examiners as well as the public on how to use and work a patented invention. Now, patent law requires only a drawing of the patent.[198] Drawings are helpful to articulate some tacit knowledge that a patentee cannot put into words. However, inventors often submit only schematic drawings, which, because they may require a technical background to interpret, are often less helpful than a physical model of the invention.[199]

3. Narrow Experimental Use

Patent law does not require experimental use, yet experimental use is crucial for improving a source's tacit knowledge of the invention. Patent law's current experimental use exception allows the inventor the time necessary to understand an invention before articulating her thoughts in the patent document.[200] In addition, an inventor can test an invention without having to rush to file a

---

195 RATHMANN, FINAL REPORT, *supra* note 2, at 8–9.

196 *See* Carlson, *supra* note 66, at 280.

197 *See* Fromer, *supra* note 26, at 574–75; *see also Tacit Knowledge in Patent Applications: Observations on the Value of Models to Early US Patent Office Practice and Potential Implications for the 21st Century*, 26 WORLD PATENT INFO. 131, 131–36 (2004).

198 35 U.S.C. § 113 (2002).

199 *See* Fromer, *supra* note 26, at 577.

200 *See supra* Part I.C.3.

patent application in fear that the patent term is running out.[201] Experimenting with the technology helps the source develop tacit knowledge of the invention. For example, after the Czech workers could not operate the wind farm and the wind farm shut down, the Danish Environmental Protection Agency organized two three-day training workshops for the Czech scientists, engineers, and project developers working on the wind farm.[202] The training taught the workers the process for operating a wind farm and included hands-on teaching sessions.[203] "A central item [of the project was] . . . hands-on experience with modern techniques for wind resource assessment and establishment of wind farms, thereby enabling independent assessments of wind resources in the Czech Republic."[204] This experimentation helped to transfer tacit knowledge.

Further, patent law does not require experimental use or even a working model before filing a patent application. In many industries, scientists and engineers eschew the option to experiment in the race to patent technologies.[205] Indeed, in many cases, a patented invention is not manufactured before being patented.[206] Experimental use can encourage an inventor to develop tacit knowledge of an invention. However, without a requirement to manufacture the invention and to experiment with the equipment,[207] patent law's experimental use doctrine does little to help inventors develop tacit knowledge of the invention.

4. Lack of a Relationship in Patent Transfers

Tacit knowledge transfer relies on the relationship between the source and the recipient, yet patent law allows for a patent owner to transfer her rights in the patent with little relationship established. Patents can be transferred through licenses or assignments.[208] Most of these transfers consist of only one

201 *See supra* Part I.C.3.
202 *See* RATHMANN, FINAL REPORT, *supra* note 2, at 10.
203 *See id*. at app. 2.
204 *Id.* at 7.
205 *See, e.g.*, PHASE II FINAL REPORT, *supra* note 27, at 28–31.
206 *See supra* Part I.C.3.
207 *See supra* Part I.C.3.
208 *See supra* Part I.C.4.

interaction, with the exception of royalty payments which are paid to the licensor on a more frequent basis.[209] Patent transfers do not create the common language and frequency of interactions needed to establish a familiarity or a trusting relationship between the source and the recipient to transfer tacit knowledge. This leads tacit knowledge to be transferred on a need-to-know basis, as evidenced in the Danish-Czech wind project where the tacit knowledge was transferred only after the wind turbines were no longer operational.[210]

Additionally, as an industry becomes more competitive, sources become less willing to transfer tacit knowledge.[211] Since patent law allows an inventor to transfer only the equipment or only the patent rights to make and use the invention without any tacit knowledge disclosures, patent law fails to facilitate tacit knowledge transfer in at least some competitive industries. While some knowledge can be disclosed in a knowledge agreement,[212] sources are sometimes reluctant to transfer tacit knowledge along with the equipment for fear of unwanted competition even if the knowledge agreement requires that the source keep the knowledge confidential.[213]

Further, patent law does not provide countervailing incentives to encourage tacit knowledge transfer; it does not reward (let alone protect) tacit knowledge transfer. There is no extra benefit in the patent system for giving away an extra piece of tacit knowledge that might help the public (or a competitor).[214] While interactions

---

209 *See supra* Part I.C.4.

210 *See* RATHMANN, FINAL REPORT, *supra* note 2, at 7; Burk, *supra* note 22, at 1021 ("But given that the knowledge is tacit, how is a licensor to know what may be available, or whether the licensee is holding out?").

211 *See* PHASE II FINAL REPORT, *supra* note 27, at 40.

212 *See* Haug, *supra* note 24, at 213–14; *see also supra* Part I.A.

