Iberian Engineers in the French École Centrale. A new network of industrial experts and entrepreneurs[1]

Antoni Roca-Rosell
Universitat Politècnica de Catalunya – Barcelona – Spain
Ana Cardoso de Matos
CIDEHUS-Universidade de Évora – Évora – Portugal

Keywords: Engineers, *École Centrale de Paris*, industrial experts, entrepreneurs, Spain, Portugal.

1. The importance of the École Centrale de Paris in the international context

The *École Centrale des Arts et Manufactures* was created in Paris, in 1829, in response to a demand for engineers with the necessary skills to introduce the most recent scientific and technical developments in the various industrial activities. Since its foundation this school was recognized internationally as one of the best schools of training in the field of industrial engineering. For this reason, engineers from countries all over the world have attended or completed their training in industrial engineering at this school. In addition, being a private school[2] the École Centrale needed to have students and this international recognition represented a clear benefit.

Since there was no formal education for industrial engineers in the Iberian Peninsula until 1851, when schools were established in Madrid, Barcelona, Seville and Vergara, a number of persons from Spain and Portugal went to Paris to graduate. Most of them returned to their country and played an important role in the promotion of industries and civil works. Moreover, they became part of the network of *Centraliens* active in Spain and Portugal.

In this text, we propose a first approach to the Iberian students who have studied at the École Centrale of Paris and give some examples of their professional and politics career.

2. The Iberian engineers at École Centrale de Paris

In the 19th century and the first decades of the 20th century, the influence of the École Centrale des Arts et Manufactures (Central School of Arts and Manufactures) was particularly important for those countries that, at the time, wished to follow the French model of engineering education. In this sense, it was common to send engineers to complete their training in France: so it was the case of Portugal and Spain.

There was a real interest from the Spaniards and the Portuguese for the École Centrale des Arts et Manufactures: engineers were sent to complete their technical education and also to watch and learn the teaching methods in order to have a reference for the creation of technical schools. On their return, the "Iberians centraliens" implemented knowledge and practices that they had acquired at that school and several of them created and developed companies in different branches of industry. Others would succeed in important positions in the state administration or leading political careers. The organization of the industrial schools of these two countries also had the Centrale as reference, particularly in Spain.

2.1. The Spanish engineers

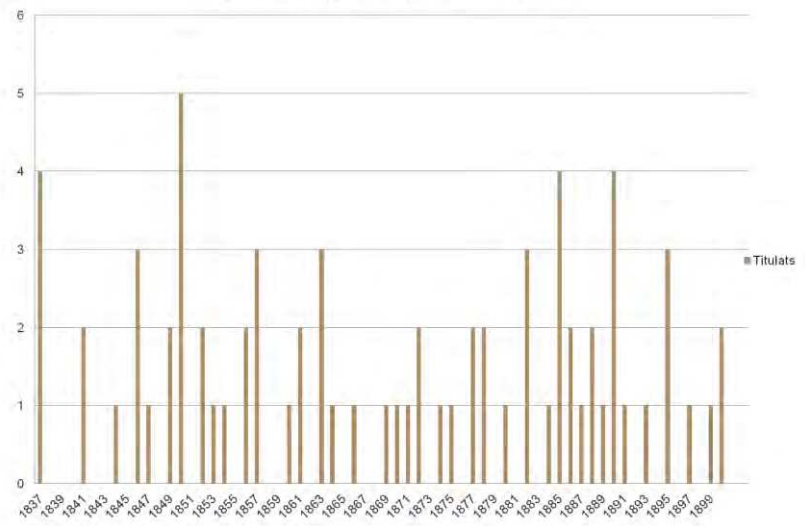
According to the study of Aingeru Zabala,[3] until 1900, 261 Spaniards studied engineering out of Spain. The main destinations were Paris, Liège, Freiberg, Lyon, St. Étienne, Clausthal,

[1] This work is included in the project HAR2010-17461/HIST from the Spanish Ministerio de Economía y Competitividad.

[2] The school became a state centre in 1859.

[3] Zabala Uriarte (2012).

