
How does knowledge cross borders? French technology transfer and the SOFRE group in the Spain of the Planning, 1959–1976

Rafael Castro Balaguer*[†] and Esther M. Sánchez Sánchez**

In this article, we study the behavior of French technical consulting firms in the Spain of the Planning (1959–1976), when the Spanish market increased its competitiveness as a result of the liberalization and modernization of its economy. For this purpose, the main players—both the French and their Spanish partners—have been identified, and the strategies, models, and sectors in which the French technical consultancies specialized in Spain have been analyzed. Our research reveals that French firms mainly operated via technical assistance contracts when providing services to the classical sectors of French investment in Spain between the first and the second industrial revolutions. These sectors include mining, railroads, iron and steel, chemicals, and electricity. The French role in these activities was based on their experience and knowledge of the market, in turn resulting from their historical presence in the neighboring country. The article is also useful to assist the available literature regarding business consultancy in the conceptualization of how management knowledge is transferred from one country to another.

JEL classification: F14, L84, N74, N84.

*Rafael Castro Balaguer, Fac. Economía y Empresa, Dpto. Análisis Económico, Teoría Económica e Historia Económica, Universidad Autónoma de Madrid, Madrid, Spain. e-mail: rafael.castro@uam.es

**Esther M. Sánchez Sánchez, Fac. Economía y Empresa, Dpto. Economía e Historia Económica, Universidad de Salamanca, Salamanca, Spain. e-mail: esther.sanchez@usal.es

[†]Main author for correspondence.

1. Introduction

This article explores how management knowledge crosses borders over time. This crucial yet under-researched topic is approached through the long-term and empirical analysis of a case study: the knowledge transfer from France to Spain via technical consultancy activity since the 1960s. We base our consideration on the data collected in a database of technical consulting activity between 1960 and 1979 and on some in-depth studies of the most outstanding French technical consulting firms, the so-called Sociétés Françaises d'Études (SOFREs). We use the tools and perspectives of business and economic history to explain how multinational enterprises (MNEs) influence knowledge transfer between countries and boost economic growth.

The international business literature provides two different frameworks that shed some light on the subject. At the firm level, international business scholars have paid much attention to foreign direct investment (FDI) spillovers on host economies, emphasizing the role of MNEs in the transfer of technology and capabilities among countries (Kogut and Zander, 1993). The increase of human capital has been among the effects that FDI has on the host country, as identified by economists. However, even with an evolutionary economic approach, we know very little about how these capabilities are created or how FDI contributes to their formation in the local business community.¹

At the international level, the contribution of international knowledge spillovers to endogenous socioeconomic growth has been widely recognized: Transfers from technological leaders have positive effects on developing countries (particularly in regard to productivity gains), accelerating their modernization and catching-up processes (Romer, 1990; Grossman and Helpman, 1991; Griliches, 1992; Coe and Helpman, 1995; Helpman, 1998; Caniels, 2000; Keller, 2004; Lee, 2006; Hidalgo and Molero, 2010; among others). However, how is the transfer realized? The landmark work by Abramovitz (1986) pays attention to the concept of backwardness as an opportunity for catching up on technology because undeveloped countries have the “social capability” to absorb more advanced technologies (Barbiellini *et al.*, 2011: 7). Abramovitz adopts the concept of “social capability” (Ohkawa and Rosovsky, 1973) to refer to the factors that inform a country’s ability to appropriate technological and organizational change. He identifies them in terms of the extent of foreign technical competence—for which education might be a rough proxy—to the

¹ As a way to transfer these capabilities, international business literature has paid a great deal of attention to the role of networks to overcome the liability of outsidership (Dunning and Lundan, 2008; Johanson and Vahlne, 2009: 1414), e.g. the social capital theory (Portes, 1988). This concept, as embodied in the relationships between MNEs and local politicians and business elites in developing countries, was also applied to the study of FDI, MNEs, and the ability to transfer capacities among countries (Vernon, 1971). Recent literature on business groups has paid attention to the relationships established by MNEs among local groups in protectionist, developing nations (Amsden and Hikino, 1994; Kock and Guillén, 2001; Guillén, 2010).

local political, commercial, and financial institutions. Yet another limitation to the absorption of technology from leading countries is represented by limited “technological congruence” (Abramovitz, 1993, 1994), such as market size, stage of development, and scale of production, in which new technology is generated and adopted (Fagerberg, 1994).

We present here a rather exceptional case study that aims to integrate both frameworks (firm and international levels) through the experience of a backward country (Spain) that tried to modernize its economy in the 1960s and 1970s. Given its serious internal shortcomings in research and development, Spain largely did this by resorting to the importation of external technology through three different channels: international trade, FDI, and payments of patents, licenses, and/or technical assistance from other countries (Cubel *et al.*, 2012). This is confirmed by historical data on patents (Saíz, 2013), education expenditure (Núñez, 2005), and imports of machinery and equipment (Tena, 2005). Access to foreign technology allowed Spanish companies to accrue savings in time, money, and risks, but it also resulted in the national economy’s significant degree of dependence on the exterior (O’Brien, 1976; Muñoz *et al.*, 1978; Sánchez and Paloma, 1983; Braña *et al.*, 1984; López, 1992; López and Valdalisó, 2001; López and Cebrián, 2004; Cebrián, 2005, 2008, 2009; Álvaro, 2009, 2011).

The backdrop of this history is the Stabilization Plan of 1959, which represented the starting point for the opening up of the Spanish economy and the commencement of a long journey toward its incorporation into a market economy. Protectionism had been a recurring procedure of Spanish economic policies during the last years of the 19th century and the first decades of the 20th. Both agricultural and industrial protection rates had reached very high levels compared with other European countries, particularly after the promulgation of Cánovas and Cambó Tariffs (1891 and 1922)². Nevertheless, it was during the first governments under Franco (1940s and, to a lesser extent, 1950s) that protectionism reached its maximum levels because it was not limited to mere temporary tariff barriers but involved an oppressive rationing in the purchase of foreign goods and services, along with prior authorization for every external transaction. This extremely protectionist and interventionist policy, which connected more with European fascism than with the Spanish system of the turn of the century, disrupted the market mechanism for allocating resources, harmed private and foreign enterprises, and thus increased the relative backwardness of the Spanish economy.³ To stimulate economic

² For an historical approach to Spanish protectionism, we refer to Herranz and Tirado (1996) and Tena (1999, 2005, 2010).

³ In practice, however, the intended autarky was never absolute. During the 1940s and 1950s, domestic and foreign agents started negotiations and concluded agreements that greatly facilitated the full cooperation developed in the 1960s under more favorable legislation. See the case of French players and an updated review of the literature about the subject in Sánchez and Castro (2013).

development, the technocratic governments in power in the 1960s first enacted the aforementioned Stabilization Plan and then three Development Plans, with the support of the European Organization for Economic Cooperation, the International Monetary Fund, and the World Bank.

The main objective of the new economic policy was to alleviate the country's financial difficulties so that sustained and balanced growth could be fostered once the problem was solved. Principally, this was based on the reestablishment of financial discipline, the creation of a fixed exchange rate for the peseta (using realistic criteria), the opening up of foreign investment and trade, and the introduction of a mixed economy that combined market and state forces.⁴

Nevertheless, the Stabilization Plan did not produce all of the expected liberalizing results (Fuentes Quintana, 1984: 25–40). High inflation and a persistent commercial deficit, together with the regressive pressure exercised by institutions such as the state-owned holding National Institute of Industry (INI)—with its first and most long-term president, Juan Antonio Suanzes, at the head—provoked an intensification of government intervention. The prolongation of the state's hand was reflected in the economic planning adopted in 1963, based on the World Bank's 1962 best-selling report about Spain's economic development, 20,000 copies of which were sold that year (IBRD, 1962; García Delgado, 1987: 175). The report's recommendations referred to the conduct of “preliminary studies for the preparation of an Economic Development Plan” and “on the long term,” the establishment of the bases “for the expansion and modernization of the Spanish economy,” “the improvement in the standard of living,” and “the implementation of financial stability” (De la Torre and García-Zúñiga, 2009: 65; De la Torre, 2011; De la Torre and García-Zúñiga, 2013). Employing this ideological basis, three Development Plans were implemented between 1963 and 1975. In all of them, the state programmed economic growth within the bounds of stability, thereby conditioning private initiative, to gear it in the direction of the goals established in each Plan. The success or failure of these three Development Plans and their influence on the so-called “Spanish economic miracle” has been strongly debated.⁵ One of the coinciding opinions among researchers has been that, without foreign financial and technical support, the achievement of the governmental objectives would have been difficult, if not impossible (Ullastres, 1975; Muñoz *et al.*, 1978: 263–267; García Delgado, 1987: 175).

As a result of this situation, the general overview of Spanish planning has basically been negative (Tamames, 1989: 59); some scholars conclude that without the Development Plans of Spanish growth in the period (in excess of an average of 6%

⁴ The commitment of the Spanish government to stabilization was ratified in the Decree-Law regarding Economic Planning of June 21, 1959.

⁵ A summary may be found in De la Torre and García-Zúñiga (2009: 13–14).

annually) would have been even greater (Fuentes Quintana, 1995: 131). Given that the majority of the investment relative to the Development Plans targeted the sectors that were considered to yield immediate returns and overlooked heavy industry, which was mainly invested in by the public sector, development was criticized not only quantitatively but also qualitatively (De la Torre and García-Zúñiga, 2009: 83).

Nonetheless, assessing the possible positive or negative influences on the country's economic development, we concur with De la Torre and García-Zúñiga (2009: 13) that the economic history of the Development Plans remains to be verified and that little is known about the means by which the diffusion of developmentalism was undertaken. The present study analyzes one of these means of transmission: the consulting firms, in this case, those of French origin.

Why this sector and why France? The answer to this double question is related to the main objectives of and influences on Spanish planning. In fact, if the final goal of the Plans were the development of the country, it would only be possible by means of the economic and organizational rationalization of its production system, which would lead to a greater competitiveness (Kipping and Puig, 2003: 123–126). For this purpose, as previously mentioned, it was necessary to resort to foreign know-how. Given that France had acquired a strong world position in scientific and technological development in the second half of the 20th century and had traditionally constituted one of the historical foreign trading and investing partners of Spain, the study of how French consulting firms behaved and how they participated in the diffusion of developmentalism on the other side of the Pyrenees remains indispensable.⁶

For this purpose, the main players—the French and their Spanish partners—have been identified, and the strategies, models, and sectors in which the French technical consultancies specialized in their neighboring country have been analyzed. Our research reveals that the French firms acted above all via technical assistance contracts when providing services to various classical sectors of French investments that were made between the first and second industrial revolutions: mining, railroads, iron and steel, chemicals, and electricity. The French presence within these activities was based on their experience and knowledge and thus allowed them easier access to the corresponding markets.

The structure of this article is as follows. Following the introduction, the second section highlights the main landmarks of French influence on Spanish indicative planning. The third section provides the background of the technical consultancy sector in Spain, identifying its main individuals and institutions. The fourth and fifth sections are dedicated to examining the quantitative and qualitative evidence used in

⁶ At the end of the 1960s, France registered an annual average of 11 500 of their own patents (2500 in Spain) and devoted approximately 3% of its national income to R&D activities (0.3% in Spain) (OECD, 1968). Conversely, France accounted for 10–20% of the Spanish total inward FDI and 15–25% of the Spanish total trade during this period (Puig and Castro, 2009; Castro, 2011).

our case study: on the one hand, the database of bilateral contracts regarding transferring technology and technical services and, on the other hand, the French group SOFRE's trajectory in Spain. The analyses of this information serve to corroborate the previous results and assist in the conceptualization of the topic in light of the available literature on business consultancy.

