

Portuguese engineers, public works, and professional identity. The Portuguese Association of Civil Engineers (1869–1937)

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Abstract

This paper explores the link between the modernisation of Portugal and the emergence of a professional community embodying both technical knowledge and ‘know-how’, i.e., the society of engineers. After 1835 Portugal undertook a sustained, albeit slow, process of industrialization. The period following 1850, known as *Regeneração* (the Regeneration period), favoured an economic framework based on circulation, brought on by the development of a means of communication and, especially, by the establishment of a railway network. The close relationship between technology and progress is at the core of both the political agenda of António Maria Fontes Pereira de Melo (1819–1887), the leader of the Regeneration, and the strategy of Portuguese engineers to become a top influential professional group.

Keywords: engineers, public works, professional identity, modernisation, Portuguese 19th century.

This paper analyzes the role of the Portuguese Association of Civil Engineers (1869–1937) as one of the building blocks of the nineteenth-century technocratic modernizing agenda in Portugal.¹ The deployment of this technocratic agenda profited from the favorable conditions

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¹ The term “technocracy” was coined by William Henry Smyth in his 1919 article “Technocracy –Ways and Means to Gain Industrial Democracy,” published in the journal *Industrial Management* (57). However, ideas involving governance by technical experts had already been proposed and discussed before.

offered by the *Regeneração* and by the new post-Berlin conference colonial order, both largely based on the development of national, transnational and imperial networks of infrastructures.

Unlike most European engineers, Portuguese civil engineers separated from their military counterparts not through academic training, but through professional practice. Although the first non-military engineering schools in Portugal were founded only in 1911 during the Republican regime, a group of engineers with military training chose to be civil engineers, first public works engineers and later in the nineteenth century embracing industry as well. This was a well-planned move the success of which depended on the group's ability to assert itself as the exclusive master of technical knowledge and know-how, particularly concerning public works.

Sleeping with the enemy: from military to civil engineers

From the sixteenth to the eighteenth century, the Portuguese economy was characterized both by a severe lack of dynamism in production and a hypertrophy of the sphere of circulation. In fact, although Portugal was, in the fifteenth and early sixteenth centuries, one of the leading countries in establishing New World trading routes, the financial benefits of this leadership had little effect on Portuguese productive structure, feeding instead a huge unproductive group that lived on rents.² Moreover, the abundance of goods, especially sugar and gold, coming from Brazil during several centuries gave the Portuguese ruling class the possibility to acquire abroad manufactured products that were unobtainable at the time in its own country. Consequently, the need for home-based production of these materials simply did not arise. The result of this lack of national conditions for production of goods can be seen both in the Portuguese economic structure and in cultural attitudes, machines and textiles, as well as in its technicians and teachers, who were regularly imported.³

The absence of investment in technological and scientific structures lingers until the second half of the eighteenth century, when a new attitude towards industrialization emerged as a

² For a more detailed analysis see the Vitorino Magalhães Godinho, *A Estrutura da Antiga Sociedade Portuguesa* (Lisbon: Arcádia, 1975 (2ª. Edição), "Portugal and her empire 1648–1720", *New Cambridge Modern History*, 14 vols., Vol. V: *The Ascendancy of France, 1648–88* (Cambridge: Cambridge University Press, 1961), pp. 384–397 and Vol. VI: *The Rise of Great Britain and Russia, 1688–1715/25* (Cambridge: Cambridge University Press, 1970), pp. 509–540.

³ See Godinho, *A Estrutura and Portugal and her Empire*. Joel Serrão refers to the "desnecessidade" (unnecessariness) of science (Joel Serrão, Gabriela Martins, *Da Indústria Portuguesa do Antigo Regime ao Capitalismo* (Lisbon: Livros Horizonte, 1978), p. 41).

result of the enlightened and pro-industrial agenda of the Marquis of Pombal.⁴ It was however only in the nineteenth century and particularly after the 1850s, that the transition to an industrialized society took place. By then the key word became progress and its major reference technology.

The signs of an industrially driven agenda are traceable from 1812 onwards, based on an overall change in the technological system.⁵ The first steam machine applied to industry (with 40–50 horsepower) was established in 1819,⁶ in Lisbon, though this kind of machinery had been known in Portugal since 1742, when Bento de Moura presented to the Royal family a pioneering steam machine, based on that of the English Captain Thomas Savery (c. 1650–1715) and improved by the Portuguese himself.⁷ However, it was only after 1835 that the Portuguese industrial milieu gathered momentum and was able to transform the basic conditions of manufacture, by introducing new forms of production (from a domestic-based to a factory system) and machinery, by using steam-driven energy sources and by enlarging the size of factories and the number of workers.

