

*This is the accepted manuscript version
We have renumbered the paper pages to exactly
follow the final chapter.*

The final chapter is available at:

(2014)

*ROUTLEDGE. Taylor & Francis Group
Organizing Global Technology Flows
Institutions, Actors, and Processes*

Edited by Pierre-Yves Donzé and Shigehiro Nishimura

SEE

[https://www.routledge.com/Organizing-Global-Technology-Flows-
Institutions-Actors-and-Processes/Donze-
Nishimura/p/book/9780415843904](https://www.routledge.com/Organizing-Global-Technology-Flows-Institutions-Actors-and-Processes/Donze-Nishimura/p/book/9780415843904)

2 Why Did Multinationals Patent in Spain?

Several Historical Inquiries*

Patricio Sáiz and David Pretel

INTRODUCTION

To fully understand the processes of technology transfer in the twentieth century, we would probably have to begin by scrutinizing them throughout the second half of the nineteenth century, especially if we would like to consider the topic from a global business history perspective. Multinational corporations initiated expansion efforts, which implied shifts of technology and human capital from one nation to another, from at least 1870 onward, just when the political and entrepreneurial interests related to patent protection also started to become global issues. The international meetings and agreements in the 1870s and 1880s that led to the International Union for the Protection of Industrial Property, the ancestor of the current World Intellectual Property Organization (WIPO), demonstrated the increasing concern and influence of corporations and networks of agents employed by the former in the ongoing process of securing transnational rights to safeguard new technologies.¹ Recent research on the role of patent and trademark agents in lobbying both national laws and international treaties corroborates the idea that in the late nineteenth century and the first decades of the twentieth century, the companies that used their legal services urgently needed protection for pressing new business: that of technological globalization.²

On the one hand, governments from pioneer and early follower countries were progressively influenced by industrial firms and economic groups politically well-connected and increasingly interested in obtaining support for the conquest of new external markets and demanding protection in domestic ones. On the other hand, the rulers and entrepreneurs of latecomer and backward economies were also attentive to and fascinated by new machines and innovations that would lead toward industrialization and sustained economic growth. In these circumstances, the progressive commercial protectionism that colored the final decades of the nineteenth century and the years leading up to World War I did not hold technology transfers back; on the contrary, it boosted foreign investments, international expansion, and industrial growth among corporations, which began to found factories and joint ventures in third countries, as well as exchanges of scientific and

informal knowledge, technical innovations, and human capital. That is what we now call the first globalization process, a transformation in which firms and “capitalists” undoubtedly were the main actors.

From 1883 to 1884, when the first twelve countries signed the Paris Convention for the Protection of Industrial Property, to the beginning of World War II in 1939, scores of nations signed the patent and trademark agreements, among them all the most industrialized and developed countries in the Western world and their followers.³ Spain was one of the original founding members of the Union. Thus, it compromised by granting foreign-resident patentees the same treatment as domestic ones, something that, in practice, had been occurring since the beginning of the system in 1820–1826. The Spanish patent law of 1878 guaranteed two years of priority rights to foreign patents (but limiting them to a ten-year rather than a twenty-year extension); this policy was standardized after the signing of the 1883 agreement, which demanded only six months of priority rights (one year from 1900 on), and after the more modern law was passed in 1902.⁴ While Spanish legal institutions in charge of patent protection apparently adjusted to international standards, providing protection for foreign inventors and especially firms and corporations starting to extend their patent rights throughout Europe, the Spanish legal system was also designed initially to encourage “innovation activity” in addition to “invention activity.” The latter was not the most relevant issue for a country distinguished by extreme industrial, scientific, and technical underdevelopment during most of the nineteenth and well into the twentieth century. The Spanish government was eager for industrialization and economic growth; promoting foreign technology transfers and imitation was the quickest path to innovation.

Thus, the Spanish patent system was conceived in a rather hybrid manner both to ensure a basic normative framework for attracting foreign inventors and innovators hoping to extend their rights to Spain and to limit that protection if it did not turn into actual innovation and economic growth within national borders. This was implemented via two major means that operated simultaneously: regulating patents of introduction and establishing compulsory working clauses. The former provided ways to protect foreign third-person technologies without their authorization in order to implement them locally, providing they were not already established in Spain. The latter required nationals and foreigners to put into practice the inventions granted by any patent (in one, two, or three years depending on the law)⁵ within national territory or otherwise declare an expiration date, thereby making the corresponding technical knowledge public and of free use. Both strategies remained in force until Spain joined the European Union in 1986. If one factors in Spain’s traditional judiciary weakness in prosecuting fraud against industrial property, which current international reports on intellectual piracy suggest is still a pressing problem,⁶ it seems that the Spanish patent system was rather feeble until recent times.

Commercial policy was the other means of promoting industrialization, first by opening the market to direct technology imports from abroad—the

principal path of technical advancement for many industries in nineteenth-century Spain—and second by the protectionist swing that began in 1877 and slowly drove the economy toward imports substitution. These latter measures triggered some changes in the “National Innovation System,” which lasted from 1880 to 1939 and allowed for the acquisition of technological capabilities and sowed the first seeds of domestic scientific and inventive activity,⁷ but the main sources of innovation lay abroad. These sources spurred innovation in several ways: first, direct technological imports were still possible and frequent in some sectors that required complex machinery and equipment (electricity, the chemical industry, etc.);⁸ second, domestic entrepreneurs and firms in sectors favored by protectionism (textile, mechanics, metal works, etc.), parties that likely did not care much about promoting inventive activity but needed proven techniques from abroad, could use “patents of introduction” to copy and bring in knowledge and/or technicians to build the machines; third, domestic entrepreneurs and firms could also negotiate with foreign companies that patented in Spain by purchasing all the corresponding rights within the country, acquiring a work license, or attempting a joint venture. Finally, international protectionism had another significant effect: the growth and expansion of corporations that began businesses and opened factories in other countries, as was the case in Spain.⁹ Alone or in joint ventures with domestic capital, companies invested abroad and transferred technologies and knowledge.