2. French assistance to Spanish indicative planning

As far as foreign investment is concerned, developing Spain constituted a market of >30 million persons, with a cheap but not highly qualified labor force. France used all of its influence on the Spanish political and financial authorities to exercise a presence within this economic environment. It was clear to French agents that planning would serve as a catalyst for business opportunities, a quick road for the entry of French goods, capital, and technologies, and an excellent way to gain market share to the detriment of other foreign competitors. Therefore, although not the only country, France was the main point of reference for initiating *indicative planning*⁷ in Spain (Sánchez Sánchez, 2006: 166).

The 1958 visit to Spain of Jacques Rueff, the father of the French economic reform of that year, constituted the first step in adopting the French model. Invited by José Solís (General Secretary of the [Francoist] Movement) and mediated by Antoine Pinay (French Minister of the Economy), Rueff privately visited Juan Lladó in the offices of Banco Urquijo (one of the most important corporate banks in Spain) and later met with other representatives from the Spanish world of economics and finance in the Bank of Spain.⁸ His conferences, in which he summarized his experiences in France and explained the actions that should be taken in Spain, had a great influence upon his listeners (López Rodó, 1971; Navarro Rubio, 1991). His advice was very useful in preparing the Stabilization Plan of 1959, which was to be the first decisive step toward development.

The Development Plans also followed other high-ranking figures' visits to Spain. For instance, François Perroux, the father of the theory of areas of development in France, was invited to head various meetings in Madrid and Barcelona in 1962.⁹ In

⁷ The planning known as "indicative" first emerged in France at the end of the World War II as a distinctive economic policy that, in contrast to the planning of the 1930s, left a significant space to the free interplay of market forces. Further details can be found in Estrin and Holmes (1983) and Kuisel (1984).

⁸ Unfortunately, there is no written record of the conversations that took place in the Urquijo meeting. It is mentioned in the Archives of the French Chamber of Commerce in Madrid, Bulletin 402 (April 1958) and in the Centre of Economic and Financial Archives of France, B 10837: 'Notes on the issue of the Stabilization Plan of Spain, visit of Jacques Rueff' (April 11, 1958).

⁹ AMAE-F, Volume 361, 'Telegram and Report on the visit of Perroux to Spain' (December 1, 1962).

addition, commissions comprising French engineers and consultants prepared many of the recommendations set forth by the World Bank.¹⁰ In this respect, the opinion of the economist Fabián Estapé, one of the principal advisors for Spain's new economic policy, is significant: “[We] were not asked to invent garlic soup (i.e. the wheel), but rather just copy the French system to the letter” (Estapé, 2001: 197).

Thus, the organizational outline of the Plan's committee, created in 1962 and headed by Laureano López Rodó, clearly reflected its French inspiration (López Rodó, 1990: 77). Other initiatives, such as the Coordinated Actions (*Acciones Coordinadas* in Spanish) between the state and selected industrial sectors, the Poles of Development (Vigo, La Coruña, Valladolid, Saragossa, and Seville), and the Poles of Industrial Promotion (Huelva and Burgos) also followed the French system.¹¹

Apart from these specific examples, other reasons may explain the preponderance of French influence. In the first place, the challenge of *Grandeur of France*, which was the leitmotiv of De Gaulle's governments during the first stage of the Fifth Republic, should be taken into account. A significant turn in economic policy occurred starting in 1958, reflecting a weighty liberal change. On the international level, an intense economic diplomatic policy was put into effect to conquer markets for French exports, though there was no specific plan for the Iberian Peninsula (Sánchez Sánchez, 2006; Badel, 2010). Within the realm of this economic diplomacy, Spanish–French relations were characterized by a clear institutional “serenity” in comparison with other periods (Martínez and Antonio, 1993; Dulphy, 2002; Delaunay, 2011). The stability of the Foreign Affairs Ministries in both countries—led by Maurice Couve de Murville in France and Fernando María Castiella in Spain—resulted in an intense diplomatic collaboration, perhaps facilitated by the presence of Opus Dei members on both sides of the border, as indicated below (Pardo Sanz, 2001). Additionally, many French representatives adapted well to the Spanish idiosyncrasy, given the lack of full democratic control in France at that time (Broder, 2000: 194). To a greater or lesser extent, all of these issues influenced the French Plans that were considered and selected for use in Spain.

It would seem clear that the French foreign policy and advisement to the Spanish authorities won out over other nations. Nonetheless, the paradox lies in the fact that as the bilateral government relations became consolidated, the volume and influence of French FDI shrank (Castro, 2011: 171–174). Despite these results, the French authorities always considered the supply of “gray matter” to Spain indispensable to guarantee at the very least a certain French presence in the Spanish marketplace

¹⁰ Archivo de la Fundación de Ferrocarriles Españoles (AFFE, hereinafter), Report R/32-01: ‘Information for the BIRF Commission and the RENFE Modernization Plan’. The report contains information regarding other French commissions, such as those pertaining to mining or the iron and steel industry. All of the authors were French.

¹¹ In the majority of these areas, there was a presence of major French firms: Renault in Valladolid, Citroën in Vigo, Pechiney in La Coruña or Saint Gobain in Burgos (Sánchez Sánchez, 2006: 168).

(Sánchez Sánchez, 2006: 224). An example of this materialized in the actions of the technical consultancies, the sector that is addressed in the following section.

3. Origins of the technical consultancy sector in Spain

The origins of the consultancies as a relevant sector within the economy date to the end of the 19th century, when the precepts of American scientific management began to spread on a generalized basis. Since that time, and within an historical perspective, there have been three generations of consultancies, dependent on the degree of development of a set economy (Table 1). These three generations, which all originated in the USA, have overlapped throughout the years. This scheme was reproduced in Spain with few variations, though much later and always in connection with foreign investments, the majority of which were European in origin.

During the first half of the 20th century, engineering consultancy in Spain, as in the rest of Europe, was a service that was closely connected with public works (railways, mining, electricity, building, and chemical industries) and linked to laboratories and engineering departments of the major international industrial groups of the time (rather than provided by independent service companies, as it is currently) (Álvaro, 2012).

Starting in 1953, the main influence on Spanish consultancy came from the USA. The treaty signed by both countries allowed for the gradual transfer of American technology, innovation, and knowledge to Spain, basically through a fixed program (technical assistance), a military aim (the construction of bases and related infrastructure), and a few outstanding individuals (Fermín de la Sierra being particularly noteworthy) (Egurbide, 1976; Puig and Álvaro, 2004; Álvaro, 2012). Since the 1950s, the training of Spanish impresarios, managers, and technicians to achieve productive rationalization became one of the prime objectives of national developmentalism under American auspices. The spreading of such ideas was secured by the participation of both official and private agents.

With regard to public entities, it should be noted that de la Sierra was the secretary of the National Commission for Industrial Productivity (Comisión Nacional de Productividad Industrial, CNPI), by means of which the main technical training projects were designed: the regional commissions for industrial productivity and, most of all, the Escuela de Organización Industrial (EOI). Within the private sector, the most significant channels were the Asociación para el Progreso de la Dirección (APD), which was created in 1956, and a large number of business schools and consulting firms that appeared at nearly the same time (Puig and Fernández, 2008). Apart from the aforementioned EOI (1955), the Instituto Católico de Administración de Empresas (ICADE, 1956), the Escuela de Administración de Empresas (EAE, 1957), the Instituto de Estudios Superiores de la Empresa (IESE, 1958), the Escuela de Alta Dirección y Administración (EADA, 1958), the Escuela

Table 1 The three generations of consultancies and their implantation in Spain

Wave/ generation	Central theme	Date of appearance	Major expansion	Arrival to Spain	Most important consultancies (particularly in Spain)
Scientific organization of labor	Rationalization and productive effi- ciency. Spread of <i>Taylorism</i> .	1900s	1930s–1950s	1950s	Bedaux (Kipping 1999)
Management, organization and strategy	Decentralization, planning, and strategy. Spread of the multidivi- sional company.	1930s	1960s–1980s	1980s	McKinsey (Mckenna 1995)
IT and communications	External and in- ternal coordin- ation, flows of information. Maximization of the chain of value.	1960s	1990s	1990s	Accenture, IBM, Gemini

Sources: Adaptation of Kipping and Puig (2003: 115).

Superior de Administración de Empresas (ESADE, 1958), the Escuela Superior de Ingenieros Comerciales (ESIC, 1965) and the Instituto de Empresa (IE, 1973) were also created hand-in-hand with the process of the liberalization (and Americanization) of the Spanish economy. The majority of these schools were established in Madrid or Barcelona, and many of them were patronized by Catholic congregations that were allied to the technocratic movement, particularly the Opus Dei and the Society of Jesus (Puig and Fernández, 2003).

With regard to the consultancies, Bedaux—the Spanish affiliate that was established in 1952 and headed by the wife of its creator, Charles Bedaux—practically monopolized the sector of business consulting firms in the 1950s and 1960s (Kipping and Puig, 2003: 119). Additionally, the French firm TEA-CEGOS, associated with APD, permitted the spreading of American assistance to European institutions on the path to facilitating the professionalization of Spanish companies (Puig, 2008: 474). It is worth noting the relative resistance of public companies, especially those related to the INI, to this modernization process (Puig, 2002). Though the largest consultancies knocked on the doors of state-owned firms from the 1950s onwards, most of them were not very welcome. Public universities also did not take part in this

American-style modernization drive because they were affected by the insufficiency of financial and human resources, the underdevelopment of engineering and technical studies, and the lack of links to business and industrial circles (Montoro, 1981; Carreras and Ruiz, 1991). Only the technocratic influence that commenced in the 1960s contributed to the expansion of engineering and technical courses and the recruitment of experts: engineers in rationalization and productive efficiency became the first generation of consultants.

This first wave originated in the USA and reached Spain having been filtered by European action, particularly that of the French and Belgians, because the consulting firms in those countries did not simply accept the American patterns (Schröter, 2005); rather, they were the ones that “in the beginning ‘humanized’ the Taylor method [...] to improve the levels of productivity and labor relations in the Old World” (Kipping and Puig, 2003: 132). This intermediation is obligatorily related to the economic and cultural influence of those countries of the North with a secular investment presence in the Spanish market (Puig and Castro, 2009).

4. Presentation and use of the database

As previously mentioned, due to the outdated Spanish national technology, the most rapid formula for gaining competitiveness and accelerating development was by means of the importation of foreign technology. This reduced time frames, expenses, and risks because in the majority of the cases, it made it unnecessary to undertake basic research and allowed the direct application of the imported knowledge. In the 1960s, a time of economic growth and international integration, Spanish government approved some initiatives to promote research in both the public and private sectors, mainly within the framework of the II Development Plan and the mandate of Manuel Lora-Tamayo at the helm of the Ministry of Education and Science, including new agencies, additional funding, and cooperation agreements. Efforts were focused on public research centers and universities and on companies related to sectors of activity prioritized in the II Plan, such as aeronautics or nuclear energy. Nonetheless, all of the internal and external reports during this time¹² continued to underscore the serious shortcomings of the Spanish research system, particularly in public universities. Basic research was concentrated in public research centers, headed by the Superior Council for Scientific Research (CSIC), and applied research, which was dominant, was mostly conducted within enterprises via foreign technology transfer.

