

# The global rise of patent expertise in the late nineteenth century

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CWPESH no. 31

Abstract: This paper examines the rise of various forms of patent expertise over the course of the second industrialisation. The essential insight here is that patent agents and lawyers, as well as consultant engineers, became, in the late 19<sup>th</sup> century, critical actors in the production and transmission of patent rights and patented technologies within and among societies. This paper considers three main themes. First, the global institutionalisation of patent agents during the late nineteenth century and their growing centrality in several national systems. Second, the transnational patenting networks created during the 1880s, particularly the activities of associations of patent agents and their impact on the making of an international patent system. Third, the controversial role of patent experts as agents of corporate globalism. The most important point remains that agents' powers, and their many services to multinational corporations, had enduring consequences on the structure of knowledge property worldwide.

## Introduction

Ever since the institutionalisation of modern innovation systems in industrial and industrialising countries, diverse social actors – from lawyers to engineers, from intermediaries to consultants – have been active participants in the regulation and operation of patent institutions. The period from about the 1870s through the early twentieth century marked a pivotal moment in the nature and level of participation of specialised experts in patent rights in several national systems. Since then, these ‘invisible’ agents have shaped the direction and transmission of technical innovation worldwide. Their particular kind of expertise has consistently contributed to the making of new technologies and the management of property rights over such technologies. It has also, however, been a source of controversy insofar as patent experts have been regarded as actors that support an excessive concentration of power over technologies, a problem that remains endemic in modern societies.

The ‘diffusion’ of science and technology is, as Steven Shapin observes, ‘an active process that is undertaken by specifiable social groups for their particular purposes’.<sup>1</sup> This is especially true for the production and transmission of patent rights and patented technologies within and among societies. Patenting and patent management are complex activities in which a varied range of experts participate. This expertise is a central component of the modern institutional arrangements by which patents are granted. An array of social actors are active mediators in the process of transforming an idea or a material device into a piece of tradable private property in the form of a patent.

Most of the studies on patent professionals hitherto available have adopted a national perspective that rarely examines the rise of patent agents beyond the country of study.<sup>2</sup> The historiography has tended to focus on case studies of agents assisting specific inventors or firms. The question of the international extension of this professional activity has not been thoroughly analysed thus far. The role of agents in international dynamics, such as international patenting, has likewise been overlooked.

This study adopts an international perspective. The interplay between patenting activity and globalisation is a subject of growing interest.<sup>3</sup> With the late nineteenth-century wave of

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<sup>1</sup> Shapin, S.: ‘Nibbling at the Teats of Science: Edinburgh and the Diffusion of Science in the 1830s’, in Inkster, I. and Morrell, J. (eds): *Metropolis and Province: Science in British Culture, 1780—1850*, London: Hutchinson, 1983, p.151.

<sup>2</sup> See, for instance, the contributions to the two following special issues: Galvez-Behar, G. and Nishimura, S.(eds): ‘Le management de la propriété industrielle’, *Entreprise et Histoire*, No.82 (2016); Inkster, I. (ed.): ‘Patent Agency in History: Intellectual Property and Technological Change’, *History of Technology*, Vol. 31 (2012).

<sup>3</sup> See Kranakis, E.: ‘Patents and Power: European Patent-System Integration in the Context of Globalization’, *Technology and Culture*, Vol. 48, No. 4 (2007), pp. 689–728; Khan, Z.B.: ‘Selling ideas: An international

globalisation, industrial property regimes achieved an international reach. Patenting turned out to be increasingly transnational, although patent systems remained nation-state institutions. In this context, the active role of patent experts and their expertise during a period of accelerating globalisation is not well understood. Nor does the historiography tell us much about the globalisation of the patent profession.

The purpose of the first section of this paper is to shed light on the global institutionalisation of patent agents during the late nineteenth century. This section takes a broad comparative perspective, offering some generalisations about the growing centrality of patent experts in several national systems. Here I reflect on the diverse forms of patent expertise in industrial and industrialising countries. The essential insight of this section is that patent professionals of the late nineteenth century had varied roles, reflecting heterogeneous innovation cultures, institutional environments and degrees of industrialisation across countries.

The second section goes on to consider patent practitioners as links among national systems. The question here is whether these specialists contributed to international technology transfer and, if so, how? I argue that patent experts should be seen not only as system-builders but also as agents of globalisation. Beginning in the 1870s, not only was patent expertise becoming globalised, but patent experts were acting as globalising agents. In other words, experts became central to the burgeoning connections among diverse patent institutions worldwide. The issue of which actors legitimised patent institutions is another concern of this second section. Did these professionals participate in the making, regulation and legal shaping of the ‘international patent system’ from the 1870s? To address all these questions, I examine the activities of professional associations, international institutions and transnational networks of patent agents. Particularly relevant to this discussion are agents’ publications and international directories.

Much of the research analysing patent expertise has concentrated on the business strategies of multinational corporations. Scholars have focused on patent management in high-technological industries and on the in-house agents of European and American companies. Building on this work, I discuss in the third part of this paper the controversial role of patent experts as agents of corporate globalism. Neither the problematic aspects of the rise of corporate patenting nor the expansion of agents to peripheral economies should go uncriticqued.

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perspective on patenting and markets for technological innovations, 1790-1930’, *Business History Review*, Vol. 87, No. 1 (2013), pp. 39–68.

Multinational activities in the outer and distant peripheries – that is, Latin America, South Africa and Australia – remain much less well understood. Corporate patent strategies connected to global networks of commodity production, such as in agroindustry and mining, reflect the limits and contradictions of late-nineteenth century technological globalisation.

### **A global profession**

Because of the multiple roles of patent practitioners in various historical contexts, the concept of ‘patent expert’ can be both vague and highly complex. There is no standard definition for patent expertise valid for all countries during the late nineteenth century. Patent expertise was, in Anna Guagnini’s words, a ‘hybrid occupational activity’ at the interface of legal, economic and technological realms.<sup>4</sup> In spite of the ambiguity that characterised their profession, patent practitioners at the turn of the twentieth century had already gained professional ‘jurisdiction’, to use the term coined by sociologist Andrew Abbott.<sup>5</sup> By the 1880s, so-called patent agents in most European countries and the United States as well as peripheral and colonised countries began to be recognised as a professional body with expertise in legal procedures and technical issues. This professional expansion was not uniform across nations. In many countries, especially those that were less industrialised, patent agencies were less developed. Sizable professional communities of patent experts were concentrated in just a few countries, with the United States, France and Britain hosting the overwhelming majority. The number of agents in each national system correlated with their level of patent activity. Early industrial countries, such as Britain and France, had more informal agencies, whereas latecomers such as Germany and the United States had larger numbers of formal agencies.

Studying the institutional organisation of national patent systems during the late nineteenth century means going beyond the narrow definition of the present-day profession of ‘patent agent’; it means investigating all the social actors who, as Ian Inkster puts it, ‘organised relationships and information flows within systems’.<sup>6</sup> In this article, the term ‘patent expert’ refers to the work of patent attorneys (the American term) and patent agents (the British, French and Spanish term), as well as other actors who occupied some intermediate position between inventors, manufacturers, investors, and patent officers. I use the terms ‘patent practitioner’ and ‘patent professional’ as synonyms for ‘patent expert’ throughout this paper. The definition

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<sup>4</sup> Guagnini, A.: ‘Patent Agents in Britain at the turn of the 20<sup>th</sup> Century’, *History of Technology*, Vol. 31 (2012), p.159.