The period following 1850, the *Regeneração* (Regeneration), changed the Portuguese economy. António Maria de Fontes Pereira de Melo, the Regeneration leader⁸ advocated that the development of transport and communication should be the main lever for the development of the national economy and particularly for the industrial take-off. Infrastructure such as railways,

⁴ The Marquis of Pombal, Sebastião José de Carvalho e Melo, was King José I's Prime Minister and became famous by his leadership in the aftermath of the 1755 Lisbon earthquake. As a diplomat he lived in London where he became acquainted with the English industrial milieu. As Prime Minister he used enlightened despotism both to promote a set of economic and educational reforms that aimed at developing Portugal and to reinforce his power and crush his opponents.

⁵ In 1812, after a short but sharp rise in grain prices, the curve of prices begins a long descent, giving a new impetus to industrial development, which is already clear by 1814. Victorino Magalhães Godinho, "Depressões comerciais e arranques industriais," in Joel Serrão, Gabriela Martins, *Da Indústria Portuguesa do Antigo Regime ao Capitalismo*, (Lisbon: Livros Horizonte, 1978), pp. 223–258 (246–248).

⁶ Jorge Custódio, "Preface to the work by José Acúrcio das Neves", *Memória sobre os meios de melhorar a industria portuguesa, considerada nos seus diferentes ramos* (Lisbon: Editorial Quercus, 1983).

⁷ Bento de Moura was a member of the Royal Society. In the letter of his admission it is stated: "A gentleman very well versed in Polite Literature, Skillfull in Natural Philosophy and an Extraordinary Genius for Mechanics (...)". His work as an engineer was acknowledged by the British engineer John Smeaton in the article published in the *Philosophical Transactions*. "An Engine for raising water by fire; being an improvement of Savery's construction to render it capable of working itself, invented by Mr. de Moura of Portugal" (January 1, 1753). Smeaton's article is available in <http://archive.org/details/philtrans01925504>.

⁸ Antonio Maria de Fontes Pereira de Melo was the main ideologist of the Regeneradores (regenerators), one of the main Portuguese political parties of the second half of the nineteenth century. He served as Minister of Finance from 1851 to 1852, as Minister of Public Works, Trade and Industry from 1852 to 1856, and as President of the Council (the equivalent to Prime-Minister) during 1871–77, 1878–79, and 1881–86. For more details on Fontes Pereira de Melo see Maria Filomena Mónica, "Um político, Fontes Pereira de Melo", *Análise Social*, vol. XXXII (143–144), 1997 (4.º–5.º), 731–745.

roads, and telegraphs were at the core of Fontes' agenda of material improvements, which became known as *fontismo*. The idea of the existence of a close relationship between technological advance and progress (the concept of progress was associated with the physical presence of the machine) is the key to understand his policy. In numerous public statements Fontes refers to the railway as the most important feature of the new economic framework: in 1855, 'Above the horse driven carriage, there is the trolley, above this the locomotive and above this, progress;'⁹ in 1865, 'I see railways as an instrument of civilization, as the most powerful instrument of progress (...).'¹⁰

In such context, how did Portuguese engineers react? In Portugal, as in all of Europe, the first engineers were military engineers, those who had attended lectures related to military problems. The first reference to a Portuguese engineer seems to date back to 1559 when King D. Sebastião engaged Isidro de Almeida as 'provedor e feitor de metaes' (provider and producer of metals) based on '(...) his skill in everything dealing with metals and knowledge concerning both military and metallic mines.'¹¹

The use of the title of engineer became more common towards the end of the 17th century and throughout the eighteenth century for officers trained in the *Aula da Fortificação e Arquitectura Militar* (Class of Fortification and Military Architecture), under the direction of Luis Serrão Pimentel, who first used the title of Grand Engineer of the Kingdom and was author of the book *Methodo Lusitano de desenhar as fortificações* (Portuguese Method for Planning Fortifications) (1647).

In 1719, Manuel de Azevedo Fortes (1660–1749), then Grand Engineer of Portugal (he succeeded Pimentel), sketched the first plan for regulating the work of engineers, namely his professional duties and academic training.¹² Azevedo Fortes was an *estrangeirado* (a term used for

⁹ Speech given on 18 January 1855 at the Câmara dos Deputados. For more details about the debate on the railways see Hugo Pereira, *Caminhos-De-Ferro nos Debates Parlamentares (1845–1860)* (Master Degree diss., Faculdade de Letras da Universidade do Porto, 2008). Available in <http://repositorio-aberto.up.pt/bitstream/10216/23124/2/tesemesthugopereira000093156.pdf>.

¹⁰ Speech given on 6 December 1865.

¹¹ Francisco de Sousa Viterbo, *Dicionário histórico e documental dos arquitectos, engenheiros e constructores portugueses* (Lisbon: Imprensa Nacional, 1899), p. 5.