¹² For instance, the 1964 OECD Report (*Country Report on the Organization of Scientific Research: Spain*) or the *Libro Blanco de la Educación* en España edited in 1969 by the Spanish Minister of Education and Science José Luis Villar Palasí. Further information can be found in López-Piñero (1991), Sebastián and Muñoz (2006), and Romero and Santesmases (2008).

The lax regulation of the transfer of technology also encouraged its introduction into Spain¹³, although its imprecise content often resulted in a wide variety of procedures in terms of time and control and the confusion of the transfer of technology with veiled foreign investment (Martín González and Rodríguez, 1977; Muñoz *et al.*, 1978: 80–87; Braña *et al.*, 1984).

According to the information provided by the Spanish Ministry of Industry (and compiled by the review *Economía Industrial* since 1963), the French firms maintained in Spain a privileged position regarding the transfer of technology and technical assistance.¹⁴ They obtained >25% of the total contracts signed between 1959 and 1979, surpassing the USA (20%), Germany (19%), Switzerland (7.25%), and the UK (7.24%).¹⁵ All of these contracts had to be registered in the Ministry of Industry for approval before they were put into effect. However, this registry is difficult to interpret because it does not reflect the totality of the operations that were performed to transfer technology/technical assistance. Some authors believe that the Ministry of Industry had access to only two-thirds of the existing contracts (O'Brien, 1976: 39), even if the sampling is not biased (Cebrián, 2005: 2). French and Spanish official records state that French superiority was due to (i) the vicinity of the two countries, leading to significant savings in the transportation costs of people and goods; (ii) the relative abundance of bilateral co-manufacturing agreements, which involved a high percentage of participation of the Spanish industry that required French assistance; and (iii) the fact that the French companies submitted to the Spanish authorities the greatest number (if not value) of contracts (Sánchez Sánchez, 2006). These hypotheses seem plausible but insufficient.

Consequently, we decided to revise the topic in light of the available sources, though they run the risk of being fragmented. The results of our study are derived from technical assistance contracts that were signed between Spanish companies and French firms from 1959 to 1979, covering a broad range of activities. Most of them

¹³ The texts were limited to ensuring that all operations that make implicit “a reasonable periodicity, acceptable technical guarantees, and markets with sufficient capacity” in addition to “presenting positive conditions for the nation’s economy” would be included. See the studies of O'Brien (1976), Lobo (1979), Molero (1979), Buesa and Molero (1982), Sánchez and Paloma (1983), Sanz (1997), and Cebrián (2005, 2008).

¹⁴ In Spanish official statistics (Ministry of Industry), the terms “technology transfer” and “technical assistance” are used interchangeably. The contracts generally included both the granting of a license (for new products and/or processes) and the provision of services (in a wide variety of ways, depending on each field of activity).

¹⁵ The data regarding percentages up to 1973 are from Cebrián (2004: 180–181) and self-preparation for the period of 1973 to 1979 by Castro (2011: Appendix 4). It must be noted, however, that the patent register gives priority to USA (c. 21.5%) and Germany (18.2%) over France (17.5%). For more details, see Hidalgo and Molero (2010).

are housed in the historical archives of the Ministry of Industry.¹⁶ The contracts included in the different boxes are in no specific order with regard to the year of the agreement or the sector. Contracts that refer to the concession of patents, that are repeated, or that imply “veiled foreign investment” (as denominated by the reports of the Ministry of Industry, which did not impede their approval) are not included.¹⁷

The subsequent database contains 238 contracts. The largest contracts were very detailed, running between 15 and 20 pages in length. The standard contract contained essentially the same basic elements: a summary of the names and addresses of the parties and the reasons for entering into the agreement. After explaining the intentions of the parties, the next section aimed to clearly express the terms of the contract. Technical terms were most often defined, such as the identification and definition of the know-how transferred. After a common vocabulary had been established, it was standard practice to include clauses that identified the process, the duration of the contract, and the possibility of *subtransferring* the knowledge. Quite often, the French firm wanted to implement safeguard clauses that included territorial restrictions to avoid opportunistic behavior from their Spanish counterpart. The contract usually also incorporated a clause that obliged the licensee to detail all relevant uses of the product and process that were transferred to maintain the value of the brand name or the service and uphold quality control.

Most of the contracts also specified the type of payment, which included lump-sum payments, royalty payments, or simply a two-part tariff.

Regarding termination provisions, there were two types: those that established the normal expiry date and those that applied to the cancellation of a contract for breach or some other specified cause. A termination of the agreement normally resulted in the immediate cessation of the rights and privileges conferred by the contract.

Finally, although not included in all the contracts, the tacit dimension of knowledge obliged firms to organize personnel circulation between the two entities. The French firm could supply the know-how by sending technicians to Spain or bringing the Spanish staff to its domestic plants. In most of the agreements, we can affirm that it was a usual practice, as noted in Section 5.¹⁸

¹⁶ The historical archives of the Ministry of Industry are found in the Archivo General de la Administración (AGA hereinafter): Fondo del Ministerio de Industria (13), Expedients 5109, 5111, 5129, 5181, 5191, 5218 and 5232, completed with the compilation of *Economía Industrial* since 1963. Due to the lack of space, the list of contracts, included in Castro (2011: Appendix 4), cannot be reproduced here.

¹⁷ The database thus does not include agreements between a parent company and its subsidiary if the former participates in the latter with more than 50% of the total capital because these firms were not allowed to make foreign currency payments for technology transfers to parent companies (e.g. Cebrián, 2009: 1140).

¹⁸ We are not able to provide systematic information due to the lack of description in the part of the database compiled in *Economía Industrial*.

Once the database was prepared, a system of classification had to be chosen, despite certain methodological difficulties that derived from the lack of a concrete definition of consultancy firms in Spain. In reality, when the consultancy firms started, they were partially eclipsed by the rise of technical engineering. Nonetheless, their origins were not very different. Therefore, it is not strange that the first definition of “consulting” (the English name was commonly used in Spain at that time) came from the 1970s’ engineering world.¹⁹ According to most historians of technology, “consultings” included a series of firms that offered services not directly connected to the production of goods. These firms operated in the economic sector (organizational studies, economic advice, and planning) and on the technical side (studies, partial projects, “turnkey” projects). This lack of differentiation between sectors made it initially useful to adopt the definitions proposed by Arjan Van Rooij in his studies of engineering in the chemical sector. Although engineering is basically a question of constructing an industrial plant, according to Van Rooij, he does leave room for other processes.²⁰ He therefore establishes three types of engineering, which is used to classify our database (Van Rooij, 2004: 21–24). These types are as follows:

- Process engineering, by means of which a technical consulting firm sells processes of production generally developed within the firm itself and accompanied by basic engineering for implementing them.
- Project engineering, by means of which a consultant sells the complete project from its conception to its placement in operation (what is commonly called “turnkey”).
- Plant engineering, which falls between process and project engineering and offers something more than processes to be implemented but does not cover all of the aspects of a “turnkey” project.

It is clear that process engineering is quite similar to first-generation consultancy (Table 1), which is what is of interest here. Therefore, a first classification that employs these criteria (process, project, and plant) has been undertaken. Thus, our database is also valid for studying the case of transferring knowledge between countries with a different degree of industrial development and investment in R&D. Although the technology transferred was at a very advanced stage, the cooperation of the innovator was essential to developing and adapting the technology once the

¹⁹ We emphasize once again that the term “consulting” is used here as it appears in the editions of *Información Comercial Española* consulted (Egurbide, 1976: 134; Molero, 1979: 61).

²⁰ For these authors, engineering forms part of the complete process of creating a plant, together with the preliminary research and later construction. Nonetheless, it does distinguish between basic engineering, summarized in the design of the plant, and detailed engineering, which in the future plant covers aspects such as the implementation of tasks within the production process, or the management of the project itself until its finalization (Van Rooij, 2004, 2007).

contract had been granted. This study suggests that the reason why Spain needed to seek the transfer of the know-how was their relatively poor investment in R&D and low level of human capital. Unsurprisingly, Spanish expenditure on the import of technology through technical assistance contracts was higher than its R&D expenditure (Saíz, 1999; López and Valdalisó, 2001).

The database provides some outstanding results (see Figures 1–4) and reveals three main characteristics.

1. From a sectorial point of view, the Spanish firms that signed the most contracts with French consulting companies pertained to the classic and renowned sectors for French investment between the first and second industrial revolutions. In order of importance, these sectors are mining (15%), iron and steel (13%), chemicals (12%), and electricity (10%), as we can see in Figure 1.
2. The contracts included in the database refer to those signed between 1959 and 1979, but most date after 1964 due to the growth of the Spanish economy. Spanish imports of foreign technology increased sharply after this year. As expected, the promulgation of the successive Development Plans signified a marked increase in contracts signed by Spanish and French firms (Figure 2). This reflects the range of the two contracts signed in the first five-year period to the maximum of 94, which pertains to the period 1970–1974. The growth rate for the different countries was similar, with France maintaining its percentage at approximately 25%.
3. Following the classification issued by Van Rooij, the category of process engineering was dominant. Almost two thirds of the agreements were related to improvements in production or organization within Spanish companies, as we see in Figure 3. Table 2 and Figure 4 confirm the scale of process engineering during the Development Plans. This predominance ranges from 50% to 70%. It is interesting to note that plant engineering “competed”—approximately 30% of the contacts—with process engineering just when *indicative planning* reached its peak in Spain, as observed in Figure 4. This was most likely related to the sectors considered in the first and second plans—above all, heavy industry—which was mainly invested in by the public sector.

Nevertheless, the path of introduction remains clear. Over 60% of the technical assistance contracts signed with French firms were not related to the action of engineering companies but were instead within the realm of pure consultancy, and the importance of that way of transferring knowledge never decreased in that period. From this, it may be deduced that these contracts were not only a means for the penetration of foreign investment but also a way to allow the entry and diffusion of the different methods of production rationalization, company organization, and, thus, effectiveness. Further, it would seem to be the method that French firms selected for conveying the precepts of the first wave of consultancies, something that researchers have rarely considered when analyzing the sector.

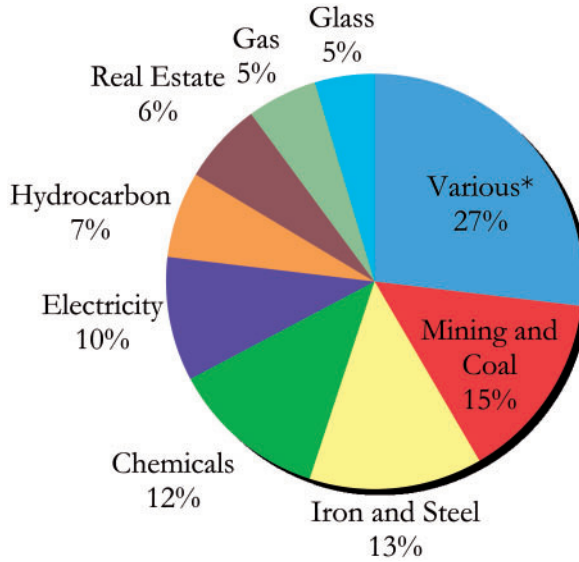


Figure 1 Technical assistance contracts between French and Spanish companies by sectors, 1961–1979. *This includes the sectors of food, aluminum, vehicles, shipbuilding, paper, textiles, and transportation (excluding railways which are not included in the database due to the explicit lack of existence of technical assistance contracts with RENFE, which went through the Ministry of Industry).