<sup>5</sup> Abbott, A.: *The System of Professions: An Essay on the Division of Expert Labor*, Chicago: University of Chicago Press, 1988.

<sup>6</sup> Inkster, I.: ‘Patent Agency: Problems and Perspectives’, *History of Technology*, Vol. 31 (2012), p. 91.

used here is thus broad in scope and transhistorical so as to encompass the various kinds of professionals who operated in different national patent systems and their relationships to these systems. In short, I use ‘patent experts’ to refer to the professionals who assisted patentees – whether as solicitors, attorneys, intermediaries, legal advisers, property rights merchants or technical consultants within or through industrial property institutions.

From the early nineteenth century, patent practitioners could be found in Britain, France and the United States. During these foundational years, members of this diffuse community began describing themselves as ‘patent agents’, although there is little evidence of their early activities.<sup>7</sup> It was not until the expansion of the specialised patent business in the second half of the nineteenth century that agents became a community of full-time professionals, with their own regulations and associations. In both early industrial countries and latecomers, a larger market for patenting services emerged in the second half of the nineteenth century. During the final decades of the century, professional patent agents also emerged in industrial latecomers, including Japan, India, Sweden, Germany, Spain and Australia.<sup>8</sup>

The activities of patent practitioners varied geographically, in line with the industrial and institutional disparities from country to country, even region to region. Likewise, the training and background of these practitioners, their influence on governmental regulations and their degree of participation in international patenting differed significantly. The degrees of specialisation, as well as the legal and technical standards required of agents, differed across countries. What is significant here is not so much the national variations themselves but what these variations tell us about the heterogeneity of patent cultures and legal structures during these years.

From the mid-nineteenth century, there was an increasing division of labour between inventors and those who registered and commercialised patents. Professional patent practitioners in both core and peripheral systems participated in various related activities and offered clients a range of services. The primary role of agents was to support patentees in the

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<sup>7</sup> Swanson, K.: ‘The Emergence of the Professional Patent Practitioner’, *Technology and Culture*, Vol. 50, No. 3 (2009), pp. 519–548; van Zyl Smit, D.: ‘Professional Patent Agents and the Development of the English Patent System’, *International Journal of the Sociology of Law*, Vol. 13 (1985), pp. 79–105; Gálvez-Behar, G.: ‘Des Médiateurs au Coeur du Système d’Innovation: Les Agents de Brevets en France (1870-1914)’ in Corcy, M., Douyère-Demeulenaere, C. and Hilaire-Pérez, L. (eds.): *Les archives de l’invention. Ecrits, objets et images de l’activité inventive*, Toulouse: Université Toulouse-Le Mirail, 2006, pp.437-447.

<sup>8</sup> See the articles on patent agents and patent management in Spain, Sweden, Japan and Germany in the special issues mentioned in Footnote 2. For Japan see as well Nicholas T. and Shimizu, H.: ‘Intermediary Functions and the Market for Innovation in Meiji and Taisho Japan’, *Business History Review*, Vol. 87, No.1 (2013), pp. 121-149. For Australia see Hack, B.: *A History of the Patent Profession in Colonial Australia*, Melbourne: Clement Hack & Co., 1984.

application process with regard to administrative procedures, patent writing and the preparation of models and drawings. The writing of patent specifications was the core endeavour of this process.<sup>9</sup> The presentation of claims had to be accurate enough to secure a patent, yet vague enough to preclude imitation. It was through the process of writing or translating patent specifications that inventors effectively became owners of their own practical knowledge in different national jurisdictions.

Only the inventive idea embodied in a text could generate rights.<sup>10</sup> The patent specification did not just convey the inventive idea, but it also translated and transformed its essence. After being granted a patent, not only did the inventor become the owner of a property right but also the author of the text that embodied the idea. In 1882, A. V. Newton, professional patent agent and fellow of the British Institute of Patent Agents, made this point, stating that a main agent's duties were:

To collect the inventor's ideas, to arrange them in an intelligible form, and ultimately to embody them in a specification, which will not only stand the scrutiny of the Law Court, but which will effectually prevent any rival manufacturer from doing anything in the direction of the patent... At the same time, he must be careful that the boundary is not so indefinitely drawn as to overlap existing rights, or to interfere with rights of new-comers.<sup>11</sup>

Marconi's patent on wireless telegraphy, granted in 1897 in Britain, is a particularly telling example of the central importance of patent lawyers and agents in the making of a patent at the turn of the nineteenth century. In a groundbreaking article, Anna Guagnini showed how dependent the Nobel Prize-winning Italian inventor and industrialist was on London-trained agents for the successful writing of the patent specification of his famous invention.<sup>12</sup> Given Marconi's scant formal scientific background and ignorance of British patent application procedures, he could not have succeeded in obtaining the patent on his own. With the help of expert professionals, however, Marconi's specification resulted in a model of patent-writing and subsequent commercial success. The patent experts with whom Marconi was associated included the prestigious London patent agents' firm Carpmael & Co. and the barrister and

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<sup>9</sup> On the writing of patent specifications see, for example, Myers, G.: 'From Discovery to Invention: The Writing and Rewriting of Two Patents', *Social Studies of Science*, Vol. 25, No. 1 (1995), pp. 57–105.

<sup>10</sup> Biagioli, M.: 'Patent Republic: Representing Inventions, Constructing Rights and Authors', *Social Research*, Vol. 73, No. 4 (2006), pp. 1129–1172.

<sup>11</sup> Newton, A. V.: 'On the Patent Agent and his Profession', *Transactions of the Institute of Patent Agents*, Vol. I (1882-3), pp. 158-169.

<sup>12</sup> Guagnini, A.: 'Patent Agents, Legal Advisers and Guglielmo Marconi's Breakthrough in Wireless Telegraphy', *History of Technology*, Vol. 24 (2002), pp. 171–201.

technical advisor Sir John Fletcher Moulton, a distinguished lawyer with outstanding scientific training. Interestingly, Marconi's agents, especially Moulton, wrote the final specification of the patent. Moulton's contribution was more than a simple adaptation of the text; he introduced real changes in the new technology – he was making technical knowledge – and, more importantly, he transformed a scientific idea into a valuable piece of property. In short, Marconi's agents were connecting different fields and transforming the status of technical knowledge.