This chapter will explore how multinationals used the Spanish patent system in the late nineteenth century and the first decades of the twentieth. The discussion will focus on the origins and evolution of corporate patenting in Spain, the effects of compulsory working clauses, the management of assignments, the various strategies followed by the firms, and the effects of patents on technology transfers in the Spanish economy. To investigate these areas, we will use a database of 150,000 patents registered in Spain between 1820 and 1939 that our research group has built during the last ten years through the direct reading of the original documentation (administration files and technical reports) for every patent in the Archive of the Spanish Patents and Trademarks Office (OEPM) in the framework of one of the major recent research projects on Spanish economic history.¹⁰

THE EVOLUTION OF CORPORATE PATENTING IN SPAIN (1820–1939)

During the nineteenth century and the first decades of the twentieth, patent systems everywhere went through a progressive shift from being tools for independent inventors, skilled artisans, small-scale industrialists, and entrepreneurs themselves to being the “targets” of firms and corporations. By the second half of the twentieth century, the vast majority of patents and new technologies protected in Western economies were already owned by firms that then

employed inventors and scientists in their research departments and simply limited their recognition by naming the authors in the patent procedures. The period between 1880 and 1939 was crucial in reversing patent owning, especially in countries such as the United States, Germany, the United Kingdom, and France.¹¹ Lagging economies eventually followed the same pattern as far as the first wave of technological globalization spread and corporations from the North Atlantic extended their influence. That was the case of Spain, where firms progressively increased their presence after 1875–1880, coinciding with the restoration of the monarchy and the normalization of the sociopolitical and economic situation.¹² This larger presence took hold particularly during the final years of the nineteenth century and the 1920s, a decade of exacerbated protectionism and heavy industrialization under Primo de Rivera's dictatorship and a time during which many foreign corporations arrived in Spain.

Figure 2.1 illustrates this development by highlighting the long-term evolution of patents applied for by firms and independents in Spain. Although numerous previous studies have explored the general trends of the Spanish patent system,¹³ it is necessary to remember the repercussions of the financial crisis of 1864 and the revolutionary events of 1868, which led to Queen Isabel II's exile, and the aforementioned economic changes brought about by the Restoration after 1876. We must give special consideration to the patent law of 1878, which introduced a system of progressive annual quotas that,



Figure 2.1 Independent and corporate patents. Spain, 1820–1939

Source: Archivo Histórico Nacional y Gaceta de Madrid for privileges from 1820 to 1826. Between 1826 and 1939: Original documents of patents at the Oficina Española de Patentes y Marcas.

Independents: patents applied by one or more individuals. *Firms*: patents applied by firms alone or with individuals.

in practice, would spark an enormous savings in patent rights, considering that only the first-year fees were required to make it effective. Likewise, the 1883 international agreement on industrial property is another significant point as it reinforced protection for foreign patents. From that time on, there was a continuous increase in applications and grants, both domestic and even more so foreign, in response to legal and socioeconomic improvements. Foreign patent activity also intensified in response to the general increase of inventions and patents in the world, as statistical evidence and the lineal regressions in another of our analyses confirm.¹⁴ Patent growth slowed at the end of the 1920s due in part to the decline of the international economic panorama after the crisis of 1929 and the 1930s recession, which influenced foreign patentees, but mostly because of a sharp deterioration in domestic political and social conditions in Spain; this tumult led to Franco's military coup and to the Spanish Civil War (1936–1939), which brought with it a rapid economic collapse and continued decreases in patent series.

This very general trend holds for all the patent distributions examined, as Figure 2.1 demonstrates for independents and firms. Apart from this consistent evolution, however, the processes through which corporations caught up in the long run are particularly noteworthy. In Spain, independent patentees stood out over the entire period studied. Many of them were industrialists, manufacturers, entrepreneurs, traders, and other parties closely related to production processes and enterprises,¹⁵ but they—not the firms—were the true owners of technologies, which made a remarkable difference. Independents completely dominated the period before 1880, boasting an average of 90.1% of the patents; the remaining 9.9% were applied for by firms, most of which were small family companies with limited partners, and only a few were incorporated.¹⁶ Nevertheless, the proportion of patents accounted for by independents decreased consistently from 1880 on, whereas the shares of firms and corporations grew, especially from 1890 to World War I and in the 1920s, as Table 2.1 demonstrates. From 1890 to 1930, the Spanish economy improved and expanded under intense protectionism and governmental support for “national” industrial production, which signified both

Table 2.1 Percentages of independent and corporate patents. Spain, 1880–1939

	Independents %	Firms %	Patents
1880–1889	88.8	11.2	9,681
1890–1899	83.9	16.1	14,913
1900–1909	78.0	22.0	21,811
1910–1919	74.4	25.6	24,965
1920–1929	64.5	35.5	44,338
1930–1939	58.3	41.7	31,284

Source: See Figure 2.1

domestic and foreign firms installing factories within national territory. Spain benefitted from World War I for several reasons: first, the increase in the values of direct industrial and services exports during the conflict yielded enormous profits for firms and entrepreneurs; second, the import-substitution phenomenon in times of war produced advantages; and finally, Spain's neutrality attracted capital, bank branches, firms, and skilled human capital from abroad. These foreign investments, together with national accumulated capital, would play a significant economic role in the industrial expansion of the 1920s (especially in heavy industry), the decade in which corporate patents rapidly increased.

There were two distinct periods in the development of corporate patenting in Spain, both in the propensity to register and in the companies' countries of residence. The first period was from 1820 to 1880, when, as previously discussed, independents represented the prevailing force and there were only a few firms using the patent system. As Figure 2.2 shows, the majority of these firms were Spanish or operated from Spain; hardly any hailed from abroad. But in the second period, from 1880 to 1939, when the number of entrepreneurial patents increased constantly, that tendency reversed course as foreign companies located outside of Spain quickened their collective rhythm of registering new technologies in the Spanish market to a greater extent than resident firms did. Among the latter were also a few Spanish subsidiaries of foreign corporations that understood the market in which they were operating perfectly but aligned themselves with their parent companies and employed complementary strategies of patenting. Although