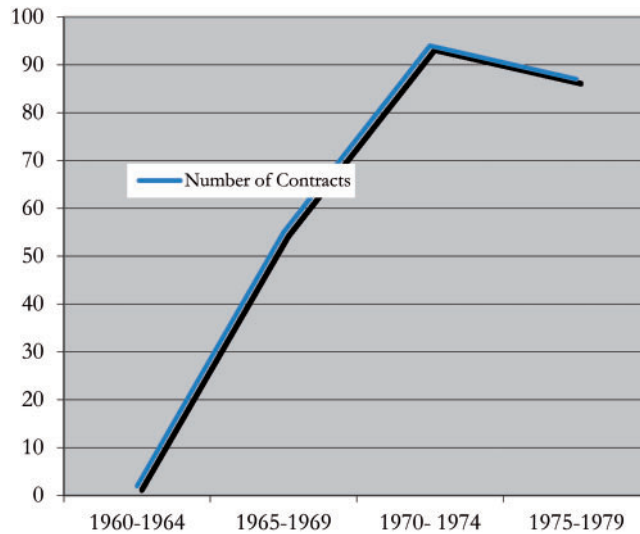


Figure 2 Technical assistance contracts between French and Spanish companies by years (1961–1979).

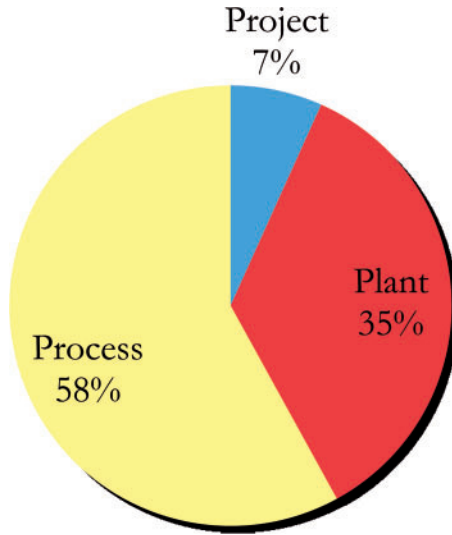


Figure 3 Technical assistance contracts between French and Spanish companies by types of engineering.

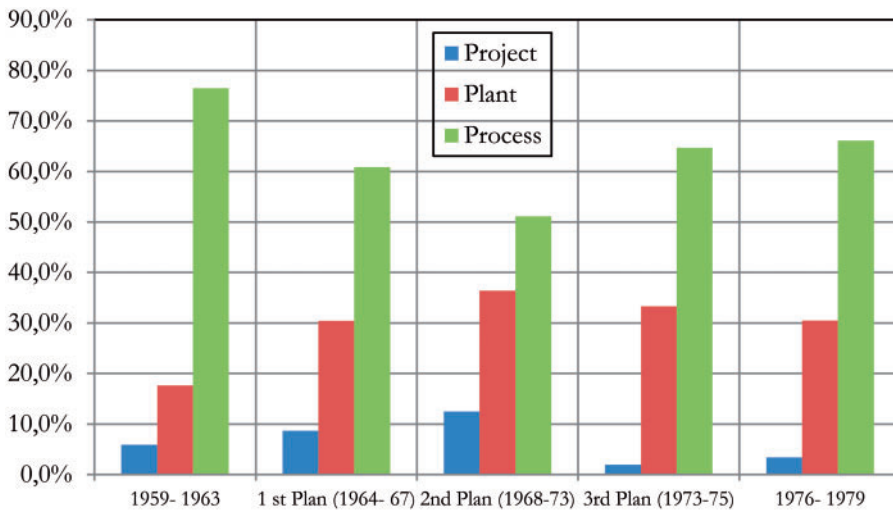


Figure 4 Technical assistance contracts between French and Spanish companies by types of engineering and by years (focusing on Development Plans, %). Source: Archivo General de la Administración (AGA hereinafter): Fondo del Ministerio de Industria (13), Expedients 5109, 5111, 5129, 5181, 5191, 5218 and 5232; completed with the compilation of *Economía Industrial* since 1963. See Castro (2011: Appendix 4).

Table 2 Technical assistance contracts between French and Spanish companies by types of engineering and by development plans

Type of engineering	1959–1963	1st plan (1964–1967)	2nd plan (1968–1974)	3rd plan (1973–1975)	1976–1979	Total
Project	1	2	11	1	2	17
Plant	3	7	32	17	18	77
Process	13	14	45	33	39	144
Total	17	23	88	51	59	238

Finally, when compiling the data, we noticed the preponderance of a set of companies called the SOFREs, which constituted >10% of the sample (in excess of 29). This seemed to be excellent grounds for paying attention to how the French companies offered their services to their Spanish counterparts and where their competitive advantages resided. The more detailed study of this paradigmatic example (the SOFREs) and their influence within the Spanish railroad and mining sectors could refine the general findings, as presented in Section 5.

5. The action of the SOFREs in Spain

Our research led us to delve more deeply into the study of some of the French consulting firms with the greatest influence on two of the most important sectors of the Spanish economy since the first attempt at industrialization in the mid-19th century: railroads and mining. Both sectors were experiencing major difficulties in the mid-20th century. The solution to their problems resided in their reconversion, or at least their significant remodeling. The following section describes and analyzes the action of the SOFREs in Spain within its railroad (SOFRE RAIL) and mining (SOFRE MINES) branches.

France was home to some of the most important engineering firms in the world, the Sociétés Françaises d'Études (SOFREs). The SOFREs specialized in four main sectors with which a set company was associated: mines were associated with SOFRE MINES, electricity with SOFRE ELEC, gas with SOFRE GAZ, and railways with SOFRE RAIL. Other SOFREs were developed over the years in new sectors, such as the iron and steel industry (SOFRE SID), telecommunications (SOFRE COM), and atomic energy (SOFRE ATOM).²¹ These corporations were

²¹ All of the companies mentioned employed the same nomenclature: “Société Française d'Études et de Réalisations, SOFRE,” which has not been repeated to avoid excessive reiteration.

independent from the public powers, at least in theory, because they never lacked the support of the Service of Technical Cooperation of the French Ministry of Economy and Finances or of the commercial advisors of French Embassies, which operated as true promoters of their activities (Sánchez Sánchez, 2006: 222). They were backed by the most important French investment banks (though in a testimonial fashion among their shareholders) that employed their infrastructures for the purpose of facilitating business in different countries.²² This last observation has greater implications than it would seem; it is not outrageous to believe that part of the prestige of the French technical consultancies in some sectors may be credited to its promoters.

SOFRERAIL and SOFREMINES were selected with the aim of analyzing the services that they provided to various Spanish companies and the procedures for implementing them.

5.1 *Origins of the RENFE modernization plan: the action of SOFRERAIL*

The creation of a national railway company, the Red Nacional de los Ferrocarriles Españoles (RENFE), in January 1941, culminated an attempt of >40 years to nationalize it (Ortúñez, 1999; Vidal, 1999). Nonetheless, nationalization did not put an end to the primary problems identified in the interwar period: powerful interventionism, financial insufficiency, a lack of energy resources, and the absence of technological means. On a long-term basis, these problems resulted in a continued decrease in passengers (favoring other means of transportation), major operating deficits, and a decline in the quality of service. The situation was so critical that it could even produce a network collapse due to the slowness of credits and supplies expected to compensate the natural degradation of machinery.

In view of this situation, RENFE management decided to foment the modernization of the company. As had occurred with some Spanish public companies (particularly those pertaining to the INI), RENFE's leaders sought French experience. SOFRERAIL, as an affiliate of the Société Nationale des Chemins de Fer Français (SNCF), was the closest mirror in which RENFE would have liked to be reflected. Therefore, communication would seem to be fairly simple. In addition to the geographical proximity of the two countries, they had a collaboration that had been ongoing for a century.

Starting in mid-1958, conversations were initiated to prepare an agreement into which RENFE and SOFRERAIL could enter.²³ On February 7, 1959, RENFE and

²² The Banque de l'Union Parisienne (BUP) participated in SOFRERAIL, SOFRELEC, and SOFREGAZ since at least 1957—Banco Urquijo Fund, annual report of BUP (1957–59); Paribas had a participation in SOFRESID since 1959—Association pour l'Histoire de BNP-Paribas, Industrial Department of Paribas, Meeting with J.F. Reignier.

²³ AFFE, IIF (1972), 'Studies of the Spanish National Network of Railroads'. SOFRERAIL report, June 1959.

SOFRERAIL signed a contract whereby the French firm would conduct a study (analysis and critical examination) of the Spanish company's general situation on a short-term basis, in addition to proposing an integral plan for its modernization with broad French participation. The report presented in June of the same year studied all facets of the company:²⁴ (i) administrative organization and structure, commencing with its configuration within the state and including the network's regional organisms, (ii) operation of the network, (iii) quality of the services provided (passengers and goods), (iv) performance of personnel, (v) installations (quality, maintenance, and operation), and (vi) accounting. In the seventh chapter of the report, a synthesis of the work was presented along with the most urgent tasks required.²⁵ Each section contained a general introduction and a series of proposals for improvements in service. This mission was carried out between February and May of 1959. It should be noted that the SOFRERAIL Plan of 1958–59 formed the basis for all of the RENFE's modernization plans created in the 1960s and 1970s.²⁶ This study was the basis for the report prepared by the International Bank for Reconstruction and Development (IBRD), which would in turn help elaborate the Ten Year Modernization Plan of 1964 and its update in the RENFE Plan of 1972.²⁷

The SOFRERAIL Plan reviewed various aspects of the Spanish railway system. First, the report analyzed the situation of RENFE within the framework of the government administration. One of the main problems observed by the French mission was RENFE's lack of autonomy as far as the state was concerned, which resulted in four major predicaments. The first was the existence of a multitude of administrative organisms within RENFE itself, which served to dilute responsibility and paralyze control authority. The government's constant intervention in the railroad system did not help, either. These problems were enhanced by the absolute financial dependence upon the state, a dependence that made it nearly impossible to manage the new lines of the seven transportation zones inherited from the different railroads of the 19th century.²⁸

²⁴ SOFRERAIL report, June 1959. For this, a team of engineers from the French firm was assigned to each facet of the study. The SOFRERAIL delegation was directed by the president of the firm, M. Porchez, who coordinated the different teams: general organization (M. Fioc and M. Tougne); general accounting organization (M. Bonneau); operational and quality service affairs (M. Dine); fixed installations (M. Oudoutte); railway stock, workshops and tooling (M. Plu); and personnel (M. Girardot), apart from a fixed representative (M. Cusson).

²⁵ SOFRERAIL report, June 1959, Chapter 7 (summary and proposals).

²⁶ An excellent summary may be found in Comín (1998, Volume 2: 115–132).

²⁷ AFPE, R/32-01: 'Information for the IBRD commission and the RENFE Modernization Plan'; IIF-90 (Volume 1): 'SOFRERAIL's RENFE Modernization Plan' (July 1963), IIF-201: 'SOFRERAIL's recommendation for the updating of the Modernization Plan' (July 1964). All of these studies stress the importance of SOFRERAIL's first report when establishing the bases for the modernization of the company.

²⁸ SOFRERAIL report, June 1959, Chapter 2.