One important issue to consider is how specialised patent lawyers provided inventors with vital legal support, negotiating authorship, power and authority at the backstage.<sup>13</sup> As experts on patent legislation, patent lawyers, attorneys and barristers guided patentees in the preparation of their applications so as to avoid litigation trials, and represented them in courts of law in the event of infringement proceedings. The increase in litigation that occurred during the late nineteenth century reflected the need for patentees to enforce their patents in court in order to ensure the successful commercial exploitation of their inventions.<sup>14</sup> The rise of legal assistants and expert witnesses in patent disputes, meanwhile, indicated that the capitalist appropriation of invention was a collaborative process in which various actors were interacting. This argument connects to a long-running debate in technology studies. Indeed, the legal process of making a patent largely negates the traditional heroic accounts of technological progress.<sup>15</sup> The participation of lawyers and expert witnesses in patent appropriation has serious implications that continue to threaten the very foundations of intellectual property institutions.<sup>16</sup>

Primarily in core industrial countries, some experts also acted as patent brokers, assisting inventors in the commercial exploitation of their patented technologies. These intermediaries helped patentees to assign and license their property rights and to facilitate external investment. These professionals connected two realms, invention and the market, that

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<sup>13</sup> Bowker, G.: 'What's in a Patent?', in Bijker, Wiebe E. and Law, John (eds.): *Shaping Technology Building Society. Studies in Sociotechnical Change*, Cambridge: MIT Press, 1992, pp. 53-75.

<sup>14</sup> For patent disputes and their relationship to patent pool agreements see Usselman, S. W.: 'Patents Purloined: Railroads, Inventors, and the Diffusion of Innovation in 19th-Century America', *Technology and Culture*, Vol. 32, No. 4 (1991), pp.1047–1075.

<sup>15</sup> Good examples of scholarly research that acknowledges the various legal actors participating in patenting dynamics are Cambrosio, A., Peter Keating, P. and Mackenzie, M.: 'Scientific Practice in the Courtroom: The Construction of Sociotechnical Identities in a Biotechnology Patent Dispute' *Social Problems*, No. 37 (1990), pp. 275–93; and Lucier, P.: 'Court and Controversy: Patenting Science in the Nineteenth Century', *The British Journal for the History of Science*, Vol. 29, No. 2 (1996), pp.139–154.

<sup>16</sup> Bijker, W. E.: 'The Social Construction of Bakelite: Toward a Theory of Invention' in Bijker, W., et al.: *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, Cambridge: MIT Press, 1987, pp. 164-173.



were already becoming closely linked by the mid-nineteenth century. Being a valuable commercial asset, a patent – or the prospect of one – could be sold and licensed. Finding some commercial sponsor or partnership could be an essential way of minimising manufacturing risks as well as attracting resources to finance the invention process.<sup>17</sup> Several large firms, such as the ‘hub company’ Brush Electric, and professional inventors like Thomas Edison, Lord Kelvin and George Westinghouse, participated intensively in the American and British markets for technology through patent rights licensing and partnerships. The practice of collecting patent royalties as an alternative to monopoly made agents indispensable in the market for invention. It was, however, in the United States where expertise in the patent trade, systematic licensing and partnerships developed most rapidly.<sup>18</sup> In countries with less developed markets for patents, such as Spain and Mexico, the occupational activity of brokerages was less professionalised than in the United States.<sup>19</sup>

In the period 1870-1900, agents placed themselves at the centre of patent systems; as a result their services became indispensable for successful patent application. They monopolised the process of obtaining patents in European countries such as Britain, Spain, Sweden and France. A small number of high-priced agents with technical and legal backgrounds, concentrated in European capital cities (such as London, Paris and Madrid), dominated the management of economically valuable patents through influence and close personal contact with patent officials.<sup>20</sup> By contrast, in the United States, patent agencies were not concentrated in a single city but distributed among several commercial and industrial cities, namely New York, Boston, Washington, D.C. and Philadelphia. American agents were more involved in the commercialisation of intellectual property rights and the financing of inventions, due to the larger size and diversified structure of that country’s market for technologies. The higher rate of patent litigation in the United States necessitated a higher number of agents who specialised in patent trials.

British, Spanish and French agents focused primarily on the patent application process due to the highly bureaucratic, costly and complex administrative processing of patent

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<sup>17</sup> MacLeod, C.: ‘The Paradoxes of Patenting: Invention and Its Diffusion in 18th- and 19th-Century Britain, France, and North America’, *Technology and Culture*, Vol. 32, No. 4 (1991), pp. 885–910.

<sup>18</sup> Lamoreaux, N. R. and Sokoloff, K. L.: ‘Intermediaries in the US Market for Technology, 1870-1920’ in Engerman S. L. et al. (eds.): *Finance, Intermediaries, and Economic Development*, Cambridge: Cambridge University Press, 2003, pp. 209–46; Cooper, C.: *Shaping Invention: Thomas Blanchard’s Machinery and Patent Management in Nineteenth-Century America*, New York: Columbia University Press, 1991.

<sup>19</sup> Pretel, D. and Sáiz, P.: ‘Patent Agents in the European Periphery: Spain, 1826-1902’, *History of Technology* Vol 31, 2012, pp. 97-114.

<sup>20</sup> For the French case, in 1881, 89 percent of ‘cabinets’ of Patent Agents were established in Paris. Gálvez-Behar, *Des Médiateurs*; In Britain in 1893, 53 percent of agencies were located in London. Inkster, *Patent Agency*.

applications. The British and French systems, in contrast to the American one, have been accused of concentrating patent applications among a restricted elite community of patentees and agents, thereby making access to intellectual protection less democratic. The American patent system appears to have encouraged patent applications across a wider range of individuals and regions.<sup>21</sup> During the 1880s and 1890s, patent intermediaries in industrial latecomers and colonised countries acted mainly as agents of technology diffusion, working throughout patent systems designed not only to protect invention but also to promote industrial emulation. In countries with reduced markets for patents, such as Spain, agents' activities overlapped with other occupations, for example engineering consultancy or commercial endeavours. Even during the 1890s, many Spanish lawyers and engineers were still not yet professionally engaged as full-time patent professionals and did not recognise themselves as such.<sup>22</sup>

During the second half of the nineteenth century, patent agents published their own specialised technical and trade journals that provided detailed information about patent procedures and descriptions of patented technology. The most relevant examples of patent journals include the weekly *Scientific American*, edited by the leading American patent agency Munn & Co., the *Patent Journal and Inventors Magazine*, edited by the London patent business of Barlow, Payne and Parker, and the monthly publication *Le Génie Industrielle* published by the French 'ingénieur-conseils' from the Armengaud family.<sup>23</sup> For Latin America and the Caribbean, the agency Munn & Company published, from 1890, its first international edition, *La América Científica e Industrial*, a mechanical magazine written in Spanish. These widely circulated agents' journals contained lists of patents, reports about patent issues and information on the necessary specialised training that agents required. Meanwhile, patent agents published manuals, pamphlets and doctrinal treatises on how to invent and patent, national and international patent laws, practical mechanics and draught, and other issues of interest for the development of the patent profession.<sup>24</sup> An early example of a patent agent's

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<sup>21</sup> Khan, Z.: *The Democratization of Invention: Patents and Copyrights in American Economic Development, 1790-1920*, Cambridge: Cambridge University Press, 2005.

<sup>22</sup> Pretel and Sáiz, *Patent Agents*.

<sup>23</sup> Other relevant mechanics' and trade journals related with the patent business included *The Artisan*, *The Repertory of Patent Inventors* and *Mechanics' Magazine* in Britain. *The American Artisan*, *American Inventor* and the *Patent Right Gazette* in the United States; and *Le Journal des Inventeurs* and *Moniteur des Inventions* in France.