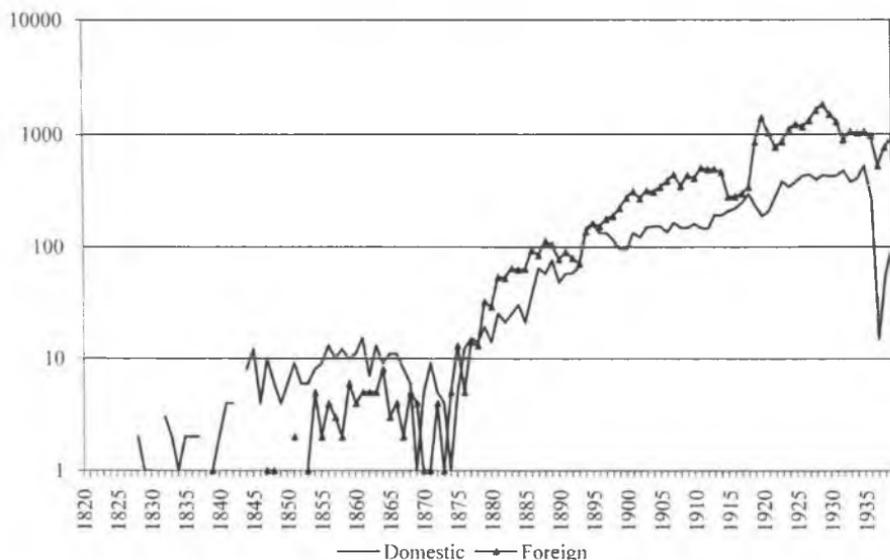


Figure 2.2 Corporate patents by firms' residence. Spain, 1820-1939

Source: See Figure 2.1

we will offer some data on this phenomenon in the conclusion, we will here analyze the corporations with foreign addresses (with or without Spanish subsidiaries) that began compulsive patenting in Spain in the late nineteenth century and the first half of the twentieth century in order to assess their technology transfer-related management strategies and the economic consequences for backward countries.

As Figure 2.2 shows, foreign companies began to patent in Spain during the 1880s not only in response to significant institutional changes, such as the 1878 law and the international agreements of 1883, but also due to the progressive tendency to extend patent rights to other countries. The effects of the international crisis that marked the end of the nineteenth century and the consequences of World War I are clear. The former affected both domestic and foreign companies, but the war impacted the entrepreneurial activities of warring nations. Despite these circumstances, foreign companies intensely ramped up their application efforts from the beginning of the twentieth century up until World War I and beyond, into the 1920s, always markedly outnumbering domestic companies. The following sections will examine the organization and repercussions of this “patent colonization” initiative.

FOREIGN CORPORATIONS IN THE SPANISH PATENT SYSTEM

Now that we have defined two distinct quantitative and qualitative periods, the next step is to delve into where foreign corporate patents came from in each of these periods and what their long-term evolutionary paths were. Before 1880, when Spanish resident firms were the major players, there were only 162 patents applied for by nonresident companies. As Table 2.2 indicates, most of them were French (72.2%), which unmistakably points to a scarcely integrated patent system in which market knowledge, human capital mobility, and direct investments in the Spanish economy drove the interest in taking out patents. In this context, geographic proximity plays another key role and helps explain the considerable leadership of French firms and French independent businessmen. Not only had Spanish patent legislation been totally shaped by the French revolutionary Patent Law of 1791, but many entrepreneurs, capitalists, technicians, and firms had also invested extensively in the first Spanish industrialization from 1845 to 1865; some had even established themselves in Spain and become legal residents. A great quantity of new European technologies (French or not) had poured into the country through their hands and brains, principally in railways, mining, and several other sectors. As we have already demonstrated in other works, 75% of the patents applied for by foreign residents in Spain before 1878 went to French patentees.¹⁷ Thus, it is not surprising that firms residing in France were also the main source of corporate patents from abroad. Coming chiefly from Paris and its surroundings, most of the patents went to family companies with limited partners, although the first incorporated firms can

Table 2.2 Foreign corporate patents by firms' country of residence. Spain, 1820–1939

	1820– 1939%	1820– 1879%	1880– 1899%	1900– 1919%	1920– 1939%
Germany	29.7	11.1	26.9	29.9	30.0
France	19.7	72.2	34.6	22.0	17.1
USA	14.5	1.2	9.4	13.7	15.4
UK	13.7	6.2	11.1	14.9	13.5
Switzerland	6.6	3.1	4.3	4.9	7.4
Netherlands	3.8	0.0	0.4	0.9	5.1
Italy	3.3	3.1	2.4	3.3	3.5
Belgium	2.4	1.2	6.5	3.2	1.7
Sweden	1.6	0.0	0.5	1.4	1.7
Austria	1.0	0.0	1.6	1.7	0.7
Norway	0.6	0.0	0.2	1.0	0.6
Hungary	0.5	0.0	0.2	0.7	0.5
Czech Republic	0.5	0.0	0.0	0.2	0.7
Denmark	0.4	0.0	0.3	0.4	0.3
Luxembourg	0.3	0.0	0.2	0.1	0.3
Poland	0.2	0.6	0.7	0.3	0.2
Canada	0.2	0.0	0.0	0.3	0.2
Rest	1.0	1.2	0.8	1.0	1.0
Total Patents	32,264	162	2,061	7,761	22,280

Source: See Figure 2.1

also be found, especially in mining, basic metals, mechanical construction, machinery, gas and lighting, and similar areas.¹⁸

Far behind France, the other countries with corporate patents before 1880 were Germany (11.1%), whose corporations were beginning their international expansion throughout Europe, especially after the unification in 1870, the United Kingdom (6.2%), Switzerland, Italy (3.1% each), Belgium, and the United States (1.2% each). Together, these figures illuminate a narrow international scope of patents and technologies before the 1870s–1880s. Essentially, technology transfers occurred through human capital shifts and direct investments abroad, traversing a world where knowledge was embedded in the skills of workers and technicians and where scientific education was universally scarce, especially in Spain.¹⁹ Given this backdrop, the transmission of that “useful and reliable knowledge,” as J. Mokyr has called it,²⁰ was directly driven by people who maintained some kind of economic interest in the country and could use the domestic patent system, depending on its strengths or weaknesses, in defending their businesses in court. This notion retained its currency in the twentieth century, when corporations

captured and exploited the “international patent system” on their way to technological globalization.