The second group of observations had to do with the organization and structure of RENFE's general accounting system. The main problem with the company resided in its lack of liquid assets, partially caused by their specialized nature: a public company offering a public service managed by private accounting. The accounting and treasury system constituted the main headache for the SOFRERAIL mission; for example, one of its reports revealed that >26 000 punch cards were collected weekly for accounting purposes.²⁹

The following sections addressed both the quality of service and the existing equipment. With regard to passenger transportation, there was the problem of the low average speed of the trains and their lack of comfort; additionally, three travel classes were still maintained on the trains.³⁰ Moreover, the organization of the network presented major difficulties. Its size was more than sufficient for current and future demand. However, the existence of numerous lines with very low levels of use served to bring down the general quality of service.³¹ With regard to materials, an analysis of the radial scheme and costs of the railroad was initiated. Leaving aside the influence of orographical difficulties, the main problem resided in the fact that the majority of the railways (many only one-way) were in poor condition and largely comprised antiquated and lightweight rails. Further observed were minimal levels of maintenance and repair and the severe deficiencies of materials. All of these factors resulted in a loss in speed, low safety, and a premature deterioration of equipment. Additionally, the majority of the maintenance and renovation work was undertaken by RENFE itself at high prices.³² The operational costs of railway stock were also expensive: >80% of RENFE's trains were steam-fired, and of these, >40% were >40 years old.

Finally, the report addressed the spiny problem of personnel, recognizing that one of the issues was how to find jobs for surplus employees. The SOFRERAIL mission estimated that there were ~3000 employees too many at the end of the 1950s, which hindered the company's productivity and efficiency.³³ Given this panorama, SOFRERAIL proposed an integral plan, the two main objectives of which were the technological modernization of the system and the autonomy of the company. This plan was summarized in 100 proposals. SOFRERAIL offered to intervene directly and immediately in some of them (Table 3).

²⁹ SOFRERAIL report, June 1959, Chapter 2.

³⁰ SOFRERAIL report, June 1959, Chapter 4.

³¹ This was due to the fact that the company was obligated to provide a service to low-density areas or transport large numbers of passengers for reduced prices (Comín, 1998, Volume 2: 115).

³² The situation was so severe that much of the credit for the purpose of modernization had to be used solely and exclusively for renovation. SOFRERAIL report, June 1959, Chapter 5.

³³ SOFRERAIL report, June 1959, Chapter 6.

Table 3 Proposals for the direct intervention of SOFRERAIL in the RENFE modernization plan

Provide up-to-date administrative and technical documents to be employed for a better coordination and control of services.
Establish for each line plans for improvement in speed.
In-depth adaptation of the high and low speed train systems
Improve the use of railroad cars by means of the creation of a car file and the siding of those not in use.
Recuperate the 42.5 and 40 kg tracks to be used in the group 3 system as well as the lower weight tracks for the service railways. Create a workshop for this purpose.
Systematically reballast the ends of the tracks without removing them.
Recuperate small parts, creating a workshop for this purpose.
Mechanical and chemical removal of weeds and grass in the majority of the tracks as soon as possible.
Create a training course for the purpose of improving the performance of regional, sector, and section heads (as well as for possible future candidates)
Rewrite instructions for track maintenance.
Rewrite instructions for maintenance of mechanical and electrical signals and for electric traction systems.
Create a training course for the purpose of improving the performance of subordinates (Section and Sector heads, as well as for possible job candidates)
Prepare technical warning system in order to codify the different repairs which are required (steam, electricity, diesel, railroad cars, shafts, brakes, equipment) and define their control.
Study the time required for the execution of the different projects.
Organize an industrial management accounting system employing a uniform plan and calculate the cost prices at the level of yards and towed material (i.e. railroad cars, wagons) warehouses as well as large repair shops.
Reorganize supplies. Create local warehouses near establishments. Create warehouses or parks for partial assemblies and spare parts near these warehouses as well as selected private industry workshops in order to effectuate change in a standard fashion.
Improve training of middle level managers and specialized personnel.
Systematically proceed in all departments with the determination and control of personnel in each level.
Create a centralized organism at the management level together with work organization committees for each zone.
Foment the training of personnel within RENFE.
Study the reduction in personnel in the Department of Materials and Traction which would allow for an improvement in the quality of repair, organization of work & cost control and which would also permit a concentration of workplaces (i.e. stations, railyards, workshops, etc.)
Establish in the Department of Tracks and Works calendars/programs for the maintenance of the tracks and proceed with the rationalization of personnel contemplated in said programs.

Sources: SOFRERAIL report of June 1959.

As may be observed, the majority of the proposals were related to the internal organization and rationalization of the company.³⁴ Although the application of the Plan was not immediate (due to the stabilization measures of 1959), it constituted a magnificent legacy for the RENFE planners because it studied in detail each and every one of the company's fields of action. From the French standpoint, the SOFRERAIL endeavor could be interpreted as the consultancy's adaptation to the new Spanish market. The French firms would look for their niche with comparative benefits, which in the case of the railroad were undeniable: accumulated experience and knowledge of the market.

Undoubtedly, SOFRERAIL was the key to the implementation of the Modernization Plan of 1964. To achieve its goals, SOFRERAIL for the most part laid its stake on the organizational rationalization of the company. RENFE required a lightening up of its administrative arm and, at the same time, a reorganization that would serve to alleviate the pressure exerted by the state. Therefore, it was proposed that the government have only one representative in the Board of Directors (hereinafter referred to as C.A.): the General Director of Railroads. Additionally, the C.A. would meet only to address affairs of vital importance to the company. This would be the first step in achieving a certain amount of decentralization in decision making, which would be attained through the creation of new committees and a clear definition of their tasks and functions. For example, SOFRERAIL reorganized the powers of the executive committee and the director of the network, making it possible to undertake a significant amount of delegating.

With regard to accounting, auditing, and the state's control of the company, SOFRERAIL reinforced the authority of the finance department, regrouping the different special accounting systems of the various departments and creating an inspection body. In this manner, a more reliable state of the firm would be achieved. The key seemed to reside in control and information. The execution of both factors allowed for the simplification of financial management and a more efficient assignment of future income. Therefore, an improvement in the accounting of the company's fixed assets was recommended to facilitate the calculation of their depreciation. This would prove fundamental for the estimation of state subsidies (yearly subsidies that palliated RENFE's chronic annual deficit).

With regard to the network, prior to undertaking any reform measures, SOFRERAIL proposed obtaining knowledge on the financial viability of the different lines and establishing complete statistics about delays in trains and the reasons behind them. This would make it possible to pressure the government into eliminating the lines that were not profitable and facilitate the establishment of plans for augmentation in train speed and thus the revision of different timetables. At the same

³⁴ The following pages are based on AFEE IIIIF-90 (Volume 1): 'Plan for the modernization of RENFE by SOFRERAIL' (July 1963) and AFEE-IIIIF-201: 'SOFRERAIL's recommendations for the updating of the Modernization Plan' (July 1964).

time, the cost prices and fares pertaining to the different lines also had to be examined. In this respect, it was also recommended that the trains' third class be eliminated because it was obsolete. The improvement in service would result in higher profit through the sale of tickets.

Finally, with regard to personnel, SOFRERAIL also opted for control. It created an organizational department for the rationalization of employees. This signified a substantial reduction in personnel, which would be compensated for by the investment to be carried out. At the same time, particular attention was paid to personnel training, with the creation of improvement courses and practices for apprentices.

All of these measures contributed to the freeing up of resources for the purpose of modernizing and renovating the equipment necessary for the infrastructure that was to remain in service. These resources were not sufficient on their own. It was recognized that the entire system required a major investment: tracks, engines, railway yards, and other equipment that formed part of the main railroad network. Of the different elements, at least one third of the total investment had to be employed for the renovation of the tracks and, secondarily, for the conversion of the engines to diesel fuel.³⁵

The results of these measures were observed over the medium-term. While trading income was not in the black until 1970, passenger revenue improved considerably. While income from passengers almost doubled between 1964 and 1974, this corresponded with a 30% increase in the transport of goods (Comín, 1998: 175).

5.2 SOFREMINES and the reconversion of the coal-mining sector

The highest level of coal production in Spain was reached in 1958. The sector suffered a major crisis that commenced that year. The liberalization of the coal-mining, starting in 1950, culminated before the Stabilization Plan of 1959. What was until then a minor price intervention by the state was converted into the opening of the market to the importation of foreign coal. Additionally, coal had lost its domination as the primary source of energy in the 1950s, both at the national level—in favor of oil—and the household level—in favor of cleaner energy, such as gas and electricity.³⁶ Not only was there a decrease in demand, but there was also an exponential increase in the cost of production, which was not compensated for through sales. The reduction in these margins provoked a loss in profitability within the vast majority of the companies to such an extent that, starting in 1962, there was no dividend sharing.

Faced with this critical situation, the government acted by means of a Concerted Action concentrated on the coal sector (Braña, 1983; Braña *et al.*, 1984). The bases for this new policy were established in December 1963 in the First Development Plan

³⁵ This option was preferred over electrification due to its lower cost and better adaptation to the Spanish orography (Comín, 1998: 122).

³⁶ Only the iron and steel industries continued as regular clients (Coll and Sudriá, 1987: 593).

but did not receive approval until the publication of the order on March 30, 1965.³⁷ Government aid was subject to mines' achieving a 20% increase in production over a four-year period (an increase in productivity to 1100 kg/day), the creation of high performance coal washing plants (in excess of 90%), and the promotion of a concentration of the mining sites to enhance the companies' operational and financial capacity. These actions would result in an improvement in retributions to fixed assets and labor. To meet these goals, the companies had to present projects for "the improvement and reconversion of the operations" (BOE, 1961–1967). In return, the Spanish government would maintain the System for Aid to Mining of 1964, which established a declining system of non-refundable grants for production over a period of four years and fiscal reductions for the mines.³⁸ At the same time, the state would absorb any increases in the companies' capital and use it for improvements in productivity, and they would also grant official loans for up to 70% of the investment at a 6.5% interest rate, to be paid off in periods of between seven and 16 years.

SOFREMINEs came into the picture within this context. This firm was created in 1955 under the initiative of the French government.³⁹ The coal sector had been nationalized in France after World War II due to the difficulties encountered in the market (Saint Marc, 1961). Its shareholders were government companies—ATIC Services, Bureau de Recherches Géologiques et Minières, and Charbonnages de France—although it was a corporation with an undoubtedly international vocation, which Alexandre Verret, President of Charbonnages de France, made clear in a letter sent to Juan Antonio Suanzes in 1960:⁴⁰

"Our objective was to provide outside of France [...] the type of technical assistance frequently requested by our National Service [...] dedicated to the study of all of the technical and financial problems which result from mining operations, [...] and taking into account our corporate statutes, SOFREMINEs takes advantage of all of the experience of its shareholders. It provides in foreign countries all of the impartial expertise requested for the purpose of the technical and financial studies for those public or private

³⁷ "Order of March 30, 1965, which set up the general bases of the Concerted Action for the Spanish coal sector provided for in Article 5 of the Law 194/1963, of December 28, by means of which the Economic and Social Development Plan was approved" (BOE, 1961-1967).

³⁸ The grants were set at 50, 37, 35 and 15 pesetas per ton of coal produced (Díaz-Faes, 1979: 173–174).

³⁹ <http://www.sofremines.com/essai6/presentaSFM.htm> (accessed April 2013).