<sup>24</sup> The contemporary agents' literature on these topics is vast. These are just some pointers: Munn & Co., *Hints to Inventors*, New York: Munn & Co., 1867; Johnson, J. and Johnson, J. H.: *The Patentee's Manual*, London: Longmans, Green, and Co., 1890; Thompson, W.P.: *The Patent Road to Fortune*, London: Stevens & Sons, 1884; Thirion, C.: *Législations Française et Étrangères sur les Brevets d'Invention: Tableau Synoptique*, Paris: Dupont,

manual is Armengaud's *Practical Draughtsman's Book of Industrial Design* (1853), translated into English by the British agent William Johnson.<sup>25</sup>

Another critical dimension of patent experts' activity throughout the late nineteenth century was their participation in the regulation of patenting activity.<sup>26</sup> In Europe and the United States, patent lawyers and patent practitioners in general were, alongside judges, the most highly regarded specialists in the interpretation and drafting of legislation. Their body of expertise gave agents the authority not only to shape the interpretation of industrial patent law but also to influence legal reforms. For instance, agents participated in parliamentary debates leading to the reform of national patent laws in countries such as France, Britain and Spain.

The major technical journals edited by agents were also an important instrument by which to demand reforms in patent laws and to advance the interests of agents, inventors and patentees. For example, London-based agents such as Moses Poole, Alfred Carpmael and William Johnson – the latter the editor of the *Practical Mechanics' Journal* – were major players in the British patent system reform of 1852. In Spain, the weekly journal *Industria e Invenciones*, edited by the engineer and agent Gerónimo Bolívar, lobbied for the legal recognition of the patent profession that was eventually attained through a 1902 law.

After the patent controversy that swept Europe between 1850 and 1875, agents emerged as an empowered group that actively pushed not only for national reforms but also of an international convergence of intellectual property laws. Agents were among those who campaigned for worldwide patent protection and were active in drafting multilateral agreements in patent law in the 1880s. As I will discuss in next section, professional associations were critical to patent agents' international lobbying efforts and an instrument that promoted the development of an international network of agents.

### **International expert networks**

Despite the increasing incentives for international patenting in the second half of the nineteenth century, there remained important barriers that inhibited or retarded the flow of applications beyond national borders. The variations in national patent laws and the lack of reliable

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1878. Carpmael, A.: *Patent Laws of the World*, London: W. Clowes, 1889; Edwards E. and Edwards, A. E.: *How to Take Out Patents in England and Abroad*, London: Edwards and Co., 1905.

<sup>25</sup> Armengaud, J. E.: *The Practical Draughtsman's Book of Industrial Design*, London: Longman, Brown, Green and Longmans, 1853. The original in French is *Cours de Dessin Linéaire Appliqué au Dessin des Machines*, Paris: Z. Mathias, 1840.

<sup>26</sup> Dutton, H. I.: *The Patent System and Inventive Activity during the Industrial Revolution 1750-1852*, Manchester: Manchester University Press, 1984, pp. 43–51; Gálvez-Behar, *Des Médiateurs*; Usselman, *Regulating Railroad Innovation*, pp. 149–51.

information about market opportunities for patent rights in different countries were seen by inventors, firms and agents as significant constraints in their efforts to extend their property rights to multiple national jurisdictions. In the 1870s, after two decades of controversy on patents, inventors and industrialists became increasingly interested in establishing a set of international regulations that would protect patents globally.<sup>27</sup> As the leading British mathematical physicist and engineer Lord Kelvin pointed out in an 1869 letter to the Glasgow Philosophical Society, inventors had ‘the grand object of obtaining a common patent law among all civilised nations.’<sup>28</sup> Similarly, some years later, in a public address delivered in November 1882, the vice-president of the British Institute of Patent Agents, the renowned engineer John Imray, called for ‘something like an International Patent Law’, describing the present situation as ‘a horrible abuse’ for inventors patenting in foreign countries.<sup>29</sup> Demands for an international patent law, or at least a greater degree of uniformity among national models, also came from free-trade supporters who saw fragmented national regulations as constraints to the liberalisation of international trade.<sup>30</sup>

The growing trend toward transnational patenting, along with the pressures of large companies and agents, set in motion a process of relative institutional convergence during the 1880s. Yet this process had its direct origin in the special international Congress on Industrial Property held in 1873 on the occasion of the Vienna World’s Fair.<sup>31</sup> The Vienna Congress served mostly to resolve the patent controversy. Patent experts, such as the civil engineer Carl Pieper, a German who served as secretary of the event, played a prominent role in the conference.<sup>32</sup> The patent lawyer George Haseltine, a British representative, declared that if a

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<sup>27</sup> Machlup, F. and Penrose, E.: ‘The Patent Controversy in the Nineteenth Century’, *The Journal of Economic History*, Vol.10, No.1 (1950), pp. 1–29; Plasseraud Y. and Savignon F.: *Paris 1883: Genèse du droit de brevets*, Paris: Litec, 1983, pp. 102–6; Christine MacLeod, C.: ‘Concepts of Invention and the Patent Controversy in Victorian Britain’ in Fox, R. (ed): *Technological Change: Methods and Themes in the History of Technology*, Amsterdam: Harwood Academic, 1996, pp. 137–153.

<sup>28</sup> Sir Williams Thomson to Dr Bryce, ‘Discussion on Patents’, *Glasgow Philosophical Society* (14th December 1869), cited in Smith C. and Wise, M. N.: *Energy and Empire: A Biographical Study of Lord Kelvin*, Cambridge: Cambridge University Press, 1989, p. 708.

<sup>29</sup> ‘Inaugural Meeting’, *Transactions of the Institute of Patent Agents*, Vol. I, 1882-3, p. 46. For a contemporary account of international patenting see also Imray, O.: ‘On Foreign Patents’, *Transactions of the Institute of Patent Agents*, Vol. II, 1883-4.

<sup>30</sup> May, C. and Shell, S.: *Intellectual Property Rights: A Critical History*, London: Lynee Rienner Publishers, 2006, pp.115-117.

<sup>31</sup> The British patent barrister Thomas Webster, a delegate at this conference, wrote about this meeting. Webster, T.: *Congrès International des Brevets d'Invention tenu à l'Exposition Universelle de Vienne en 1873*, Paris: Marchal, Billard et Cie, 1877.

<sup>32</sup> Ricketson, S.: *The Paris Convention for the Protection of Industrial Property: A Commentary*, Oxford: Oxford University Press, 2015, pp. 36-39

preliminary international agreement on patent protection was attained, delegates ‘shall have contributed more to the material interests of mankind than any congress of modern times’.<sup>33</sup>

The discussions initiated in Vienna continued in 1878 in Paris with a second International Congress on the Protection of Industrial Property, once again coinciding with a world’s fair.<sup>34</sup> At this conference, with French civil engineer and agent Charles Thirion acting as conference secretary, industrialists and patent experts enthusiastically supported the international harmonisation of industrial property rights.<sup>35</sup> Finally, in 1883, at the International Convention for the Protection of Industrial Property in Paris, a formalised international patent system was established. The result was an early intergovernmental treaty for the gradual convergence of national patent laws signed by, among others, France, Spain, Portugal, Italy, Belgium and Brazil. The United Kingdom joined in 1884, the United States in 1887, Japan in 1899 and Germany and Mexico in 1903.<sup>36</sup> Regulations were established for a range of fundamental issues, such as priority rights, compulsory working and temporary protection in international expositions.<sup>37</sup> However, the impact of the agreement on international legal convergence was limited and, as Sam Ricketson notes, ‘institutionally the new Union was quite unstable’.<sup>38</sup> The Paris Union implicitly accepted international institutional diversity and consequently had the effect of reinforcing national patent models.