Still, a closer look at Table 2.2 clearly reveals the tremendous differences in the international scene from the 1880s onward. In the first period analyzed, firms from only a few key countries were represented, the main one being France, but in just the last twenty years of the nineteenth century, that tendency had begun to change. The reasons for this change were generally twofold: first, a radical decrease in the French firms’ proportion of patents compared to those granted to corporations from Germany, the United States, the United Kingdom, Belgium, or Switzerland, which began to extend their “tentacles of progress,” in the words of David Headrick;²¹ second, the diversification among the nations from which firms applied for patents in Spain also pushed against the traditional tendency.²² This means that companies located in Sweden, Austria and Hungary, the Netherlands, Norway, Denmark, Luxembourg, Poland, and Canada (among many others in the “Rest” group in Table 2.2, with a meager proportion of grants) also began to patent lightly in the Spanish market after 1880. These two general trends remained during the first third of the twentieth century. German corporations became leaders, reaching around 30% of corporate patents in the entire period from 1900 to 1939, while France continuously fell from 34.6% between 1880 and 1889 to 17.1% in the 1920s and 1930s. Just as Germany did, the United States constantly increased its presence in Spain, rising to 15.4% of corporate patents. The United Kingdom also grew to 15% (1900–1919) but then fell to 13.5% in the final period examined, and Belgium, whose firms patented in Spain at a rate of 6.5% in the late nineteenth century, later decreased to a mere 1.7%. The case of Swiss and Dutch firms is very interesting; they increased their patents to surpass the Italians between 1920 and 1939 (Switzerland 7.4%, the Netherlands 5.1%, and Italy 3.5%). The rest of the countries registered just over 1% of patents each, but the general tendency still demonstrates how corporations had a similar international vocation everywhere.

If we now focus on Table 2.3, which shows firms and capital invested in Spain by country of origin up until World War I, we can easily observe how the investment distribution matches the corporate patents, as industrial and intellectual property rights are no more than other investments abroad. Despite the facts that the nations represented are virtually the same in both tables (including the “Rest” group) and that France appears as the leading foreign investor, there are also some interesting differences. According to T. Tortella, France and the United Kingdom represented 68% of all firms and 75% of all capital investments, which fit well with the proportion of corporate patents before 1880 (taking into account that France was the dominant force) but not afterward, when German patents increased between 1880 and 1914. However, German real investments in Spain were apparently limited compared with French and British ones, as were those of the Swiss, Italian, and especially Anglo-American firms—organizations

Table 2.3 Foreign corporations in Spain and capital investments, 1780–1914

	Firms (1780–1914)		Capital (1851–1914)		
	Nº	%	Thousands	Euros	%
France	234	42.3	6,204.43		59.11
UK*	140	25.3	1,728.93		16.47
Germany	63	11.4	366.74		3.49
Belgium	45	8.1	656.91		6.26
Switzerland	16	2.9	28.49		0.27
Italy	14	2.5	10.10		0.10
USA	7	1.3	3.19		0.03
Rest**	34	6.1	1,497.36		14.27
TOTAL	553	100.0	10,496.14		100.0

Source: Teresa Tortella, *A Guide to Sources of Information on Foreign Investment in Spain, 1780–1914* (Amsterdam, 2000), Tables 1 and 5, pp. xi and xix. ■

Note: *In the United Kingdom figures, six Irish enterprises are included. **Rest includes firms from the Netherlands, Canada, Norway, Sweden, Argentina, Austria (including Hungary) Czechoslovakia, Denmark, Mexico, and Portugal.

from countries with increasing patent applications in Spain in the first two decades of the twentieth century.

All of this outlines some well-known fields in business and technological history but also raises new questions. Analyzing the Spanish patent system first shows that, before the 1880s, the international mobility of firms' capital, technology, and patents was still rather limited, mainly related to those with direct investments in the Spanish economy or with interests around it. That led directly to France, whose firms' investments in Spain—patents included—reached a wide variety of sectors. To a lesser extent, companies from the United Kingdom, Germany, Switzerland, and Italy were also represented. However, after 1880, German corporations began systematically extending their patent rights throughout Europe and America,²³ as did companies from the United States and several other countries—newcomers to technological globalization—while the United Kingdom reached its “technological climacteric.” This does not necessarily mean an increase in direct capital investments from Germany or the United States in the Spanish economy, as shown in Table 2.3.

What is certain is that inventions from Germany and the United States made entries en masse into almost all the patent systems of the North Atlantic economies, opening the door to what we have long called the “second industrial revolution.” This technological and entrepreneurial competition, in the framework of a scientific, economic, and commercial struggle, resides within different patent strategies of corporations and multinationals from the most significant economies before World War I. But how can we interpret

this data in light of the technological “backwardness” of Spain and other lagging nations? What explains the increase in total corporate patenting after 1880, especially from certain countries such as Germany, the United States, the United Kingdom, Switzerland, and the Netherlands? Does it mean that the process of technology transfer to Spain also grew in the same proportion or that it came first from France and then mostly from others? Were the frontiers of geographic proximity really changed, favoring technology transfer and technological globalization? These are not easy questions to answer without a detailed analysis of the administrative life of patents or a reservoir of case studies that obviously transcends the scope of this chapter. Nevertheless, we can offer some clues to address the research agenda.

THE VALUE OF MULTINATIONAL PATENTS

Thanks to the large body of work produced over the last decade at the Archive of the Spanish Patent Office, we have been able to analyze the documentation of obligatory patent implementation, an interesting administrative requisite in Spain. Within a one- to three-year time frame,²⁴ firms were required to demonstrate that the patented object was being implemented within national territory; this requirement was enforced to varying degrees depending on the period, always under penalty of expiration of the monopoly and, from 1924 on, also of a compulsory license to whoever applied.²⁵ Once the implementation requirements were met, another significant point was the duration of the patent, especially if we suppose that greater length and cost were consequences of the reasonable expectations of profit that could be derived from the monopoly.²⁶ We obtained this information from the analysis of the initial and renovation fees met by firms to maintain exclusive rights, which were paid in advance between 1826 and 1878 after choosing an expiration date (5, 10 or 15 years) and then annually from 1878 onwards for up to twenty years.²⁷

As Table 2.4 clearly demonstrates, the great majority of corporate patents granted to foreign firms were never implemented, which means that an average of 77% expired within a maximum of three years and that the corresponding technological information entered the public domain.²⁸ Moreover, if we examine the fees paid out for corporate patents for which implementation was legally proven, roughly 14% lasted more than five years. Therefore, around 86% of foreign corporate patents were left unexploited and in the public domain in five or six years in Spain during the period studied. This suggests that firms and corporations internationally extended their patent rights as a common protection strategy, especially after 1880, regardless of the specific conditions of the particular patent system or country, assuming that it fulfilled the minimum legal guarantees for registration and that its economic or technical position might offer some business opportunities. Yet, only on very few occasions did patents actually turn into significant

Table 2.4 Corporate patents from different countries by implementation and duration percentages. Spain, 1820–1939