213 *See* Haug, *supra* note 24, at 214; RATHMANN, INTERIM REPORT, *supra* note 2, at 6; *see also* WILLIAM CORNISH & DAVID LLEWELYN, INTELLECTUAL PROPERTY: PATENTS, COPYRIGHTS, TRADE MARKS, AND ALLIED RIGHTS 285 (6th ed. 2007); Andres Guadamuz, *The Future of Technology Transfer in the Global Village*, 3 J. WORLD INTELL. PROP. 589, 590–94 (2000); K. Ravi Srinivas, *Climate Change, Technology Transfer and Intellectual Property Rights*, RES. & INFO. SYS. FOR DEVELOPING COUNTRIES 8 (2009).

214 *See* Fromer, *supra* note 26, at 596.

and trust can drive a tacit knowledge transfer,[215] patent law's transfer mechanisms do not facilitate the requisite relationship.

III. POTENTIAL TO TRANSFER TACIT KNOWLEDGE WITH PATENTS

Tacit knowledge can be difficult to transfer. Yet since patent law already teaches a patented invention, patent law could help to teach tacit knowledge about a patented invention as well. Patent law could serve as a means to reduce some of the difficulty associated with the transfer of tacit knowledge. In addition, considering tacit knowledge in patent law could help to encourage new inventions and innovative thinking for the public and in turn more fully achieve one of patent law's goals.[216] Patent law could facilitate tacit knowledge transfer by building a collaborative network of patented inventions, patent documents, and inventors. Also, it could require at least some articulation of experiences and routines in the patent document and it could expand experimental use to assist tacit knowledge codification in the patent document. Lastly, patent law could facilitate tacit knowledge transfer by increasing personal interactions with patent transfers.

A. Establish a Network

Tacit knowledge transfers better when the source and the recipient share a familiarity of technical experience and a technical language. Thus to improve tacit knowledge transfer, patent law could help to close a common communication gap and facilitate a familiarity between the source and the recipient. Patent law could help to build technical networks to encourage tacit knowledge transfer either through interactive databases or through collaborative research efforts.

Patent law could assist tacit knowledge transfer through an interactive database of patented inventions, patent documents, inventors and experts. The first step in building this database is to organize all clean energy patent documents in one searchable database. While patent documents are public and can be read by

---

[215] *See* Alavi, *supra* note 49, at 119–20; *see also* Gupta & Govindarajan, *supra* note 43, at 489.

[216] *See supra* note 67.

engineers for technical information, engineers often do not know the best patents to read.[217] Patents can be found in a United States Patent and Trademark Office database under a classification designated by the USPTO. However, if an engineer is not familiar with the patent classification system, it might be hard to locate the proper classification of a technology.[218] A more helpful structure might be to pool similar patents by subject area (e.g., clean energy technology or wind technology).[219] For example, the Eco-Patent Database operated by the World Business Council for Sustainable Development has started a database of clean energy patents for collaborative teaching. The database has approximately one hundred patents, but is somewhat limited because the database is a collection of patents for which companies have pledged to release their patent rights. A database does not have to be restricted to only patents in the public domain. A related idea of grouping similar patent documents together could increase exposure to the already-public knowledge contained in the patent document and could spread tacit knowledge about patented inventions faster because similar technologies are located in one central place. Thus, an engineer could easily locate relevant patents.

The second step is to make the database of clean energy technologies interactive. An interactive database containing similar patents which an engineer could quickly sift through would allow engineers to easily mark patents that answer a specific question, and could serve as a guide for other engineers to find an answer to a similar question. "If [a patent] is useful to one expert user, chances are [it] would be useful to others."[220] Patent readers could share the knowledge that they found in a patent or view the titles of patents that another engineer viewed. Engineers could make notes or comments in the database corresponding to the

---

217 *See* Fromer, *supra* note 26, at 585.

218 *Id*. at 585–86. ("Patent documents are publicly available on the PTO website and numerous commercial databases. Patents, however, are currently hard to find due to the vast number of issued patents combined with insufficient attention to indexing the patents.").

219 *See id*. at 586 ("Some scholars find it useful to classify patents by industry or analogous art, enabling experts to access developments in their industry easily.").

220 *See id*.

patents they reviewed so that another engineer could find the information.

This database, thus, would not only act as a convenient resource for engineers, but would also serve as a communication tool for engineers in a similar field. An interactive database of clean energy patents could help to build a familiarity between the source of the information and the patent readers. In addition, the database could allow readers to post questions or comments on the patents in the database. Through such a database, reading a patent document could become more of an interactive experience among engineers in the same technical field. Interactive databases would encourage successful clean energy transfer because they would help to build the familiarity needed between the source and the recipient to share tacit knowledge either directly—through comments on patents in the database—or through disclosures in future patents.