This progressive process of legal convergence contributed to the emergence of an international patent system, or in Peter Stearns’ words, a ‘global political institution’.<sup>39</sup> There remained, however, significant institutional and bureaucratic differences among national systems, a diversity that presented difficulties for patentees who wished to register their inventions in several countries. The international patent system was more than a group of patentees engaging in transactions across national borders. International patenting continued to be unfeasible without agents, who facilitated the global exchange and registration of property rights of invention by writing and translating patent specifications.

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<sup>33</sup> Cited in Seckelmann, M.: ‘The Indebtedness to the Inventive Genius: Global Expositions and the Development of an International Patent Protection’, in Barth, V. (ed.): *Identity and Universality/ Identité et universalité*, Paris: Bureau International des Expositions, 2002, p.132.

<sup>34</sup> *Congrès international de la propriété industrielle tenu à Paris du 5 au 17 septembre 1878*, Paris: Imprimerie Nationale, 1879.

<sup>35</sup> Penrose, E.: *The Economics of the International Patent System*, Baltimore: Johns Hopkins Press, 1951, pp. 48–55; Plasseraud and Savignon, *Paris 1883*, pp. 155–174; Gálvez-Behar, G.: *La République des Inventeurs: Propriété et Organisation De l’Innovation en France, 1791-1922*, Rennes: Presses Universitaires de Rennes, 2008, pp. 153–177.

<sup>36</sup> See <http://www.wipo.int/treaties/en/ip/paris/>

<sup>37</sup> Penrose, *The Economics of the International Patent System*, Chapter 4; Plasseraud and Savignon, *Paris 1883*, pp. 205–9.

<sup>38</sup> Ricketson, *The Paris Convention*, p. 69.

<sup>39</sup> Stearns, P. N.: *Globalization in World History*, London and New York: Routledge, 2010, pp. 107–8.

Patent experts likewise were essential in the establishment of the International Association for the Protection of Industrial Property (AIPPI), a non-governmental association established in 1897.<sup>40</sup> Under the auspices of this interest group, industrialists, lawyers and engineers pursued the advancement of international agreements on patent protection and the effective implementation of the provisions of Paris Convention. Agents such as the British Edward Carpmael, the French Armengaud Jeune and the Spanish Francisco Elzaburu were part of the association's first executive committee.<sup>41</sup> In 1902 AIPPI had 530 members, mostly from European countries, with Germany (111), France (110) and Britain (110) with the largest number of affiliates. Countries from the European periphery, such as Italy (26), Russia (4) Spain (5) and Sweden (2), were less represented. The United States had nine members and Canada only one.<sup>42</sup> In 1906 came the founding of another non-governmental professional association, the International Federation of Patent Agents (FICPI), which consisted of patent lawyers and attorneys.

Experts were essential actors in the global race for patents. Heterogeneous patent bureaucracies and the complexity of science-based industrial technologies led patentees to seek out specialised professionals who could mediate in the international arena. In a context of growing interconnectedness among national systems, experts helped build an international network in which knowledge, practices and information were exchanged. We can think of the international patent system as a series of interlocking and overlapping networks of national offices, companies, engineers, capitalists and inventors that transcended the boundaries of Western Europe and the United States. In these networks, agents were linkers or networkers. The relationships between patentees and their agents transcended the borders of national jurisdictions long before the emergence of international agreements on patent law in the 1880s. However, it was during the 1880s that these patenting networks became truly cross-national to the extent that they began to include the extra-European and colonial worlds.

The various actors who operated across national patent systems constituted a social and informational network mediated by intermediaries. Networks of late nineteenth-century patent experts were not merely social networks; they were socio-technical networks intertwined with material circuits. Patent experts were mediators between different realms. These experts were

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<sup>40</sup> Ricketson, *The Paris Convention*, pp.75-6. See also the article by Max Georgii, founding member of this association, Georgii, M.: 'International Association for the Protection of Industrial Property', *The Inventive Age*, No.3 (March 1898), p.42-3.

<sup>41</sup> See the *Annales de L'Association Internationale pour la Protection de la Propriété Industrielle* published from 1897.

<sup>42</sup> *Annuaire de L'Association Internationale pour la Protection de la Propriété Industrielle, 1902, Congrès de Turin*, Paris, 1903, p.31.

not only connected with other social actors but also with texts (patent specifications in different languages) and artefacts (specific technical devices).<sup>43</sup>

Agents networks had hubs in New York, Washington, London and Paris, cities where the central offices of both larger international patent agencies and professional associations of agents were located. These cities, which received information from all over the world, were the centres that oversaw the patenting occurring in many diverse countries. In the industrial periphery, professional patent experts worked primarily as correspondents or representatives of foreign firms and inventors, acting as sub-agents of agencies based in core industrial nations. From this perspective, agents could be considered consultants in international patenting. When the services provided by agents were limited to the administrative communication of property rights, these specialists could be considered interactional experts insofar as they were performing an activity of an inherently bureaucratic nature. Most often, however, the communication services performed by agents involved the translation of specifications and the adaptation of drawings, in which case their activity was not merely administrative but substantially influential in the international making and circulation of technological knowledge on a global scale.<sup>44</sup>

The international interconnectedness of the various national systems is best understood if we look at the professional associations of patent agents established during the last decades of the century.<sup>45</sup> These organisations, which first appeared in the industrial countries in the 1880s and then in peripheral ones, created a space of transnational socialisation that gave rise to an international community of experts. Good examples of this trend are the creation of the French *Syndicat des Ingenieurs- Conseils en Matière de Propriété Industrielle* (1884), Chicago's *American Patent Law Association* (1884), London's *Chartered Institute of Patent Agents* (1882), the *Australasian Institute of Patent Agents* (1890) and the Spanish *Association of Commercial and Industrial Property Agents* (1907). Agents' associations in major industrial nations had foreign as well as local members, thus facilitating the activities of international networks of agents in the periphery. These associations served the twofold mission of connecting professionals and circulating information about patent laws, markets for inventions and professional practices worldwide. As an article in the London Journal of the Society of

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<sup>43</sup> Callon, M.: 'Techno-economic networks and irreversibility', *The Sociological Review*, No. 38 (1990), pp.132–161; Biagioli, 'Patent Republic'.

<sup>44</sup> For a sociological analysis of the idea of 'interactional' and 'contributory' expertise and the difference between experts and specialist see Collins, H. and Evans R.: *Rethinking Expertise*, Chicago and London: University of Chicago Press, 2007, pp. 23–38 and 77–90.

<sup>45</sup> Magee, G. B. and Thompson, A. S.: *Empire and Globalisation: Networks of People, Goods and Capital in the British World, c.1850-1914*, Cambridge: Cambridge University Press, 2010, pp. 143–5.