Tharandt, Gembloux, Louvain, London, and Berlin. Those who had studied at École Centrale des Arts et Manufactures represented 28 % of all the engineers that had studied abroad[4]. Between the years of 1837 and 1900, 74 Spaniards had graduated in this school. However, the relationships between these engineers and the school were very different: some had attended comprehensive studies; others have attended only some subjects, without getting the degree.
Despite the existence of a degree equivalent in Spain – industrial engineering created in 1851[5]–, the presence of Spanish at Ecole Centrale was constant. What changed was the geographic origin of students. After 1850, the number of Catalans dwindled, and there was an increase of the number of students from Madrid and other cities of Castile; from Bilbao, the Basque country and other regions of the North of Spain; as well as from the region of Andalusia (especially Malaga). That means that the main Spanish regions, sets of modernization and industry – continued to send many students to the École Centrale of Paris.



Spanish graduates in the École Centrale in Paris from 1827 to 1900
Source: Table made by the authors with data from Zabala (2012)

A detailed analysis of all Spaniards who completed their training at the Ecole Centrale de Paris goes beyond the objectives of this article; however, the presentation of a few examples can be illustrative of the career paths of the Spanish engineers who graduated at this school. In 1834 four young Spaniards – Cipriano Segundo Montesino (1817-1901), Eduardo Rodríguez (1815-1881), Juan Cortázar (1809-1873), and Joaquín Alfonso y Martí (1805-1868?)[6] –, went to Paris with a scholarship from the Spanish government to attend the École Centrale of Paris. Before leaving, all four had attended the Conservatorio de Artes (Conservatory of Arts) of Madrid, which had been set up in 1824.
In 1837, after having graduated, they returned to Spain. Except for Juan Cortázar, who had graduated in science, all of them played an important role in engineering, building the transport network, developing the economy, and the political and administrative life of the country.
At the time of receiving the degree of the Centrale, Montesinos was only twenty years old, reason why he was considered too young to be led to a position of professor. Thus, he was subsidized by the State for two more years with the aim of perfecting his knowledge on the construction of machines in England.[7] On his return to Spain, Montesinos became professor

[4] Idem.
[5] Lusa Monforte; Roca-Rosell (2005); Roca et al (2006); Roca-Rosell (2013).
[6] About these engineers see: P. J. Ramón Teijelo and M. Silva Suárez (2007).
[7] J. Ramón Teijelo (2002-2003).

of the Conservatorio de Artes of Madrid, which allowed him to transmit to a new generation of engineers the knowledge that had acquired in the Centrale.
In 1847, he was appointed as founder member of the Real Academia of Ciencias Exactas, Físicas y Naturales de Madrid (Royal Academy of Exact, Physical and Natural Sciences of Madrid). In 1855 he was the director of public works in Madrid and the recognition of his technical skills was one of the reasons why he was chosen to be one of the thirteen experts of the International Commission for the Suez Isthmus, created in 1855[8].
He also had an important role in the Spanish railways. He was director of Compañia Tudela a Bilbao (Company from Tudela to Bilbao) and between 1869 and 1897, he directed the services of the new constructions of Compañia de los Ferrocarriles de Madrid a Zaragoza y Alicante (Company of the Railroads of Madrid to Saragossa, and Alicante). From 1897 to 1899 he became a member of the board of that company. He had also been actively involved in the political and administrative life of the country, namely as a member of the Senado (as part of the Spanish Parliament).
In 1837, Joaquin Alfonso y Martí graduated as a chemical engineer at the Centrale[9], and in 1844 he became a professor, and later director of the Conservatorio de Artes de Madrid. He was also a professor of the Real Instituto Industrial (Royal Industrial Institute), and, because of his expertise, he was chosen to organize this new center[10]. Alfonso y Martí was also a founding member of the Real Academia de Ciencias Exactas de Madrid (Academy of Exact Sciences of Madrid), created in 1847, and he was elected as a member of the commission that established the metric system in Spain.
After returning from Paris, Eduardo Rodríguez was nominated professor of elementary mathematics at the University of Madrid (1838-1839), after professor of geometry and linear design at the Escuela Normal (Normal school). In 1842, he became a professor at the Conservatorio de Artes (1842-1843), where he stayed only a year returning to the University of Madrid where he taught cosmography. He also was the first president of the Asociación de Ingenieros Industriales (Association of Industrials Engineers), founded in 1861.