⁴⁰ Alexandre Verret was president of Charbonnages de France from 1957 to 1963, as observed on the Web site of the extinct Charbonnages de France: http://webcdf.brgm.fr/article.php?id_article=821 (accessed April 2013).

organisms that wish to preserve their independence in the final selection of their production process.”⁴¹

SOFREMINEs encountered a sector that was experiencing a transformation and thus required a solvent firm of international renown and a wide knowledge of the Spanish market. This would seem to coincide with what the French entities could offer.⁴² This was expressed by the French consul in Seville during the 1964 Annual Congress of the Spanish Association of Mining Engineers: “*Les ingénieurs [...] espagnols semblent regarder à l’heure française avec ferveur*”.⁴³ SOFREMINEs did not hesitate to take advantage of the opportunities to be found in the Spanish market.⁴⁴ Its connection with Spain was carried out under the auspices of Antoine Pinay, the head of external relations of SOFRERAIL, SOFREMINEs, and SOFRESID and a former French Prime Minister, who had, since the 1950s, had close relationships with Spanish politicians and businessmen and was even associated, in a veiled manner, with the Opus Dei.⁴⁵

As a result, between 1959 and 1979, SOFREMINEs signed 29 technical assistance contracts—all for process engineering—with 14 different Spanish firms. In the majority of the cases, SOFREMINEs offered similar comprehensive texts based on the integral restructuring of the companies. Of the files observed in the Archivo General de la Administración (Ministry of Industry records) and in INI’s Archives, the most common heading was “technical assistance, restructuring, and modernization of mining installations.”⁴⁶ All of the contracts had practically the same structure. Their duration ranged from six to 18 months, although there were some exceptions,

⁴¹ Archivo del Instituto Nacional de Industria (AHINI hereinafter), Suanzes Fund. ‘Letter of Alexandre Verret to Juan Antonio Suanzes’, answered on January 1, 1960.

⁴² AMAE-F, Volume 316: ‘Spanish-French economic relations 1961–1967’. Note of the French Ambassador to Spain, Robert de Boisseson, regarding the reconversion of the coal mining sector in Spain (March 25, 1966).

⁴³ “The Spanish engineers seem to regard French time with fervor”. AMAE-F, Volume 320: ‘Industry in Spain’. Note of the Consul of France in Seville on the occasion of the 1964 Annual Congress of the Spanish Association of Mining Engineers.

⁴⁴ AMAE-F, Volume 316, ‘Spanish-French economic relations 1961–1967’. Note of Robert de Boisseson regarding the possibility of French mining engineering in Spain.

⁴⁵ Archivo de la Cámara de Comercio de Madrid, CDU 380.151. ‘French-Spanish Committee for Technical Exchange’, and *ABC* (February 22, 1963), visit of Laureano López Rodó to France. For more in-depth knowledge of the person, see Dulphy (2000). For more information regarding Pinay’s contacts with the Opus Dei, see Pardo Sanz (2001).

⁴⁶ AGA, Industria (13) 1.04, boxes 5109, 5111, 5181, 5191, 5206, 5218 and 5232. AHINI: Files 173 through 678 (various files). A complete list of the contracts may be found in Castro (2001: Appendix 4-bis).

as in the case of SOFREMINES' contract with Antracitas de Fabero, S.A., which was renewed eight times over a period of seven years.⁴⁷

First, a team of engineers was transferred to collaborate with local personnel.⁴⁸ This team gathered all of the necessary information *in situ* and prepared their findings in France. These reports identified the main problems of the Spanish mines and proposed solutions. In the majority of the cases, the internal reorganization of the firms was tackled, opting for the imposition of mechanized mining cuts and, most of all, the specialized training of employees in the new activities and capabilities.

Once these variables were determined, SOFREMINES was in charge of planning long-term operations that established not only the companies' structure but also the marketing of the products. The restructuring of the sector undertaken by SOFREMINES resulted in a substantial number of employee layoffs and a considerable increase in the overall productivity of the mines, although it did not prevent a sharp decrease in production. In this regard, the different studies of the coal industry coincide with the complete failure of the Concerted Action (Table 4) (Díaz-Faes, 1979: 144; Coll and Sudriá, 1987: 601).

Given this situation, the most important firms of the Asturian basin—Sociedad Metalúrgica Duro Felguera, Fábrica de Mieres S.A., Industrial Asturiana Santa Bárbara S.A., and Hullera Española S.A.—resorted to SOFREMINES to find a viable solution for the purpose of saving the industry in the area. SOFREMINES conducted an in-depth study of the four firms. A priori, its proposal consisted of regrouping the four companies into one and reunifying the operation of the mines at the same time. As was customary, SOFREMINES prepared an integral plan. It established phases for the restructuring of the different operations, considering the future production and quality goals that had to be readdressed in the proposal extended by the Concerted Action. The plan set forth the location, capacity and characteristics of the different mines, provided the structuring of the labor to be conducted in the interior of the mines, and advised on the investments and timetables to be undertaken in each of them. Additionally, it presented a profitability project based on the overall mechanization of the mines and the reduction of personnel. Finally, the French consulting firm offered various market studies and sales plans to make the Spanish future company competitive in the international market. The conclusions of the study did not portray a bright future for the sector in Spain in general and in Asturias in particular. According to the SOFREMINES findings, the

⁴⁷ AGA, Industria (13), box 5111, file 159-MC, eight contracts between Antracitas de Fabero S.A. and SOFREMINES.

⁴⁸ AGA, Industria (13), box 5111, file 159-MC, eight contracts between Antracitas de Fabero S.A. and SOFREMINES. The teams comprised no more than five members, who were divided among technicians, engineers, and a chief engineer. The cost of a technician averaged approximately 450 French francs, the cost of an engineer was 550 francs, and the cost of the head engineer was around 650 French francs (all per diem).

Table 4 Comparison of the national production of coal proposed for 1964–1967

Year	1964	1965	1966	1967
Production programmed in the First Development Plan (thousands of tons.)	12 000	12 600	13 300	14 000
Growth rate programmed (%)	5	5	5.5	5.2
Real growth rate (%)	–10.6	–6.8	–0.5	–3.3

Source: By the author employing information from Díaz-Faes (1979: 144).

only solution would be to reach the largest critical size. Government aid to the new company on the medium-term would be inevitable.

Supported by the SOFREMINES research, the companies themselves proposed to the government a group called HENOSA (Hulleras y Energías del Norte S.A.), which had an equity capital of 7,000 million pesetas. The resulting corporation would be split evenly between the state and the private firms, with an equal amount of shares. The company's activity would be the joint operation of coal mines and thermal plants.⁴⁹ The project was subjected to various amendments, the most important of which was the abandonment of electricity. The final solution was enforced in the Decree 486/1967 of March 9, 1967, which created the Empresa Nacional Hullera del Norte S.A. (HUNOSA; National Coal Corporation of the North) for the purpose of “operating coal mines together with all of those activities related to it.”⁵⁰ Joining the aforementioned companies were Carbones Asturianos S.A. and Nueva Montaña Quijano S.A. This decree established an initial equity capital of 3600 million pesetas, of which the state would provide 2600 million through the INI; the remaining 1000 million pesetas would be paid in kind by the Asturian coal firms comprising HUNOSA. The mining companies had a total of 20 017 employees and a production of 3 145 140 tons of coal.

In the end, HUNOSA was created by a public deed signed on July 14, 1967, with a capital of 3380 million pesetas and with the INI holding >75% of the shares (Table 5).

SOFREMINES, in collaboration with the INI's engineering company AUXINI Ingeniería Española S.A. (AUXIESA), was also responsible for the design of other firms entering HUNOSA.⁵¹ Commencing on July 1, 1969, Hulleras de Veguín & Olloniego, Hulleras de Turón, and Carbones de La Nueva became part of the

⁴⁹ AGA, Industria (13), 1.04 box 5111, File 28-MC-9. Report on the results of the contract.

⁵⁰ AHINI, HUNOSA annual report (1968).

⁵¹ AGA, Industria (13) 1.04, box 5206, file 889-MC-2 and box 5232, files 1098-M-3 and 1098-E-1.

Table 5 HUNOSA Shareholders in 1968 (by percentages)

INI	76.97%
Duro Felguera	9.97%
Hullera Española	6.04%
Fábrica de Mieres	2.36%
Nueva Montaña Quijano	1.82%
Carbones Asturianos	1.75%
Industrial Asturiana Santa Bárbara	0.79%
Compañía de Carbones, Industria y Navegación	0.26%
Compañía Industrial Minero Astur	0.04%

Source: AHINI, HUNOSA Annual Report (1968).

firm, and starting on January 1, 1970, Nespral & Cía, Minas de Riosa, Coto Musel, and Mina la Encarnada also joined the company. The organic growth of HUNOSA signified the almost total nationalization of the coal sector in Spain, making it the third largest public mining enterprise in the country, behind Empresa Nacional Calvo Sotelo (ENCASO) and Empresa Nacional Carbonífera del Sur (ENCASUR).

With the creation of HUNOSA, a new and different era began in the history of mineral coal mining in Spain, a period characterized most of all by social instability (Sánchez and Fernández, 2004). Nonetheless, and in spite of the difficulties, HUNOSA is still in existence today. As far as SOFREMINES was concerned, it increased its presence in Spain. On the one hand, it collaborated more intensely with AUXIESA, becoming its main technological partner (Álvaro, 2009: 100–101). Conversely, it undertook direct investments in Spain through the creation of an affiliate, Ingeniería Minero-Industrial S.A. (IMINSA).⁵² The French consulting firm held 48% of IMINSA's capital, with the remainder being in the hands of different Spanish banks that, at present, are unknown to the writers. This is pending further research.

6. Concluding remarks

Have we talked about engineering in this article? Most likely not, if we pay attention to the typology of consulting firms conceived by Edgar Schein (1988). We could identify three types of interaction between consultant and client: the acquirement of expertise, the doctor–patient relationship, and the process consultation. In the first instance, the consulting firm sells its patented knowledge. In the second, the client is offered its analytical capacity to diagnose the origins of the problem and find a

⁵² *La Vanguardia* (November 17, 1970).

solution. Finally, in process consulting, an internal change or project for transformation is structured and implemented. With regard to the latter two, the client-technical consultancy relationship is quite intense, particularly in the final stage. The study of the database and of the SOFREs makes it possible to affirm that the French firms brought together aspects of both the “doctor–patient relationship” and the “process consultation.” This type of relationship allowed the transfer of knowledge via appropriation and learning, as observed earlier in the article.

Thus, what is special about the case at hand? These are the most important findings:

1. The fact that French technical consulting companies operated mainly in the Spanish public sector. Because we did not notice any struggle between the clients and the consulting firms in more than 200 contracts analyzed, we could affirm that French and Spanish political and economic elites spoke “the same language” (Puig and Castro, 2009: 508–512). The implantation in Spain of indicative planning allowed French authorities to play a part in the diffusion of developmentalism in the country. Their influence was based on various elements. The first had to do with the execution of similar plans on both sides of the border. Referring to Estapé’s statement, the reason behind France’s influence becomes clear: the French plans perfectly met the Spanish requirements. They appeared to be openly governmentalist and, most of all, organized from “above” by the most important political and economic “cupola” of the country. At the same time, the French model enjoyed the advantage of having been successfully tested 15 years in advance of Spain, when both economies—that of post-World War II France and that of Spain of the 1950s—manifested similar levels of development. In addition, as noted throughout the article, not even in France was there true democratic control. Thus, considering the general study of the database and the specific case of the SOFREs, this research paper has tried to demonstrate that French consulting firms were introduced into the Spanish market through technical assistance contracts. Moreover, the firms not only served as a means of introducing foreign investment in Spain but were also a fundamental method for the diffusion of economic and organizational rationalization among Spanish public companies. For this purpose, these consultancies offered various attributes that gave them a competitive edge. They undoubtedly took advantage of the synergies that arose from the exploratory missions of the French banks and the support of the French state. These entities provided a solid network of contacts in Spain (the examples of Pinay and some of the SOFREs’ external representatives would seem to be paradigmatic). Furthermore, their human capital enjoyed an excellent reputation; they had significant recognition at the international level and were on the rise within the Spanish public sector. In short, French technical assistance societies occupied a significant position in Spain of the 1960s and 1970s, both in qualitative and quantitative terms, specializing in sectors that allowed them not only

to compete successfully in times of high demand but also to participate extensively in the future sectorial reconversions (Sáez and Morlán, 2009).