Patent Agents put it: ‘No other profession has so constantly to deal with legal matters in all countries, or needs the co-operation of its members in so many and so distant cities.’<sup>46</sup>

During its first decade of existence, one of these associations, The Chartered Institute of Patent Agents (CIPA)<sup>47</sup>, was described by its secretary Henry Howgrave Graham as being ‘of the most cosmopolitan and international character.’<sup>48</sup> One of the earliest committees appointed by CIPA, in 1882, was on Foreign Laws. This committee read and discussed papers concerning foreign and colonial legislation with the objective of promoting improvements in patent laws and regulations for foreign patents. In 1890, this professional association had 57 foreign members and 69 fellows practising in Britain. Foreign fellows were based in 26 cities – mostly in Western Europe (Paris, Vienna) and North America (New York, Washington, D.C., Montreal, Toronto) but also in the European periphery (Barcelona, Lisbon, Madrid, Milan, St. Petersburg, Turin) and colonial or postcolonial settings (Mexico City, Jamaica, Rio de Janeiro, Cape Town, Hong Kong, Calcutta, Melbourne, Sydney). Fellows based in Asia and Latin America were often British or American citizens working primarily for foreign companies. These included the American Richard E. Chism, a lawyer based in Mexico City with expertise in the mining sector, and the solicitor Henry L. Dennys, born in England and from 1874 based in Hong Kong.

The criteria for the selection of qualified local professionals by foreign patentees included not just past records and accomplishments but also membership in one or more associations of patent agents. Agents’ associations were, in short, instruments for establishing long-term collaborations based on mutual trust. Due to the lack of official registration or exams in many countries, patent experts garnered international reputations through their participation in professional associations in a variety of countries. For example, in 1901 the civil engineer Louis Bordes, based in Buenos Aires, was a member of professional associations in Britain, France and Australia. Bordes had in 1870 established the *International South American Patent and Trade Mark Agency*, which specialized in patent matters for all of Latin America. In Calcutta, Henry H. Remfry and Maurice Remfry, of the agency Remfry & Son (which exists to this day), were also members of professional associations in Britain, France and Australia. Remfry & Son was active not only in India, but also in Borneo, Ceylon, Hong Kong and Japan, where they had correspondents. Henry Remfry was the author of several treatises and

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<sup>46</sup> ‘Professional Co-operation’, *Journal of the Society of Patent Agents*, Vol. II, No. 13 (January 1901), p. 1.

<sup>47</sup> For a detail study of the CIPA in the late 19<sup>th</sup> century see Guagnini, Anna ‘Patent Agents in Britain’.

<sup>48</sup> Paper read at the Eight Annual Meeting of the Institute, Howgrave Graham, H.: *On the Progress and Work of the Institute of Patent Agents*, London: Spottiswoode & Co., 1890.



pamphlets on intellectual property, including *Inventions likely to 'take' and 'pay' in India and the East* (1892).<sup>49</sup>

International networks of agents grew rapidly during the 1890s. One indicator of this trend was the number of agents registered in the *International Directory of Patent Agents*, published in London from 1893. This directory, organised by countries, provided information about agents' locations and in some cases their credentials, services, costs, educational backgrounds and memberships in professional bodies. The number of agents registered in this directory increased from about 2,200 in 1893 to more than 4,000 in 1901.<sup>50</sup> In other words, there was an increase in the nodes connecting the agents' networks. The 1893 edition of the directory lists patent agents in 59 countries and reveals that more than 70 percent of the world patent agent offices were located in France, Britain and the United States.<sup>51</sup> There were also dozens of agents in places as diverse and far-flung as Japan, India, Mexico, South Africa, Argentina, Australia and Hong Kong. Interestingly, in the preface of the 1893 edition, the editor explained the reason for its publication:

The enormous growth of patent agencies (more particularly what may be termed its international developments) has suggested the publication of this volume, which will enable patent agents to find readily the addresses of members of their profession with whom they may wish to communicate, or to ascertain as regards any particular country or colony, whether patent agency is there practised, and by whom and at what address.

Despite international agreements, professional associations and directories, agents still faced uncertainty in international patenting and by the turn of the century would continue to be advocating for a more integrated international patent system. This was made clear in a 1902 editorial in the *British Journal of the Society of Patent Agents*, where agents demanded more uniformity among national laws so as to reduce 'the great risks an agent runs through the negligence or inability on the part of foreign agents employed by him.'<sup>52</sup>

### **Agents of corporate globalisation**

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<sup>49</sup> Printed by the Calcutta Central Press Co. in 1892.

<sup>50</sup> *International Directory of Patent Agents*, London: William Reeves, 1893, 1897 and 1901.

<sup>51</sup> According to Ian Inkster, in the *International Directory of Patent Agents* for the year 1893, 2,202 agencies were listed: 45 percent of them in the USA, 27 percent in France and 13 percent in Britain. Inkster, I.: 'Engineers as patentees and the cultures of invention 1830-1914 and beyond: The evidence from the patent data', *Quaderns D'Historia de L'Enginyeria*, Vol VI (2004), pp. 25-50.

<sup>52</sup> 'The Desirability of an International System of Procedure for Protection of Invention', *Journal of the Society of Patent Agents*, No. 44, 45 and 46 (1902-1903), p.116.

During the late nineteenth century, American and European companies began a movement towards international patenting.<sup>53</sup> Through the management of intellectual property rights in various national jurisdictions, large firms acquired valuable patents in countries not only in the fast lane of industrial development (countries like France, Germany, Britain and the United States), but also in latecomers such as Australia, Spain, Italy and Mexico. The transition to a modern corporate business model and the growing demand for trained experts in patent issues were closely related.

The industrial enterprise described by the business historian Alfred Chandler was a prototype of the kind of company that would go on to develop a professional management of patent rights.<sup>54</sup> Patents became the foundation of a new business model.<sup>55</sup> For the research industry, patent rights served as an indispensable means of controlling the market and preserving its commercial interests - often through patent pools and patent-based cartels - as well as a source of considerable capital amassed through royalties and assignments.<sup>56</sup> The professional bureaucratisation of innovation within German and American science-based oligopolistic industries became commonplace from the 1870s. The research laboratories of large industrial firms were directed to develop inventions that could be patented.<sup>57</sup> In Joseph Schumpeter's words, 'technological progress (was) increasingly becoming the business of teams of trained specialists who turn out what is required and make it work in predictable ways.'<sup>58</sup>

This tendency was particularly apparent in firms created around the consolidation of patent rights, including the Bell Company, Babcock & Wilcox and the various Edison firms, just to name a few.<sup>59</sup> In these companies, research laboratories worked primarily to ensure that patent rights were protected. Sometimes, as Leonard Reich has shown in the cases of General

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<sup>53</sup> There is a large literature on corporations and patent management; see, for instance, Andersen, B.: *Technological Change and the Evolution of Corporate Innovation: The Structure of Patenting, 1890-1990*, Cheltenham: Edward Elgar, 2001; Noble, D.: *America by Design*, New York: Oxford University Press, 1979, pp. 84-109; Wilkins, M.: 'The Role of Private Business in the International Diffusion of Technology', *The Journal of Economic History* 34, n.º 1 (1974), pp. 166-188.