	Imple- mented %	Non- implemented %	Implemented and Duration >5 y.%	Corporate Patents*
Germany	20.8	79.2	12.7	8,848
France	25.5	74.5	16.1	5,892
USA	22.0	78.0	13.6	4,242
UK	29.0	71.0	19.3	4,039
Switzerland	16.5	83.5	11.4	1,953
Netherlands	11.7	88.3	7.7	1,140
Italy	23.0	77.0	13.4	1,005
Belgium	31.4	68.6	12.4	725

Source: See Figure 2.1

Note: *Calculations were made based on 92.1% of patents analyzed. It is not possible to establish whether or not the remainder were implemented.

business; the majority expired within a short period of time. The networks of industrial and intellectual property agents, most of them lawyers and engineers, were increasingly responsible for the tasks of right extensions, payments, translations, and adaptations of technical descriptions to each patent system and to distinct administrative requirements.²⁹ Some previous research has clearly delineated the extent to which the descriptions of inventions changed in different patent systems and how firms and their agents toyed with administrative requirements to both achieve legal protection on the one hand and reveal the minimum key technical information of novel inventions on the other; this strategy is evident in Rudolf Diesel's Anglo-American, German, French, British, and Spanish patents.³⁰

What is also significant in analyzing Table 2.4 is how the percentage of corporate patents implemented varied depending on the country focused on. Although corporations from Germany and the United States patented more regularly in Spain after 1880, Belgium, the United Kingdom, and France—precisely the first three countries in total investments shown in Table 2.3—were the ones with more patent “effectiveness” in terms of compulsory implementation (31.4%, 29%, and 25.5%, respectively). On the contrary, the United States, Germany, and especially Switzerland and the Netherlands were well below these percentages (from 22% among US corporations to a low 11.7% in the case of the Netherlands). More or less the same holds in terms of patent duration. The United Kingdom and France had higher rates of active patents after five years (19.3% and 16.1%, respectively) than firms from any other country represented in Table 2.4 did; the United States, Germany, and Belgium represented between 12% and 13%, while Switzerland and the Netherlands came in with even lower percentage points. Thus,

although the differences do not seem entirely radical, they are remarkable enough to show that, even after 1880, during the second industrial revolution and the first technological globalization, geographic proximity and direct investments in Spain were still important in effectively extending patents and transferring technologies.

Another compelling means of measuring the real impact of a patent is by looking at the number of assignments and licenses registered during its life, no matter how short or long its duration was, as this number essentially represents an indirect proxy of both the technical quality of the invention protected and the business interest for innovation. Moreover, the corresponding legal transmissions could represent the real object for some foreign firms patenting in Spain from abroad, insofar as they were not really interested in making actual investments in the Spanish economy but rather needed national partners to maintain monopolies and get around compulsory implementation requirements. Thus, assignments and licenses could also teach us much about corporations' international strategies on technology transfer and its real consequences.

Table 2.5 demonstrates once again the apparent scarcity of business surrounding foreign corporate patents. Only a small percentage of them, around 6%, were officially assigned or licensed during the entire period studied, although the differences among countries are rather intriguing. Companies from the United States, the Netherlands, the United Kingdom, and even Germany had higher licensing rates than those from Belgium, Switzerland, Italy, and France. Comparing these ratios with those of implementation in Table 2.4 uncovers certain inverse relationships; a high level of implementation corresponds to a low level of assignments and licenses, an association that Belgium and the Netherlands exhibit in the extreme. This general tendency can also be observed in the US, German, French, and Italian examples, although not in those of the United Kingdom or Switzerland,

Table 2.5 Corporate patents from different countries by percentage of assignments and licenses. Spain, 1820–1939

	Assignments and Licenses %	Corporate Patents
Germany	6.2	9,585
France	5.4	6,354
USA	7.7	4,691
UK	7.0	4,406
Switzerland	3.9	2,120
Netherlands	7.6	1,226
Italy	4.9	1,079
Belgium	2.5	765

Source: See Figure 2.1

with high ratios of implemented patents and assignments corresponding to the former and low ones to the latter. Yet it seems reasonable to assume that firms from countries with direct investments and worthy patents in practice might have had less interest in assigning or licensing a monopoly that gave them technological advantages in competition. On the contrary, if patenting served as an international impetus from certain technical leaders, fewer implemented patents and more assignments or licenses would point to more interest in the commercialization of property rights than in applying the new innovations. These were two clearly divergent business strategies that paved two distinct paths of technology transfer. Once again, case studies are the only way to delve into and verify these processes.

CONCLUSIONS

Why did foreign corporations extend their patent rights to Spain and other peripheral countries after 1880? Were there really different protection strategies, and, if so, what were they? What was the real role of patents in technology transfer, and what were their consequences for backward nations? And, principally, what does it really mean to have a weak patent system? Was the Spanish one weaker than the Swiss or Dutch patent systems, which either did not exist or were abolished during certain significant periods to encourage imitation?³¹

This chapter has uncovered sufficient data for attempting to answer some of these questions and probably raising new ones. We have seen that firms' patenting in Spain was scarce before 1880 and seemed to be closely related to the existence of direct interests or investments in the country and to geographic proximity, as well. But from 1880 onward, corporate patent activity increased everywhere in an expansive initiative driven by progressive technological globalization and international market competition led by Germany, the United States, and other newcomers. This brand of patent expansion did not have a precise correlation to the levels and directions of foreign investments in Spain. Analyses of patent implementations and property assignments confirm the limited impact of the majority of those supposedly strong monopolies obtained by foreign corporations. On average, more than 75% of corporate patents were extinguished and released into public use in three years, a proportion that reached 85% when expanded to five years' time, while no more than 6% appear to have been licensed within Spain. All these percentages tended to increase if the firms based operations in countries with less direct investments in the Spanish economy.

Therefore, the huge patent expansion in the late nineteenth century seems to be part of a first global and general strategy of international corporations, especially from Germany and the United States but also France, the United Kingdom, Switzerland, and the Netherlands—countries that, regardless of whether they had clear intentions of investing, transferring, or even licensing

technologies in a particular country, registered and paid for exclusive rights in potential foreign markets. With the international generalization of the annual fee payments, it was likely cheaper and easier to first extend rights everywhere and then reflect on viable businesses in subsequent years than to use time and energy in selecting countries where patenting would be crucial. Although this strategy carried with it the risk of losing patent rights and making technological information public in some countries, at least that might serve to block similar patents from competitors. Industrial property agents and their networks were vital to this process.