2. We have identified the niches in which the French companies specialized in developmental Spain. They sought business in known industries that were under crisis and faced a need for reconversion, such as mining or railways, to which they offered a great deal of expertise and market knowledge. The degree of backwardness that Spaniards perceived in their own country, as well as their growing wish to reduce the USA's predominance in favor of Europe, would have helped improve and spread the reception of French programs. Therefore, it is not surprising that the French consulting firms and the Spanish public companies felt comfortable working together under these conditions. However, the fact is that French companies did not sell the most innovative management knowledge. According to Table 1, they introduced Taylorism in Spain, as other foreign firms did in the same period. The knowledge was not always innovative, but it is quite appalling that Spain could not take up the latest novelties. The works of Abramovitz could shed some light on this paradox. In fact, the concepts of "social capability" and "technological congruence" fit perfectly with our own research. Due to the backwardness of the country, Spanish firms could import only an "obsolete" knowledge that, in any case, helped them catch up on technology and management.
3. What about the real influence of these foreign consultancy firms on domestic industries? The answer is twofold. In most of the cases, the influence of French firms allowed for the modernization of their Spanish counterparts. In our case study, which refers to large state-owned holdings (RENFE and HUNOSA), the influence of the SOFREs was even greater. They were vital in both railways and coal-mining sectors to the point of avoiding their collapse and ensuring their survival. Furthermore, the modernization of their management organization permitted RENFE and HUNOSA to be prepared not only for their future reconversion in the 1980s (Sáez and Morlán, 2009) but also for Spain's future entrance into the EEC. As a finishing touch, we can note that SOFREs' action in Spain cannot be dissociated from the following international success of Spanish engineering since the end of the 1970s, particularly in Latin America. In effect, Spanish experts implemented many of the practices learned from their French masters and achieved profitable contracts in the energy, industry, transport, and service sectors, as illustrated by the case of Tecniberia (Uhagón, 1970; Cal, 2002; Álvaro, 2009).

In our opinion, a new path for research has been opened because the current study demonstrates the existence of an important group of French consulting firms that had, until now, largely been overlooked by the specialists. Thus, in the near future, a study needs to be conducted within an historical and comparative perspective of the influence of consultancies from other nations and the development within

the Iberian market of consulting firms themselves. Only in this manner shall a correct overview be obtained of how the professionalization of Spanish firms (both public and private) took place from the 1960s onwards. Further, only in this manner will its evolution, in time, be understood.

Funding

Research for this work was supported by the Spanish Ministry of Science and Innovation/Economy and Competitiveness (projects ECO2012- 35266, HAR2010-21694 and HAR2012-33298).

Sources

Archives du Ministère des Affaires Étrangères de la France (La Courneuve, France)
 Archivo de la Cámara de Comercio de Madrid (Madrid, Spain).

Archivo de la Cámara de Comercio Francesa de Madrid (Madrid, Spain).

Archivo de la Fundación de Ferrocarriles Españoles (Madrid, Spain).

Archivo General de la Administración (Alcalá de Henares, Spain).

Archivo Histórico del Instituto Nacional de Industria (Madrid, Spain).

Association pour l'Histoire de BNP- Paribas (Paris, France)

Centre des Archives Économiques et Financières de la France (Savigny-le-Temple, France).

Fondo Banco Urquijo en la Fundación March (Madrid, Spain).

Newspapers

ABC

Boletín Oficial del Estado

La Vanguardia

Web pages

www.sofremines.com

http://webcdf.brgm.fr/article.php?id_article=821

References

Abramovitz, M. (1986), 'Catching up, forging ahead, and falling behind,' *The Journal of Economic History*, **46**(2), 385–406.

Abramovitz, M. (1993), 'The search for the sources of growth: area of ignorance, old and new,' *The Journal of Economic History*, **53**(2), 217–243.

Abramovitz, M. (1994), 'The origins of the postwar catch-up and convergence Boom,' in J. Fagerberg, B. Verspagen and N. Von Tunzelmann (eds), *The Dynamics of Technology, Trade and Growth*. Edward Elgar: Aldershot, pp. 21–52.

Álvaro, A. (2009), 'Los inicios de la internacionalización de la ingeniería española, 1950-1995,' *Información Comercial Española, ICE: Revista De Economía*, **849**, 97–112.

- Álvaro, A. (2011), 'Hízose El Milagro. La Inversión Directa Estadounidense y La Empresa Española (c. 1900–1975),' *Investigaciones De Historia Económica*, 7(3), 358–368.
- Álvaro, A. (2012), *La Inversión Directa Estadounidense en España. Un Estudio desde la Perspectiva Empresarial (c. 1900–1975)*. Banco de España: Madrid.
- Amsden, A. H. and T. Hikino (1994), 'Project execution capability, organizational know-how and conglomerate corporate growth in late industrialization,' *Industrial and Corporate Change*, 3(1), 111–147.
- Badel, L. (2010), *Diplomatie et Grands Contrats: L'état Français et les Marchés Extérieurs au XXe Siècle*. Publications de la Sorbonne: Paris.
- Barbiellini, F., J. Cantwell and A. Spadavecchia (2011), *Innovation and Foreign Technology in Italy, 1861–2011*. Banca d'Italia: Roma.
- Barciela, C. et al. (1939–1975), *La España de Franco*. Economía. Síntesis: Madrid.
- Braña, F. J., J. Molero and M. Buesa (1984), *El Estado y el Cambio Tecnológico en la Industrialización Tardía: Un Análisis del Caso Español*. Fondo de Cultura Económica: Madrid.
- Braña, J. (1983), 'Gastos fiscales, grupos de poder y política de industrialización en España, 1964–1977,' *Comercio Exterior*, 33(8), 727–738.
- Broder, A. (2000), *Historia Económica de la España Contemporánea*. Alianza Editorial: Madrid.
- Buesa, M. and J. Molero (1982), 'Cambio técnico y procesos de trabajo: una aproximación al papel del Estado en la introducción de los métodos de organización científica del trabajo en la economía española durante los años cincuenta,' *Revista de Trabajo*, 67–68, 249–268.
- Cal, F. (2002), *La Importancia de la Ingeniería Española*. Tecniberia: Madrid.
- Caniëls, M. C. (2000), *Knowledge Spillovers and Economic Growth. Regional Growth Differentials across Europe*. Edward Elgar: Cheltenham.
- Carreras, J. J. and M. A. Ruiz (1991), *La Universidad española bajo el régimen de Franco (1939–1975)*. Institución Fernando el Católico: Zaragoza.
- Castro, R. (2011), *Génesis y Transformación De Un Modelo De Inversión Internacional El Capital Francés En La España Del Siglo XX*. Universidad Complutense de Madrid: Madrid.
- Cebrián, M. (2004), *Technological Imitation and Economic Growth During the Golden Age, 1959–1973*. European University Institute: Florence.
- Cebrián, M. (2005), 'La regulación industrial y la transferencia internacional de tecnología en España (1959–1973),' *Investigaciones De Historia Económica*, 3, 11–42.
- Cebrián, M. (2008), 'La contratación de tecnología extranjera y el crecimiento económico Español (1960–1973),' in J. Tascón (ed.), *La Inversión Extranjera en España*. Minerva: Madrid, pp. 199–222.
- Cebrián, M. (2009), 'The structure of payments as a way to alleviate contractual hazards in international technology licensing,' *Industrial and Corporate Change*, 18(6), 1135–1160.
- Coe, D. T. and E. Helpman. (1995), 'International R&D spillovers,' *European Economic Review*, 39, 859–887.

- Coll, S. and C. Sudriá (1987), *El Carbón en España, 1770–1961: Una Historia Económica*. Turner: Madrid.
- Comín, F. (1998), *150 Años de Historia de los Ferrocarriles Españoles: La Nacionalización de las Redes: Renfe y Los Ferrocarriles Autónomos*. Anaya: Madrid.
- Cubel, A., V. Esteve, J. A. Sanchís and M. Teresa Sanchís (2012), 'Medio siglo de innovación y transferencia tecnológica en España, 1950–2000,' *Revista de Historia Industrial*, **50**, 113–154.
- De la Torre, J. (2011), 'España como mercado: oportunidades de negocio, desarrollo económico y franquismo,' *Hispania: Revista Española De Historia*, **71**(237), 181–206.
- De la Torre, J. and M. García-Zúñiga (eds) (2009), *Entre el Mercado y el Estado: Los Planes de Desarrollo Durante el Franquismo*. Universidad Pública de Navarra: Pamplona.
- De la Torre, J. and M. García-Zúñiga (2013), 'El Impacto a largo plazo de la política industrial del desarrollismo Español,' *Investigaciones De Historia Económica*, **9**, 43–53.
- Delaunay, J.-M. (2011), *Méfiance Cordiale. Les Relations Franco-Espagnoles de la Fin du XIX^e Siècle à la Première Guerre mondiale*. L'Harmattan: Paris.
- Díaz-Faes, M. (1979), *La Minería de la Hulla en Asturias (Un Análisis Histórico)*. Universidad de Oviedo: Oviedo.
- Dulphy, A. (2000), 'Antoine pinay et l'espagne franquiste,' *Relations Internationales*, **101**, 73–88.
- Dulphy, A. (2002), *La politique de la France à l'égard de l'Espagne de 1945 à 1955: entre idéologie et réalisme*. Paris: Ministère des Affaires Étrangères.
- Dunning, J. H. and M. L. Sarianna (2008), *Multinational Enterprises and the Global Economy*. Edward Elgar: Cheltenham.
- Egurbide, P. (1976), 'El 'consulting' en España,' *Información Comercial Española, ICE: Revista De Economía*, **513**, 133–137.
- Etapé, F. (2001), *De Tots Colors: Memòries*. Edicions 62: Barcelona.
- Estrin, S. and P. Holmes (1983), *French Planning in Theory and Practice*. Allen & Unwin: London.
- Fagerberg, J. (1994), 'Technology and international differences in growth rates,' *Journal of Economic Literature*, **32**(3), 1147–1175.
- Fuentes Quintana, E. (1984), 'El plan de estabilización económica de 1959: veinticinco años después,' *Información Comercial Española, ICE: Revista De Economía*, **612**, 25–40.
- Fuentes Quintana, E. (1995), *El Modelo de Economía Abierta y el Modelo Castizo en el Desarrollo Económico de la España de Los Años 90*. Prensas Universitarias de Zaragoza: Zaragoza.
- García Delgado, J. L. (1987), 'La industrialización y el desarrollo económico en España durante el franquismo,' in J. Nadal, A. Carreras and C. Sudriá (eds), *La Economía Española En El Siglo XX. Una Perspectiva Histórica*. Ariel: Barcelona, pp. 164–189.
- Griliches, Z. (1992), 'The search for R&D spillovers,' *Scandinavian Journal of Economics*, **94**, 29–47.