<sup>54</sup> For Chandler's thesis see Chandler, A.: *Scale and Scope: The Dynamics of Industrial Capitalism*, Cambridge, Mass: Belknap Press, 1990; Chandler, A.: *The Visible Hand: The Managerial Revolution in American Business*, Cambridge, Mass: Harvard University Press, 1977.

<sup>55</sup> May and Sell: *Intellectual Property Rights*, pp. 122 y 131.

<sup>56</sup> According to Leonard Reich, industrial laboratories were 'set apart from production facilities, staffed by people trained in science and advanced engineering who work toward deeper understanding of corporate-related science and technology, and who are organised and administered to keep them somewhat insulated from immediate demands yet responsive to long-term company needs.' Reich, L.S.: *The Making of American Industrial Research: Science and Business at GE and Bell, 1876-1926*, Cambridge: Cambridge University Press, 1985, p. 3.

<sup>57</sup> Fox and Guagnini, *Laboratories, Workshops, and Sites*, pp. 158 and 166-7.

<sup>58</sup> Schumpeter, J. A.: *Capitalism, Socialism, and Democracy*, 6th ed., London: Routledge, 2003, p. 132.

<sup>59</sup> Smith, G. D.: *The Anatomy of a Business Strategy: Bell, Western Electric and the Origins of the American Telephone Industry*, Baltimore: Johns Hopkins University Press, 1985.

Electric, Bell and AT&T, these enterprise laboratories also became a means of identifying and purchasing patent rights.<sup>60</sup> As Kristine Bruland's study on Babcock & Wilcox reveals, multinational corporations frequently resorted to recourse of aggressive litigation in the management of patents and trademarks in different countries.<sup>61</sup>

The patent trials on telephone technology in Britain and the United States from 1870 to 1900 are a telling example. Bell, United Telephone and AT&T developed an economic monopoly in the early electrical industries through an intense and aggressive patent litigation strategy.<sup>62</sup> These companies controlled the telephone market by securing legal rights over the relevant technology in court. The market structure of this industry thus largely grew out of litigation and the advice of lawyers. Expert witnesses and scientific consultants were, likewise, pivotal in resolving patent disputes involving key late-nineteenth century electrical inventions (such as wireless telegraphy) and chemical inventions (celluloid, aniline red and the incandescent lamp).<sup>63</sup>

High-technology industrial companies used patents as a prime instrument for international competition in foreign markets.<sup>64</sup> These firms followed a common pattern. Their primary strategy was to block imitation, creating barriers to domestic companies. Persistent patenting, along with other mechanisms, served to preserve the potential market positions of industrial firms in the international arena. These companies tended to register patents in as many national jurisdictions as possible before disseminating the content of their inventions. Once their patents were protected abroad, industrial firms could set up factories and subsidiaries in multiple countries. More frequently, these companies proceeded to export their technology or licence their patent rights in a given country.<sup>65</sup>

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<sup>60</sup> Reich, *The Making of American Industrial Research*, 3.

<sup>61</sup> Bruland, K.: 'The Management of Intellectual Property at Home and Abroad: Babcock & Wilcox, 1850-1910', *History of Technology*, Vol. 24 (2002), pp. 151–170.

<sup>62</sup> For a recent study on the corporate monopoly in the telephone sector constructed by patent litigation see Beauchamp, B.: *Invented by Law: Alexander Graham Bell and the Patent that Changed America*, Cambridge: Harvard University Press, 2015.

<sup>63</sup> Gooday, G and Arapostathis, S.: *Patently Contestable: Electrical Technologies and Inventor Identities on Trial in Britain*, Cambridge, Cambridge: MIT University Press, 2013; Bijker, 'The Social Construction of Bakelite'; Van den Belt, H.: 'Action at a Distance: A.W. Hofmann and the French Patent Disputes about Aniline Red (1860-63), or How a Scientist May Influence Legal Decisions without Appearing in Court', in Smith, R. and Wynne, B. (eds.): *Expert Evidence: Interpreting Science in the Law*, London: Routledge, 1988, pp.185–209.

<sup>64</sup> Inkster, I.: *Science and Technology in History: An Approach to Industrial Development*, Basingstoke: Macmillan, 1991, p.113; Fox and Guanini have also identified 'protective patenting' strategies among large German chemical firms in the late nineteenth century. Fox and Guanini, *Laboratories, Workshops, and Sites*, p.158.

<sup>65</sup> According to Edith Penrose, in the last decades of the nineteenth century 'patents were used to protect international markets', Penrose, *The Economics of the International*, p. 89. The relationship between the effectiveness of the patent protection in a country and the commercialisation of technology is well developed in Arora, A.: 'Trading Knowledge: An Exploration of Patent Protection and Other Developments of Market Transactions in Technology and R&D', in Lamoreaux, N. and Sokoloff, K. (eds): *Financing Innovation in the*

By the beginning of the twentieth century a number of companies had established some distinct unit or department for the management of patent rights. Large British, French, American and German companies began to employ full-time lawyers, engineers and scientists for the management of innovations inside the firm.<sup>66</sup> This tendency reflects a broader transition from individual to corporate inventive activity. Like specialised personnel or marketing departments, legal departments (and in some cases centralised patent departments) were introduced with the goal of reducing corporations' transaction- and information-related costs. The hiring of in-house patent agents followed the creation of research laboratories. Good examples of companies with in-house departments for the management of inventive activity are Westinghouse, Schneider, Edison and General Electric.<sup>67</sup> In contrast to what we might expect, the hiring of human resources with patent expertise did not imply a reduction in the number of external intermediaries, given the difficulties that companies faced in coordinating information and securing patents in several national jurisdictions.<sup>68</sup>

In-house corporate agents became an instrument by which large firms could exert their power in the international market for technology and accumulate patents through assignments, pools and litigation. Foreign multinational firms often retained both in-house patent agents and corresponding subagents in countries at the periphery of industrial development. These local intermediaries assisted multinational corporations in patenting, diffusing and commercialising their property rights globally. The various companies set up by Thomas A. Edison in the 1880s and 1890s serve as a good example of the ways that agents assisted multinational firms. Edison's firms sent, in 1888, powers of attorney to agents in 24 countries (including several Latin American countries such as Peru, Mexico, Brazil and Argentina). The New York patent firm Dyer and Seeley, which represented Edison, coordinated transnational patenting with agents in the various countries. The differences among the foreign agents' fees were huge.

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*United States, 1870 to the Present*, Cambridge, Mass: MIT Press, 2007), pp. 365–403. According to Arora, 'patent protection and commercialisation are strategic complements' (p. 371).

<sup>66</sup> Noble, *America by Design*, pp. 84–109.

<sup>67</sup> Nishimura, S.: 'The Rise of the Patent Department: An Example of the Institutionalization of Knowledge Workers in the United States', *Entreprises et histoire*, Vol. 82, No. 1 (2016), pp. 47-63. An early example of corporate professional management of industrial property rights is the French firm Schneider and Cie. and its patents in metallurgy. D'Angio, A.: 'The Industrial and Financial Use of Patent by Schneider & Cie in the 19th Century (1836-1883)', in Merger, M. (ed.): *Transferts de Technologies en Méditerranée*, Paris: Presses de l'Université Paris-Sorbonne, 2006, pp. 345–358.