Nevertheless, if a corporation had any interest in a country or a technology, it had to manage that intangible asset in some way. Extended case studies are needed to see how major firms used patent strategies. Our work in progress deals with data from 100 corporations with more than thirty patents in Spain during the nineteenth century and the first half of the twentieth century. The most significant ones (with more than 500 patents) were from Germany and the Netherlands, such as *I. G. Farbenindustrie A. G.*, *Fried. Krupp A. G.* and *N. V. Philips' Gloeilampenfabrieken*; others from the United Kingdom, France, and Switzerland represented more than 300 records each, including *Vickers Ltd.*, *Schneider et Compagnie*, and *Brown, Boveri et Compagnie*; there were also some from the United States (with around 150 patents each) such as the *United Shoe Machinery Company* and *Westinghouse Electric and Manufacturing Company*. The analysis currently underway will detail information on real patent strategies and technology management. Here, we will only discuss some of the general ideas and examples that typify these series of tactics that, of course, hinged on previous investments, geographic proximity, industrial sector, and the state of techniques and economy in the target country.

Table 2.6 illuminates two very different strategies followed by the selected corporations during the period analyzed. On the one hand, the Swiss *Brown Boveri et Compagnie* automatically extended patents to Spain from the central headquarters in Baden beginning in 1905 but implemented a low percentage thereof (16%) in workshops belonging to temporary partners. Only 10% of those patents managed to survive for five years. On the other hand, *Babcock & Wilcox Ltd.*, the English affiliate of the American *Babcock, Wilcox and Company*, registered approximately thirty patents between 1894 and 1918, the year in which a Spanish subsidiary was created. From that moment on, both corporations registered numerous strong patents in Madrid, with a high ratio of implementation and a very long duration. *Brown Boveri* (B&B) and *Babcock & Wilcox* (B&W) were strong multinationals insofar as they had affiliates and subsidiaries in other countries. B&B extended to Germany, France, Italy, and Norway. Its German branch also patented in Madrid after 1930, albeit to scant successes, as suggested by the implementation and time-duration percentages in Table 2.6. It seems that not having a direct ally, subsidiary, affiliate, or joint venture in Spain could have been an influence on the weak character of B&B's patents

Table 2.6 Patent activity in Spain by Brown Boveri and Babcock & Wilcox corporations, 1878-1939

Company's Name	Country	Patents: Principal Sector	Patents	Of introduction %	Implemented %	Implemented and Duration >5 y. %	Assignments & Licenses %
Brown, Boveri et Compagnie	Switzerland	Electricity	282	1.4	16.0	10.3	0.4
Brown Boveri & Cie. A. G.	Germany		28	0.0	3.6	3.6	0.0
Babcock & Wilcox Ltd.	UK	Steam Boilers, Furnaces, etc.	94	22.3	66.3	46.5	54.3
Sociedad Española de Construcciones Babcock & Wilcox	Spain		94	21.3	81.7	68.3	0.0
Deutsche Babcock & Wilcox Dampfkessel-Werke A. G.	Germany		1	0.0	0.0	0.0	0.0
Société Française des Constructions Babcock & Wilcox	France		1	0.0	100.0	100.0	100.0
The Babcock & Wilcox Tube Company	USA		1	0.0	0.0	0.0	0.0

Source: See Figure 2.1

and their high “mortality” rates. Thus, most of the technology patented by B&B was public information in Spain within a few years after being protected. One potentially captivating point for future investigation would be to explore how B&B managed patents and technology transfer in other countries where it operated or had affiliates, such as Germany.

On the contrary, B&W UK participated in the foundation of the *Sociedad Española de Construcciones Babcock & Wilcox* in Bilbao in 1918. With it, the company widely used and took advantage of the Spanish patent system. The Spanish section itself was created via the transfer of patents from the English company as a combined share of the initial capital.³² After that, both firms successfully patented technologies implementing high percentages of those patents (66% in the case of the British and 82% in the case of the Spanish) and keeping approximately 46% (the former) and 68% (the latter) active after five years. Not only did these companies boast impressive success percentages, but they also made noteworthy use of “patents of introduction”—copying and transferring technologies from third parties or competitors. The strategic links between both companies were prominent. They registered exactly the same number of patents, as if they had made a pact on tactics to manage technology transfers from the British side to the Spanish subsidiary. They had an impeccable knowledge of how to use the Spanish system to tap the benefits of patents of introduction and meet the compulsory working clauses on time, issues of which the local company had a particularly strong command. Furthermore, all the assignments made by the British parent company (54% of the patents) were to the Spanish one.

As in the case of B&B, it would be critical to compare the Spanish strategy employed by the British B&W with that applied in other countries like Germany or France, where there were also affiliates or subsidiaries, as well as with that of the United States parent firm, which, as Kristine Bruland has shown, seemed to be far from the British dynamism.³³ Notwithstanding, the American B&W applied the same tactic of selling patent rights to the British company and taking a part of the shares when founded.³⁴ The B&W strategy in Spain implied real and durable monopolies on technology, while B&B quickly opened its technologies to the public domain. Still, evaluations of these strategies demand close attention to the sorts of inventions and innovations that were protected. Operating with steam technologies and dealing in general mechanical construction, which could be easily copied toward the middle of the second industrial revolution even in countries such as Spain (which was able to manufacture its own locomotives, for instance, in 1884) are entirely different exploits from working with complex new science-based technologies, such as electricity and electrical devices, which might not be so skillfully imitated by competitors. This is especially true in countries without strong scientific/technical education and in patent systems without existing technical exams, which we have shown could produce a lack of vital scientific information.³⁵

Thus, the role of patents in technology transfer is complex. They could be a useful incentive where there were previous direct investments in the target nation, joint ventures with local capital, or any other dynamic agreements between domestic and foreign interests. Likewise, patents had a greater impact if they were accompanied by human capital from the country of origin in order to facilitate the technology transfer. In such cases, patents had obvious consequences in the “backward” nations, not only expanding opportunities to access new technologies but also improving their industrial development through the externalities linked to physical investments. While patents and technology transfers could also engender technological dependence and loss of profits in favor of foreign partners, local governments accepted these risks in order to promote industrial advancement and economic growth.