2.2. Portuguese engineers at École Centrale de Paris

As early as in the 18th century, French technical schools were a reference for Portugal. Indeed, Portuguese engineers had the tradition of going abroad to complete their training; the École des Ponts et Chaussés (School of Bridges and Roads) in Paris was a privileged destiny of Portuguese engineers during the nineteenth century.
The choice of the École des Ponts et Chaussés to send engineers pensioners by the state is explained by the need for engineers with specific skills for the creation of the transport network, particularly railway networks, which started in Portugal only in 1856[11]. However, it is also possible to find Portuguese engineers, who have completed his training in other schools, as is the case of the École Centrale, the École de mines (School of Mines) and the École polytechnique (Polytechnic school). And despite the number of Portuguese engineers graduated by the Centrale was not very high, some of these engineers played an important role in Portuguese society, politics or industry.

[8] The work of this Committee has been published in *Percement de l'Isthme de Suez: rapport et projet de la Commission Internationale*, documents publiés par M. Ferdinand de Lesseps, Paris, Aux Bureaux de L'Isthme de Suez, Journal de l'Union des deux Mers, 1856.
[9] P. J. Ramón Teijelo and M. Silva Suárez (2007).
[10] J. M. Cano Pavon (1998).
[11] About Portuguese engineers that have studied at *École de ponts et chaussé* of Paris see A. Cardoso de Matos (2009).

Born in Portugal with Portuguese parents	Born in Portugal with foreign parents	Year of the diploma
João de Atouguia de França Neto (??-??)		1849
Agostinho Vicente Lourenço (1826-)		1853
	Frederico Luís Atanásio Hermano de Kessler (1843- 1895)	1865
Luis Teles de Drummond (1744-1794)		1865
	Louis Strauss (1862	1886
José Cordeiro (1867-1907)		1894
Ernesto Júlio Navarro (1876		1901
	Georges (Marius) Auguste Luis Audouard (1877- ??)	1901
	Paul Vimont (??- ??)	1903
	Louis Jean Baptiste Gaumet (1884-??)	1907
	Georges Marcel Vimont (1888-??)	1910
Sebastião Costa		1922
	Alexandre João Ceresa (1892-??)	???
	Paul Tiger (19..- ??)	1924
	Léger Félix Issenmann (1902-??)	1926

Charte 2-Portuguese engineers graduate at the Ecole central of Paris
Source: Archive of the Central School. Individual Student Process

Some of the Portuguese engineers who attended the Centrale were indeed sons of foreigners, most of whom engineers who worked in Portugal at the time of their birth. Some of them stayed in Portugal making a living in this country, others left with their parents and lived in another country. This is the case of Frederico Luís Atanásio Hermano de Kessler (1843-1895), who was the son of the 1st baron Kessler[12], of German origin, that was the doctor of the Portuguese king D. Fernando with whom he came to Portugal. His son, also named Frederico and later the 2nd Baron Kessler, graduated from the Centrale in 1865. In 1873, together with the engineer J. C. Ellicot, he obtained the concession for the railway from Porto to Póvoa de Varzim[13]. The following year these two entrepreneurs asked for the concession of other railways of reduced line[14].

In 1888, Kessler participated in the company in charge of the construction of the elevator of Nazaré. This company also belonged to the engineer Raul Mesnier de Ponsard that made the project of several elevators in iron structure, as was the case of the elevator of Santa Justa in Lisbon. Frederico Kessler was also the private secretary of the king.

Between the engineers who graduated at the École Centrale of Paris, we can mention as an example Ernesto Júlio Navarro (1867-??), who was the son of Emídio Navarro, an important Portuguese politician, that have been minister of Public Works. In 1888, Ernesto went to Paris and received the diploma of chemical engineer of the École Centrale of Paris in 1901. The industry of the ceramics for the construction was one of the industrial branches that aroused his interest. Thus, Navarro founded a ceramic factory in Pampilhosa da Serra, the Cerâmica Excelsior da Pampilhosa (Cerâmica Excelsior da Pampilhosa plant)[15].