Lastly, an organization (such as the USPTO or a private company) could keep an accurate and organized list of inventors filing patent applications. Having an easily accessible list of experts or technical people could serve as a great way to improve tacit knowledge transfer because a recipient of a technology would have a contact list of sources of tacit knowledge. A compilation of clean energy inventors or like-minded people willing to trouble-shoot a problem with a technology should it arise would help to transfer tacit knowledge. Clean-energy-minded organizations, such as the Renewable Energy and Energy Efficiency Partnership, have compiled lists of clean technology experts.[221] Yet, since patent law already requires disclosure of an invention before filing for a patent, a more complete and comprehensive list could be found using the patent document. Having a complete list of sources of tacit knowledge would encourage successful technology transfer because it would provide multiple resources for a recipient who lacks the requisite tacit knowledge.

In addition, patent documents are often written for the PHOSITA who fills in technical knowledge gaps that are not

[221] RENEWABLE ENERGY AND ENERGY EFFICIENCY PARTNERSHIP, ANNUAL REPORT 2009–2010 27–28 (2010), http://www.reeep.org/file_upload/5272_tmpphp2pyYcJ.pdf.

disclosed in the patent document. With an expert list, engineers could potentially have a point of contact who could disclose information and fill in the knowledge gaps for the patent readers who might not be of ordinary skill in the art. This could help to close the communication gap between the source and the recipient and in turn assist technology transfer.

In addition, patent law could encourage more inventor collaboration. While a patent owner exclusively has the right to make and use the patented invention, joint inventors share these rights.[222] Thus, a co-inventor has little control over what the other co-inventor does with her patent rights (which include the rights to make and use the whole invention). To encourage more collaborative efforts of inventors, patent law could allow patents for incremental inventions so that each inventor could protect their individual efforts. If patent law better protected a co-inventor's patent rights, inventors might be more willing to collaborate on ideas and share tacit knowledge with one another. With greater collaboration between inventors, initiatives such as the Renewable Energy Database could further help to build familiarity and encourage tacit knowledge transfer. The Renewable Energy Database contains a list of institutions "which are interested in collaborating internationally in the renewable energy sector" and provides "contact details as well as information on their current [research and development] activities."[223] Such joint collaboration would encourage the sharing of personal experiences and insights and help to transfer the tacit knowledge needed for successful technology transfer.

B. Encourage Experimentation

Experimental use of a patented invention should be required before filing a patent application to help to transfer tacit knowledge and place an added focus on the source's hands-on

[222] George W. Hartnell, *Joint Inventorship v. Ownership*, http://www.eapdlaw.com/files/News/00f18d3d-6c81-4d01-9a02-12c638fa1869/Presentation/NewsAttachment/ae66dee9-5983-4e12-af57-14642f3152a8/media.31.pdf (last visited Feb. 15, 2011).

[223] *Worldwide Renewable Energy Databases*, DIREKT—SMALL DEVELOPING ISLAND RENEWABLE ENERGY KNOWLEDGE & TECH. TRANSFER NETWORK, http://www.direkt-project.eu (last visited Feb. 15, 2011).

experimentation with the technology. If patent law requires experimental use, then an inventor will have to develop tacit knowledge associated with the experiment. If an inventor learns through experimentation with an invention that a problem might occur, delivering that information to the recipient of the technology could be very helpful. The source could write the patent to include solutions to common problems with the invention.

One effective way to transfer tacit knowledge is through hands-on experiences;[224] yet the articulation of tacit knowledge that aims to mimic the hands-on knowledge could be just as useful. Thus, if experimental use is required a source can relate this knowledge to the recipient by articulating routines and instructions in the patent document. For example, practical knowledge of how to use a turbine may be beneficial as it was in the Jeseník/Ostružna wind farm example.[225] Tacit knowledge in the Czech wind study case was transferred through a trouble-shooting packet as well as through hands-on training and learning sessions.[226] Requiring experimental use could facilitate the inventor's articulation of more hands-on experiences to the recipient. A transfer of this hands-on knowledge will help to improve a recipient's ability to use the equipment for the long-term.

C. Require Diverse Description

Patent documents contain technical information about a patented invention. However, to transfer tacit knowledge, patent inventors need to articulate experiential knowledge in the patent document. As noted earlier, tacit knowledge is more easily transferred when it is articulated.[227] Patent inventors should use metaphors and analogies in the specification of a patent to articulate tacit knowledge. If disclosures of experiential tacit knowledge in the patent document were made a requirement, then all inventors would have to comply before filing a patent application. Requiring the disclosure of tacit knowledge in the patent document could serve as a counter-balance to the many

224 *See* Gorga, *supra* note 48, at 1144.
225 *See* RATHMANN, FINAL REPORT, *supra* note 2.
226 *See id*. at app. 1.
227 *See* Howells, *supra* note 5, at 94–95.

fears of spawning competitors. Accordingly, requiring diverse disclosure could help spread tacit knowledge of clean technologies as well as encourage implementation and use of clean technologies.