Last, we must revisit the final questions set out at the beginning of these concluding remarks. Was the Spanish patent system weak? Perhaps it was, as was the entire National Innovation System, in encouraging domestic scientific or inventive activity—but that was not its principal political intention. On the contrary, it was a “hybrid” patent system that, while providing enough protection to those firms who actually transferred technology and made investments in Spain (i.e., contributed to industrial transformations), also determinedly punished patent activity not focused on actual transfers (through compulsory working clauses) or marked by a lack of interest in the country (exemplified by patents of introduction). Many other European states used similar strategies during the Industrial Revolution to facilitate technology transfers and imitations, ranging from the wide use of patents of introduction and replicas everywhere, the United Kingdom included, to the actual elimination of patent law, as was the case in the Netherlands. Anything that stimulated catch-up processes or took advantage of spillovers from innovation activity was valid. The United States itself used World War I to confiscate private German patents from chemical corporations, test and diffuse the protected technical information, and fortify American competitors.³⁶ Earlier, in the late nineteenth century, German machine-tool builders had made a custom of copying the US manufacturers who publicly complained about it, just as now German entrepreneurs protest against Chinese counterfeiting.³⁷ This time-honored tradition, as it were, has close ties with patent management. Chinese and Indian firms are supported by their respective governments in playing this “game,” but the small developing countries of today cannot even sit at the table.

NOTES

* This work was supported by the Collaboration Agreement between the *Oficina Española de Patentes y Marcas* and the *Universidad Autónoma de Madrid* for Cataloguing and Studying the Historical Documentation on Patents and Trademarks (1999-2012) and by the multidisciplinary research project UAM-CEMU-2012-034.

1. The seminal work on the internationalization of patent systems is Edith T. Penrose's *The Economics of the International Patent System* (Baltimore,

- 1951). See also Yves Plasseaud and François Savignon, *L'Etat et l'invention: Histoire des brevets* (Paris, 1986), 73–83, and Eda Kranakis, “Patents and Power : European Patent-System Integration in the Context of Globalization,” *Technology and Culture* 48 (2007): 689–728, (see 694–698).
2. See Anna Guagnini, “Patent Agents, Legal Advisers and Guglielmo Marconi’s Breakthrough in Wireless Telegraphy,” *History of Technology* 24 (2002): 171–201; Gabriel Galvez-Behar, “Des médiateurs au coeur du système d’innovation: Les agents de brevets en France (1870–1914)” in *Les archives de l’invention*, ed. M. S. Corcy, C. Douyère-Demeulenaere, and L. Hilaire-Pérez, (Toulouse, 2006), 437–447; and David Pretel and Patricio Sáiz, “Patent Agents in the European Periphery: Spain (1826–1902),” *History of Technology* 31 (2011): 97–114.
 3. For details of countries and join dates, see WIPO, “Industrial Property Treaties Administered by WIPO,” *Industrial Property* January (1994).
 4. A complete explanation of the main legal characteristics of the Spanish patent system and its evolution throughout the nineteenth and twentieth centuries can be found in Patricio Sáiz, “The Spanish Patent System (1770–1907),” *History of Technology* 24 (2002): 45–79, Section 2.
 5. One year from 1826 to 1878, two from 1878 to 1902, and three years from 1902 onward.
 6. See, for instance, the “2009 International Piracy Watch List” elaborated by The Congressional International Anti-Piracy Caucus of The United States Congress.
 7. This was a very interesting period in Spain for science and technology. Internationally recognized inventors such as Leonardo Torres Quevedo, Isaac Peral, and Juan de la Cierva, as well as the first Spanish person to win the Nobel Prize in Science (Santiago Ramón y Cajal), carried out their work during these years. See José Manuel Sánchez Ron, *Ciencia y sociedad en España de la ilustración a la Guerra Civil* (Madrid, 1988) and *Un siglo de ciencia en España*, ed. Jose Manuel Sánchez Ron (Madrid, 1998).
 8. See Concha Betrán, “La transferencia de tecnología en España en el primer tercio del siglo XX: El papel de la industria de bienes de equipo,” *Revista de Historia Industrial* 15 (1999): 41–81.
 9. A general view of foreign investments in Spain can be found in Teresa Tortella, *A Guide to Sources of Information on Foreign Investment in Spain, 1780–1914* (Amsterdam, 2000). See also Nuria Puig and Rafael Castro, “Patterns of International Investment in Spain, 1850–2009,” *Business History Review* 83 (2009): 505–537.
 10. See the acknowledgement note at the beginning. Around 70 people have been involved in this enormous and well-supported project for a decade (see <http://historico.oepm.es> for further details).
 11. See Ian Inkster, *Science and Technology in History. An Approach to Industrial Development* (London, 1991), 160–166. Also see John Cantwell and Birgitte Andersen, “A Statistical Analysis of Corporate Technological Leadership Historically,” *Economics of Innovation and New Technology* 4 (1996): 211–234, and Birgitte Andersen, *Technological Change and the Evolution of Corporate Innovation. The Structure of Patenting, 1880–1990* (Cheltenham, 2001), 28–34.
 12. The Restoration brought about a political and economic period of stability characterized by a new constitution and such new economic regulations as, among others, the Public Works Law (1875), the Railways Law (1877), the Patents Law (1878), and the new Commerce Law (1885). During these decades, the industrial and agricultural production indices developed, the integration of the national market was completed, and the protectionist turn began.