Being a politically engaged republican, he had held important positions during republican

[12] Frederico Lessler, was born in Kalbe na der Saale, 28th august de 1804. He got maired in Lisbon with D. Carlota Nerlaz. The title of baron was attributed to him by D. Fernando that was regent during the minority of the D. Pedro V. Frederico Kessler died the 23 of August of 1872.

[13] Decree of 19 June 1873.

[14]. In 23 of June of 1874 they demand the concession of the railroads of reduced way of Lisbon to Torres Vedras, of Sintra to Pêro Pineiro and Vale of Alcântara to Xabregas.

[15] Cette usine a était aussi connue comme usine «Navarro».

governments. He was Minister of Commerce and Communications in 1919 and 1920 and Minister of Agriculture in 1922. He was also Deputy Director General of the Department of Colonies. After the introduction in Portugal of a new political regime, the Estado Novo, he abandoned the political life and went to work for companies, especially those linked to the railways. In 1927, he was attached to the direction of Portuguese railways. Always interested in sports and tourism, during the years of 1920 he was part of the direction of the Sporting Clube de Portugal (Sporting Club of Portugal), a club related to the football, and in 1936, he was part of the commission of the Congress of Tourism that took place in Portugal.

3. Final remarks

During the nineteenth century, the number by promotion of Spanish centraliens was almost constant, despite the existence of an equivalent degree in Spain, which shows that the École Centrale continued to be a benchmark for industrial engineering. Many families and industrial groups have chosen this centre for the education of the new generations. In the case of Portugal, the number of Portuguese engineers trained at the École Centrale de Paris was more limited, but these engineers played a vital role in the economy and society.

Only after a complete prosopographic research of the Spanish and Portuguese engineers trained at the Centrale during the XIX century and the beginning of the XX, we would able to construct a picture of the actual relevance that these engineers had in the modernization of their countries. In addition, in some cases these engineers have had professional paths that spread throughout Europe, and even outside Europe, according to the complexity of the industrial development of this period.

Bibliography

A. Cardoso de Matos, "Asserting the Portuguese Civil Engineering Identity: the Role Played by the École des ponts et chaussées" in *Les enjeux identitaires des ingénieurs : entre la formation et l'action/The Quest for a Professional Identity: Engineers between Training and Action*, edited by A. Cardoso de Matos, M. P. Diogo, I. Gouzevitch, A. Grelon, Lisboa, Colibri/CIDEHUS/CIUHCT, 2009, pp. 177-209.

J. M. Cano Pavon, «El Real Instituto Industrial de Madrid (1850-1867): Medios Humanos y materiales », *LLULL*, vol. 21, 1998, 0p. 33-62.

G. Lusa Monforte; A. Roca Rosell, «Historia de la ingeniería industrial. La Escuela de Barcelona 1851-2001», *Documentos de la Escuela de Ingenieros Industriales de Barcelona,* vol. 15, 2005, p. 13-95.

J. Ramón Teijelo, "Aproximación al Real Conservatorio de Artes (1824-1850): precedente institucional de la ingeniería industrial moderna", *Quaderns d'Història de l'Enginyeria*, Vol. V, 2002-2003, p. 45-65.

P. J. Ramón Teijelo and M. Silva Suárez, « El Real Conservatorio de Artes (1824-1887), cuerpo facultativo y consultivo auxiliar en el ramo de industria», in *Técnica e Ingeniería en España. El ochocientos. Profesiones e instituciones*, edited by M. Silva Suárez, vol. V, Zaragoza, Real Academia de Ingeniería, Institución 'Fernando el Católico', Prensas Universitarias, 2007, p. 228-253.

A. Roca Rosell, «Industrial Engineering in Spain, the challenge of a new liberal profession in the Nineteenth Century», *Host. Journal of History of Science and Technology* | Vol.7 | Spring 2013, p. 36-51.

A. Roca Rosell; G. Lusa-Monforte; F. Barca-Salom; C. Puig-Pla, «Industrial Engineering in Spain in the First Half of the Twentieth Century: From Renewal to Crisis», *History of Technology*, vol. 27 (2006), 147-161.

A. Zabala Uriarte, “Una inversión, estudiar en el extranjero: Ingenieros españoles del siglo XIX”, *Quaderns d’història de l’enginyeria*, 2012, vol. XIII, p. 287-347.