- Grossman, G. and E. Helpman (1991), *Innovation and Growth in the Global Economy*. MIT Press: Cambridge, MA.
- Guillén, M. F. (2010), *The Limits of Convergence: Globalization and Organizational Change in Argentina, South Korea, and Spain*. Princeton University Press: Princeton.
- Helpman, E. (ed.), (1998), *General Purpose Technologies and Economic Growth*. MIT Press: Cambridge, MA.
- Herranz, A. and D. Tirado (1996), 'La restricción exterior al crecimiento económico español (1870–1913),' *Revista de Historia Económica*, **14**(1), 11–49.
- Hidalgo, A. and J. Molero (2010), 'Technology and industrialization at the take-off of the Spanish economy: new evidence based on patents,' *World Patent Information*, **32**, 53–61.
- International Bank for Reconstruction and Development (1962), Informe Del Banco Mundial Sobre La Economía Española. <http://dialnet.unirioja.es/servlet/articulo?codigo=3642906>.
- Johanson, J. and J.-E. Vahlne (2009), 'The Uppsala internationalization process model revisited: From liability of foreignness to liability of outsidership,' *Journal of International Business Studies*, **40**(9), 1411–1431.
- Keller, W. (2004), 'International technology diffusion,' *Journal of Economic Literature*, **42**, 752–782.
- Kipping, M. and T. Clark (2012), *The Oxford Handbook of Management Consulting*. Oxford University Press: Oxford.
- Kipping, M. and N. Puig (2003), 'Entre influencias internacionales y tradiciones nacionales: las consultoras de empresa en la España del siglo XX,' *Cuadernos De Economía y Dirección De La Empresa*, **17**, 105–137.
- Kock, C. J. and M. F. Guillén (2001), 'Strategy and structure in developing countries: business groups as an evolutionary response to opportunities for unrelated diversification,' *Industrial and Corporate Change*, **10**(1), 77–113.
- Kogut, B. and U. Zander (1993), 'Knowledge of the firm and the evolutionary theory of the multinational corporation,' *Journal of International Business Studies*, **24**(4), 625–645.
- Kuisel, R. F. (1984), *Le Capitalisme d'État en France: Modernisation et Dirigisme au XX^e Siècle*. NRF/Gallimard: Paris.
- Lee, G. (2006), 'The effectiveness of international knowledge spillovers channels,' *European Economic Review*, **50**, 2075–2088.
- Lobo, J. F. (1979), 'Política científica y desarrollo económico 1959–1979,' *Información Comercial Española, ICE: Revista De Economía*, **552**, 35–46.
- López Rodó, L. (1971), *Política y Desarrollo*. Aguilar: Madrid.
- López Rodó, L. (1990), *Memorias*. Plaza & Janés: Barcelona.
- López, S. (1992), 'Un sistema tecnológico que progresa sin innovar. Aproximación a las claves de la Tercera Revolución Tecnológica en España,' *Economiaz*, **22**, 30–55.

- López, S. and J. M. Valdaliso (2001), 'Cambio tecnológico y crecimiento económico en España en la segunda mitad del siglo XX: indicadores y polémicas,' *Revista de Historia Industrial*, **19–20**, 319–339.
- López, S. and M. Cebrián (2004), 'Economic growth, technology transfer and convergence in Spain, 1960–1975,' in J. Ljunberg and J. P. Smits (eds), *Technology and Human Capital in Historical Perspective*. Mc Millan: New York, pp. 120–144.
- López-Piñero, J. M. (ed.), (1991), *España-ciencia*. Espasa Calpe: Madrid.
- Martín González, C. and L. Rodríguez (1977), *Cambio Técnico y Dependencia Tecnológica: El Caso De España*. Fundación del INI: Madrid.
- Martínez, L. and P. Antonio (1993), *Las Relaciones Hispano-francesas En El Marco Del Aislamiento Internacional Del Régimen Franquista (1945–1950)*. Universidad Autónoma de Madrid: Madrid.
- Molero, J. (1979), 'Las empresas de ingeniería,' *Información Comercial Española, ICE: Revista De Economía*, **552**, 59–71.
- Montoro, R. (1981), *La Universidad en la España de Franco*. CIS: Madrid.
- Muñoz, J., S. Roldán and Á. Serrano (1978), *La Internacionalización Del Capital en España: 1959–1977*. Editorial Cuadernos para el Diálogo: Madrid.
- Navarro Rubio, M. (1991), *Mis Memorias: Testimonio De Una Vida Política Truncada Por el "Caso MATEA"*. Plaza & Janes/Cambio 16: Barcelona.
- Núñez, C. E. (2005), 'Educación,' in A. Carreras and X. Tafunell (eds), *Estadísticas Históricas de España. Siglos XIX y XX*. coords. Fundación BBV: Bilbao, pp. 155–243.
- O'Brien, P. (1976), 'Tecnología extranjera e industrialización: el caso de España,' *Información Comercial Española, ICE: Revista De Economía*, **513**, 33–49.
- Ohkawa, K. and H. Rosovsky. (1973), *Japanese Economic Growth*. Stanford University Pre: Stanford.
- Organisation for Economic Co-operation and Development, OECD (1968), *L'assistance Technique et le Développement Economique de l'Espagne*. OECD: Paris.
- Ortúñez, P. P. (1999), *El Proceso de Nacionalización de los Ferrocarriles en España: Historia de las Grandes Compañías Ferroviarias, 1913–1943*. Universidad de Valladolid: Valladolid.
- Pardo Sanz, R. (2001), 'The mediterranean policy of Franco's Spain,' *Mediterranean Historical Review*, **16**(2), 45–68.
- Portes, A. (1998), 'Social capital: its origins and applications in modern sociology,' *Annual Review of Sociology*, **24**, 1–24.
- Puig, N. (2002), 'The Americanisation of a European latecomer: transferring US management models to Spain, 1950's–1970's,' in M. Kipping and N. Tiratsoo (eds), *Americanisation in 20th Century Europe: Business, Culture, Politics*. Université Charles de Gaulle-Lille 3: Lille, pp. 259–275.
- Puig, N. (2008), 'Asociación para el progreso de la dirección (APD),' in F. Ribera (ed.), *Los Números Uno En España*. Dobleerre Editorial: Barcelona, pp. 471–481.

- Puig, N. and A. Álvaro (2004), 'La guerra fría y los empresarios españoles: la articulación de los intereses económicos de Estados Unidos en España, 1950–1975,' *Revista De Historia Económica - Journal of Iberian and Latin American Economic History*, **22**(2), 387–424.
- Puig, N. and R. Castro (2009), 'Patterns of international investment in Spain, 1850–2005,' *Business History Review*, **83**(3), 505–537.
- Puig, N. and P. Fernández (2003), 'The education of Spanish entrepreneurs and managers: Madrid and Barcelona business schools, 1950–1975,' *Paedagogica Historica*, **39**(5), 651–672.
- Puig, N. and P. Fernández (2008), 'La gran empresa familiar española en el siglo XX: Claves de su profesionalización,' *Revista De La Historia De La Economía y De La Empresa*, **2**, 93–122.
- Romer, P. M. (1990), 'Endogenous technological change,' *Journal of Political Economy*, **98**, 71–102.
- Romero, A. and M. J. Santesteban (eds) (2008), *Cien años de Política Científica en España*. Fundación BBVA: Madrid.
- Sáez, M. Á. and P. Morlán (2009), *El Puerto Del Acero: Historia de la Siderurgia de Sagunto (1900–1984)*. Marcial Pons Historia: Madrid.
- Saint Marc, P. (1961), *La France Dans La C.E.C.A. Une Expérience De Planifications Multiples Du Charbon Et De L'acier*. Armand Colin: Paris.
- Saiz, P. (1999), *Invencción, Patentes E Innovación en la España Contemporánea*. OEPM: Madrid.
- Saiz, P. (2013), 'Did patents of introduction encourage technology transfer? Long-term evidence from the spanish innovation system,' *Cliometrica. Journal of Historical Economics and Econometric History*, **8**(1), 49–78.
- Sánchez Sánchez, E. M. (2006), *Rumbo Al Sur: Francia y la España Del Desarrollo, 1958–1969*. CSIC: Madrid.
- Sánchez, E. M. and R. Castro (2013), 'Foreign assistance to a 'closed economy'. The case of French firms in Spain, c. 1941–1963,' *Enterprise and Society*, **14**(3), 606–641.
- Sánchez, F. and J. Oliver (2004), *Trabajo, Política e Ideología en una Cuenca Minera*. Siglo XXI: Madrid.
- Sánchez, M. and M. Paloma (1983), *La Dependencia Tecnológica Española: Contratos de Transferencia de Tecnología Entre España y el Exterior*. Ministerio de Economía y Hacienda: Madrid.
- Sanz, L. (1997), *Estado, Ciencia y Tecnología en España, 1939–1997*. Alianza: Madrid.
- Schein, E. H. (1988), *Process Consultation: Its Role in Organizational Development*. Addison-Wesley: Reading, MA.
- Schröter, H. G. (2005), *Americanization of the European Economy: A Compact Survey of American Economic Influence in Europe Since the 1880s*. Springer: Dordrecht.
- Sebastián, J. and E. Muñoz (eds) (2006), *Radiografía de la Investigación Pública en España*. Biblioteca Nueva: Madrid.
- Tamames, R. (1989), 'Los planes de desarrollo (1964–1975),' *Información Comercial Española, ICE: Revista De Economía*, **676**, 57–66.

- Tena, A. (1999), 'Un nuevo perfil del proteccionismo español durante la restauración, 1875–1930,' *Revista De Historia Económica - Journal of Iberian and Latin American Economic History*, **17**(3), 579–562.
- Tena, A. (2005), 'Sector exterior,' in A. Carreras and X. Tafunell (eds), *Estadísticas Históricas de España. Siglos XIX y XX, Coords.* Fundación BBVA: Bilbao, pp. 573–643.
- Tena, A. (2010), 'Tariff history lessons from the European periphery. Protection Intensity and the infant industry argument in Spain and Italy 1870–1930,' *Historical Social Research*, **35**(1), 340–363.
- Uhagón, J. E. (1970), *La Exportación de Estudios y Proyectos: Tecniberia*. IMNAS: Madrid.
- Ullastres, J. (1975), 'El plan de estabilización de la economía española, realizaciones y perspectivas,' in J. Ros Hombravella (ed.), *Trece Economistas Españoles Ante La Economía Española*. Oikos- Tau: Barcelona, pp. 53–79.
- Van Rooij, A. (2004), *Building Plants: Markets for Technology and Internal Capabilities in DSM's Fertiliser Business, 1925–1970*. Aksant Academic Publishers: Amsterdam.
- Van Rooij, A. (2007), 'Methods for innovation: the varying role of industrial research in DSM's nitrogen fertilizer business, 1925–1970,' *Technology and Culture*, **48**(3), 550–574.
- Vernon, R. (1971), *Sovereignty at bay: the multinational spread of U.S. enterprises*. Longman: London.
- Vidal, O. J. (1999), 'La estructura de la propiedad, de la organización y la gestión de una gran empresa ferroviaria: la compañía de los caminos de hierro del norte de España, 1858–1936,' *Revista De Historia Económica - Journal of Iberian and Latin American Economic History*, **17**(3), 623–662.