13. See Sáiz, "The Spanish Patent System," or Patricio Sáiz, *Invencción, patentes e innovación en la España contemporánea* (Madrid, 1999) (available free of charge on Google Books).
14. See Edward Beatty and Patricio Saiz, "Propiedad industrial, patentes e inversión en tecnología en España y México (1820–1914)" in *México y España ¿historias económicas paralelas?* ed. R. Dobado, A. Gómez and G. Márquez, (México D. F., 2007), 425–467, particularly patenting determinants for foreigners (Table 6) and domestic parties (Table 7). "Foreign patents," calculated as a two-year cumulative sum of patents taken in France, Britain, Germany, and the United States, was a relevant variable in the regression results for foreign patenting activity in Spain, as it also was the dummy variable for the patent law of 1878.
15. See Sáiz, "The Spanish Patent System," Table 5.
16. See Sáiz, *Invencción, patentes e innovación*, 163–169 for an analysis of these firms before 1880.
17. See Patricio Sáiz, "Patents, International Technology Transfer and Spanish Industrial Dependence, 1759–1878" in *Les chemins de la nouveauté: Innovation, inventer au regard de l'histoire*, ed. L. Hilaire-Pérez and A. F. Garçon, (Paris, 2003), 223–245, 233, Graph 1.
18. *Société Anonyme du Cuivre Français* (OEPM, *Privilegio* n. 5310, 5312, 5374, 5410); *Société du la Tonnellerie Mécanique* (OEPM, *Privilegio* n. 5328); *Les Forges et Fonderies de Montataire S. A.* (OEPM, *Privilegio* 5547); *Société Metallurgique d'Exploitation Méthode Ponsard* (OEPM, *Privilegio* n. 4934).
19. See Santiago Riera, "Industrialization and Technical Education in Spain 1850–1914" in *Education, Technology and Industrial Performance in Europe, 1850–1939*, ed. R. Fox and A. Guagnini (Cambridge, 1993), 141–170.
20. Joel Mokyr, *The Gifts of Athena: Historical Origins of the Knowledge Economy* (Princeton, 2002).
21. Daniel R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850–1940* (New York, 1988).
22. For a general view of the changes occurred in international patenting, see Ian Inkster, "Technology Transfer in the Great Climacteric. Machinofacture and International Patenting in World Development circa 1850–1914," *History of Technology* 21 (1999): 87–106.
23. For more on German chemical firms' patent landing in the United Kingdom in the late nineteenth century, see Ian Inkster, "Patents as Indicators of Technological Change and Innovation: An Historical Analysis of the Patent Data, 1830–1914," *Transactions of the Newcomen Society* 73 (2003): 179–208, Table 8
24. See note 5.
25. From the beginning of the protection system until 1838, and especially until 1849, there was hardly any control over patent implementation. However, a radical change introduced first by the Royal Order of the 26th of March, 1838, and reinforced then by the Royal Order of the 11th of January, 1849, precipitated an efficient control from 1849 to 1878, when notarized independent reports were required. Between 1878 and 1924, the implementation procedure was relaxed; in some cases, a report by an engineer certifying that the necessary means to produce an object existed at such-and-such a factory was sufficient, but nonetheless it still was a difficult requisite to beat. In 1924, the regulation of the 15th of January strengthened the practice clauses and required implementation under penalty, at first, of a forced compulsory license of the patent to whoever applied, and then, once the law of the 26th of July of 1929 was passed, included an expiration date in three years if nobody took the license.

26. The duration of the monopoly is used as a measure of patent value: see J. Streb, J. Baten and S. Yin, "Technological and Geographic Knowledge Spillover in the German Empire 1877–1918," *Economic History Review* 59 (2006): 347–373. The authors selected as German valuable patents all that survived at least ten years.
27. This is true except for patents of introduction, which only lasted a maximum of five years (ten years after 1929). These types of patents were still subject to the same requirements of compulsory implementation.
28. The only exception is that between 1924 and 1929, a nonimplemented patent did not expire if the patentee publicly offered a compulsory license. After 1929, however, the firm had three years to put into practice and another three years for offering compulsory license. The patent then expired and the technological information became public. See note 25.
29. See note 2.
30. Each technical description was translated and adapted to each national patent system to fulfill the basic requirements. Analyzed by an expert engineer, all the patents had a lack of relevant technical information, which was a real problem in systems without previous examination. See Ruben Amengual, *Bielas y álabes: Evolución histórica de las primeras máquinas térmicas a través de las patentes españolas, 1826–1914* (Madrid, 2008), 116–131.
31. Switzerland rejected patent laws until 1888. The Netherlands rescinded its legal structures between 1869 and 1912. Denmark also took advantage of the nonexistence of patent law to copy; see Petra Moser, "How Do Patent Laws Influence Innovation? Evidence from Nineteenth-Century World's Fair," *American Economic Review* 95, 4 (2005): 1214–1236.
32. OEPM, *Patente* n. 28, 258. This file contains the official documents by which the British B&B assigned several patents for the foundation of the Spanish affiliate.
33. See Kristine Bruland, "The Babcock & Wilcox Company: Strategic Alliance, Technology Development, and Enterprise Control, circa 1860–1900" in *From Family Firms to Corporate Capitalism. Essays in Business and Industrial History in Honour of Peter Mathias*, ed. K. Bruland and P. O'Brien (Oxford, 1998), 219–245.
34. *Ibid.*, 238.
35. See note 30.
36. See Kathryn Steen, "Confiscation and the Challenge of Emulation: American Expertise and German Chemical Patents, 1914–1930," *Patents in the Past, Maison des Sciences de l'Homme*, 23 September 2006 (unpublished). See also Kathryn Steen, "Confiscated Commerce: American Importers of German Synthetic Organic Chemicals, 1914–1929," *History and Technology* 12 (1995): 261–284 and "Patents, Patriotism, and 'Skilled in the Art': USA v. The Chemical Foundation, Inc., 1923–1926," *Isis* 92 (2001): 91–122.
37. Ralf Richter and Jochen Streb, "Catching-Up and Falling Behind: Knowledge Spillover from American to German Machine Toolmakers," *Journal of Economic History* 71, 4 (2011): 1006–1031.

First published 2014
by Routledge
711 Third Avenue, New York, NY 10017

and by Routledge
2 Park Square, Milton Park, Abingdon, Oxon OX14 4RN

*Routledge is an imprint of the Taylor & Francis Group,
an informa business*

© 2014 Taylor & Francis

The right of the editors to be identified as the author of the editorial material, and of the authors for their individual chapters, has been asserted in accordance with sections 77 and 78 of the Copyright, Designs and Patents Act 1988.

All rights reserved. No part of this book may be reprinted or reproduced or utilized in any form or by any electronic, mechanical, or other means, now known or hereafter invented, including photocopying and recording, or in any information storage or retrieval system, without permission in writing from the publishers.

Trademark Notice: Product or corporate names may be trademarks or registered trademarks, and are used only for identification and explanation without intent to infringe.

Library of Congress Cataloging-in-Publication Data

Organizing global technology flows : institutions, actors, and processes / [edited by] Pierre-Yves Donzé, Shigehiro Nishimura. — (Routledge international studies in business history ; 24)
pages cm. — Includes bibliographical references and index.

1. International business enterprises—Technological innovations.
2. Technology transfer. 3. Technological innovations—Economic aspects. 4. Economic development. I. Donzé, Pierre-Yves.

II. Nishimura, Shigehiro.

HD62.4.O745 2013

338'.064—dc23

2013022947

ISBN: 978-0-415-84390-4 (hbk)

ISBN: 978-0-203-75298-2 (ebk)

Typeset in Sabon
by Apex CoVantage, LLC