The patent document could serve as a manual or a how-to guide on how to operate and use the invention. In addition, the patent document might also provide step-by-step instructions if something goes wrong with the turbine. If the inventor has learned any best practices from working with the invention she could disclose them in the patent document.[228] A troubleshooting packet that helps to mimic hands-on experience such as a manual detailing how to use a wind turbine could help a recipient develop the tacit knowledge required to troubleshoot the problems on its own.

While tacit knowledge may be difficult to transfer it is not impossible and several organizations have taken on the effort to transfer tacit knowledge through hands-on training and technical manuals. For example, the Global Environment Facility reported that the United States, in aiming to build energy efficiency markets in Central America, has transferred tacit knowledge to Central America through training manuals and "technical handouts on energy efficient technology."[229]

D. Increase Interactions

Patent law allows for technology to change hands by permitting an inventor to transfer her patent ownership.[230] Since tacit knowledge transfer relies on the relationship between the source and the recipient, patent transfers should facilitate tacit knowledge transfer by requiring more than one transaction for the

---

[228] *See* Burk, *supra* note 22, at 1019–20. *See generally Handbook on Best Practices for the Successful Deployment of Grid-Connected Renewable Energy, Distributed Generation, Cogeneration and Combined Heat and Power in India Compiled*, U.S. ENERGY ASS'N, http://www.usea.org/programs/APP/APP_other/Best_Practices_Handbook_India_HYPERLINKS.pdf (last visited Feb. 15, 2011).

[229] *See Good Practices and Lessons*, GLOBAL ENV'T FACILITY, http://www.thegef.org/gef/node/2202 (last visited Feb. 15, 2011).

[230] For U.S. patent protection see 35 U.S.C. § 154 providing for "a grant to the patentee . . . of the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States." 35 U.S.C. § 154 (2006); *see also* 35 U.S.C. §§ 261, 271.

inventor to license her patent. The one-time transfers common to patent law do not create the frequency of interactions needed to establish a familiarity between the source and recipient essential for transferring tacit knowledge.

Additionally, as an industry becomes more competitive, sources become less willing to transfer equipment and tacit knowledge.[231] Since patent law allows a patent owner to transfer only the patent without any tacit knowledge disclosures, patent law fails to facilitate tacit knowledge transfer in at least some competitive industries. Currently, there is little added benefit in patent law to transfer tacit knowledge that might help the public (or a competitor).[232] A source might not want to share too much knowledge for fear of unwanted competition.[233]

One way to increase interactions and to build trust is to require that patent transfers not take place without an in-person meeting or without a specification in the transfer contract requiring that the source train the recipient with the tacit knowledge. Because increased interactions and trust between the parties can drive a tacit knowledge transfer,[234] if more training initiatives, like the Danish-Czech wind project, were required with patent transfers, tacit knowledge would follow the equipment transfer. Patent transfer relationships should aim to develop trust and incentives over time, and facilitate these interactions to improve technology transfers.

CONCLUSION

Technology transfer is more successful when tacit knowledge accompanies the equipment in the technology transfer process. Tacit knowledge can be difficult to transfer because the transfer requires developing a familiarity between the source and the recipient, a sharing of personal experiences, and a trusting

---

231 *See* PHASE II FINAL REPORT, *supra* note 27, at 40.

232 *See* Fromer, *supra* note 26, at 596.

233 *See* Haug, *supra* note 24, at 214–15; *see also* Andres Guadamuz, *The Future of Technology Transfer in the Global Village*, 3 J. WORLD INTELL. PROP. 589, 590–94 (2000); K. Ravi Srinivas, *Climate Change Technology Transfer and Intellectual Property Rights*, RES. & INFO. SYS. FOR DEVELOPING COUNTRIES 8 (2009).

234 *See* Alavi, *supra* note 49, at 119–20.

relationship. If these requirements are not met, the tacit knowledge does not transfer because of communication gaps, fear of industry competition and lack of incentives to articulate tacit knowledge. Patent law aims to disclose technical knowledge to the public to encourage innovation; however, it does not account for the type of knowledge that the public really needs for sustainable innovation: tacit knowledge. Since patent law is one of the closest existing means to transfer knowledge from a source to a recipient, patent law should help to reduce some of the difficulty associated with tacit knowledge transfer.