<sup>68</sup> Galambos, L.: 'The Role of Professionals in the Chandler Paradigm', in Lazonik, W. and Teece, D. (eds.): *Management Innovation: Essays in the Spirit of Alfred Chandler*, New York: Oxford University Press, 2012, pp. 125–146.

Interestingly, the fees in Mexico, Portugal, Brazil and India were the most expensive among the experts working for Edison.<sup>69</sup>

Corporate patent management in the agricultural and mining sectors has been less explored in the historiography. An interesting case study is provided by European and American engineering firms that specialised in the mass production of machinery. These companies supplied patented equipment to sugar plantations in Asia and the Americas. Good examples would be Duncan Stewart (Glasgow), McOnie (Glasgow) and Fives-Lille (France), all of which provided plantations with the most advanced technologies for the construction of large-scale central sugar factories throughout the Caribbean, the Indian Ocean and Southeast Asia during the last third of the nineteenth century.<sup>70</sup> These companies built their international expansion on global networks of patent counsels, chemists and machinists.

Similarly, the Cassel Company, founded in 1884 in Glasgow, developed technological improvements to be used in distant peripheries. This firm exploited patents for new mining techniques, among them, the Macarthur-Forrest process of gold extraction using cyanide, patented in 1887 by the Glasgow chemist John Stewart Macarthur and physicians Robert and William Forrest and assigned in 1888 to the Cassel Company. This company set up subsidiaries in New Zealand, South Africa, Mexico and Australia during the 1890s to exploit and licence their patented mining techniques, thereby bringing patent rights to these four countries as well as Britain and the United States.<sup>71</sup> Apart from exploiting its patents, the Cassel company commercialised its techniques in other major mining centres, including India, Chile and Russia. The Cassel techniques were a commercial success, despite the fact that the company charged royalties that were considered exorbitant by some governments. Lawyers and mining engineers were key to the company's management of its inventions far afield from its headquarters in Scotland. The Cassel Company's patent attorneys, meanwhile, were instrumental in resolving questions of ownership pertaining to originality and technical knowledge, given the large number of cases of patent infringements and lawsuits this company faced in countries such as

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<sup>69</sup> D8846ACD; TAEM 124:80; and D8846, Document Files Series 1888: D-88-46-Patents (Alfred Ord Tate to Richard Nott Dyer, 08/08/1888.)

<sup>70</sup> Pretel, D. and Fernandez-de-Pinedo, N.: 'Circuits of Knowledge: Foreign Technology and Transnational Expertise in Nineteenth-Century Cuba' in Leonard, A. and Pretel, D. (eds.), *The Caribbean and the Atlantic World Economy: Circuits of Trade, Money and Knowledge, 1650-1914*, Basingstoke: Palgrave- Macmillan, 2015, pp. 263-289.

<sup>71</sup> Todd, J.: *Colonial Technology: Science and the Transfer of Innovation to Australia*, Cambridge: Cambridge University Press, 1995; Beatty, E.: *Technology and the Search for Progress in Modern Mexico*, Oakland: University of California Press, 2015, pp.134-153.

South Africa and New Zealand, where some of its patents were deemed as invalid by local governments and mining communities.

## **Conclusion**

This article has shed light on the rise of specialised patent agents and lawyers over the course of the second industrialisation. The objective has been to broaden the study of the innovative community by analysing different forms of expertise. Historical accounts of patent institutions have almost invariably concentrated on inventors and entrepreneurs while overlooking the activities of intermediate experts. Inventors and entrepreneurs may have changed world history through their diffusion of innovative technologies, but they have done so hand in hand with other actors, from lawyers to consultant engineers.

This discussion of the various forms of patent expertise has gone beyond national histories of patenting, instead reconstructing the internationalisation of professional expertise on intellectual property issues. The pressures of a globalising economy and multilateral agreements stimulated the internationalisation of the patent profession during the 1880s and 1890s. During these two decades, national patent institutions grew more interdependent while continuing to maintain their diversity. In this context, the variations in the evolution of patent expertise among different countries depended on the level of industrialisation and the overall institutional environment. The globalisation of patenting likewise became associated with the development of engineering and legal expertise throughout various countries. This expertise was embedded in specific national technological and legal cultures.

Patent agents emerged in the international arena in order to make possible the transnational transfer of inventions and rights that had been created, and would otherwise have remained institutionally embedded, in specific national or local sites. From this perspective, patent experts were necessary mediators in knowledge transfer. They served as channels in the realm of international patenting, communicating knowledge and property rights globally. Networks of agents reduced the risks and uncertainty that foreign inventors encountered in international technology transfer. Indeed, the circulation of technologies and rights depended on overlapping long-term networks. In these networks, patent experts linked inventors, firms, patent offices, markets and technical consultancies.

The expansion of international networks of intermediary agents reflected the changing imperatives for intellectual property management during the years of the Second Industrial Revolution. The crucial role of patent agents in the transnational transmission of patent rights immediately raises, then, the question of whether these experts were also a constraint for

international technology transfer. Unfortunately, the existing historiography on the history of patents does not go very far in answering this question. It seems that patent expertise was supporting and reinforcing an asymmetric international patent system that exposed the imbalances of world industrial capitalism. Skilled and elite expert agents remained concentrated in a small group of industrial countries with advanced technological capabilities. That said, this is not just a history of core and peripheral agents, but a history of the global interdependence that existed among experts and of the long-term constraints to technological development that encouraged this interdependence.

Studies often present patent agents as driving actors in the growth of efficient markets for technology. From this perspective, the presence of expert agents removed constraints in international patenting. However, during the late nineteenth century, agents in many countries were accused of carrying out rent-seeking activities and maintained privileged relationships with officials and commissioners. A question can thus be raised as to whether intellectual property institutions at the close of the nineteenth century were actually open to a broad segment of the population or were instead primarily accessible only to powerful social classes and corporations with a large amount of capital.

Networks of patent experts as mechanisms of international knowledge transfer also posed significant limitations. Given that agents were a tacit requirement for entry into foreign markets, patenting was effectively restricted across national boundaries. While agents increased the security of patentees in transnational operations, they also limited registration to those who could afford agents' fees for moving patent rights across these boundaries. In latecomers, the chain of intermediaries necessary for foreign patentees to register their patents drove costs much higher. Even when transaction and information costs were relatively reduced by agents during the last decades of the nineteenth century, the majority of foreign inventors in advanced industrial countries remained reluctant to extend their rights to peripheral countries. The transactions costs of international patenting remained high.

The rapid expansion of networks of patent experts during the late nineteenth century also reflected the need for large companies to exercise international control over valuable inventions. The scholarship has emphasised the competitive advantages created by control over intellectual property rights and the resort to experts to maximize corporate profits. The outcomes of corporate patent management deserve further historical research. Indeed, while the historiography deals forcefully with successful business models, it tends to ignore the contentious consequences of patent management, such as lower degrees of knowledge diffusion, limited competition and predatory strategies. Similarly, alternative and sometimes

highly successful strategies, such as secrecy or the eschewing of patents altogether, are overlooked. The most important point remains that agents' powers, and their many services to multinational corporations, had enduring consequences on the structure of knowledge property worldwide.