¹² On Manuel de Azevedo Fortes, see Maria Paula Diogo, Ana Carneiro, and Ana Simões, "El Grand Tour de la Tecnología: El Estrangeirado Manuel de Azevedo Fortes," in A. Lafuente, A. Cardoso Matos, and T. Saraiva (eds.), in *Maquinismo Ibérico – Tecnología y cultura en la península ibérica, siglos XVIII–XX*, Chapter 3, Aranjuez, Doce Calles, 2006, pp. 119-139.

Europe-oriented intellectuals),¹³ who studied *belles-lettres* at the Imperial College of Madrid, ‘strict sciences’¹⁴ at the University of Alcalá de Henares, particularly modern philosophy, experimental philosophy and mathematics, courses that he later extended at the Plessis College in France. Having completed his education, Fortes taught mathematics at the University of Sienna in the service of Francesco Maria de Medici, brother of the Grand Duke of Tuscany.

Azevedo Fortes’ education outside Portugal, his professional career that also began abroad, the contacts he maintained within his personal European network of peers made him a quintessential example of a new attitude *vis á vis* science and technology in Portugal and his works will be at the heart of the nineteenth century Portuguese civil engineers’ concept about the role that engineering should play in defining the essential attributes of a modern nation. Fortes’ attitude towards this role in modern societies emerges in his works, particularly in the *Engenheiro Portuguez* (Portuguese Engineer) (1728–1729), a two-volume seminal work on Portuguese engineering, which aimed at defining the unique characteristics, as a mix of theory and practice, critical for the development of the kingdom. This work, together with *Lógica Racional, Geométrica e Analítica* (Rational, Analytical and Geometric Logic) (1744), will serve as textbooks for a new generation of Portuguese engineers.

In 1779, the *Academia Real da Marinha* (Royal Navy Academy) formally replaced the Class of Fortification and Military Architecture. Its curricula were mostly based on a maths course (arithmetic, algebra, navigation) aimed at training officers and pilots for the Royal Navy and Merchant Marine, as well as to prepare those who wanted to pursue the course of military engineering.

In 1790, the creation of the *Academia Real de Fortificação, Artilharia e Desenho* (Royal Academy of Fortification Artillery and Drawing) completed the cycle of ‘scientification’ of engineering, by emphasizing its theoretical component. The four-year course included a strong theoretical curriculum (following the previous experience of the Royal Navy Academy) and practical lectures based on field work. This curriculum presented a dual profile: the first three years were clearly military driven, covering topics such as the general rules of fortification, the

¹³ For more on the role of Portugal’s estrangeirados in science and technology, see Ana Carneiro, Ana Simões, and Maria Paula Diogo, “The Scientific Revolution in Eighteenth Century Portugal: The Role of the Estrangeirados (Europe-Oriented Intellectuals)”, *Social Studies of Science*, 30:4 (2000), 591–619.

¹⁴ Diogo Barbosa Machado, *Biblioteca Lusitana* (Lisbon: Oficina de Ignacio Rodrigues, 1752), Tomo III, p. 186.

general theory of attack and defence, artillery and mines; the last year was totally dedicated to civil engineering, focusing on ‘civil architecture, stone and wood cutting, budgeting, and everything related to materials as well as the explanation of the best methods to build roads. (...) they had to learn hydraulics and the building of bridges, channels, ports and dams.’¹⁵ This dual profile remained until very late in Portugal. Military engineers were envisaged as having a double personality, a military one in times of war, and civil in times of peace. In 1812, when the Engineering Corps was founded, the same idea still prevailed and by the end of the nineteenth century it continued to be considered as perfectly acceptable: ‘in all European countries Engineering Corps dealt with strictly military affairs. However in Portugal during peaceful times two thirds of the Engineering Corps is devoted to public works. To a certain extent this is a quite acceptable system.’¹⁶ An increasing number of officers requested royal permission to attend the classes at the Royal Academy of Fortification Artillery and Drawing classes, slowly asserting a theoretical–practical profile for engineers.

In 1804 the first of a few numbers of a journal titled *O Engenheiro Civil Portuguez* (The Portuguese Civil Engineer) was published marking the beginning of a growing awareness of civil (as opposed to military) engineers in Portugal. The relationships between theory and practice were emphasized and the exact boundaries of engineering were subsequently drawn: an engineer was not an artisan since he had an academic training; the engineer was to be distinguished from the architect because his academic training had a scientific nature.

In 1836, following the Liberal revolution and the building of the Liberal state, Passos Manuel, the Prime Minister, launched a set of reforms aimed at organizing the structure of public education, mainly on a utilitarian basis. In this context, the Royal Academy of Fortification Artillery and Drawing was replaced by the *Escola do Exército* (Army School),¹⁷ and the *Escola Politécnica* (Polytechnic School) in Lisbon and the *Academia Politécnica* (Polytechnic Academy) in Oporto¹⁸ were created, each closely linked to the Ministry of War.

¹⁵ Decree, 2 January 1790.

¹⁶ D. Luiz da Camara, *A Questão Militar. Reorganização do Exército sujeita á analyse da Comissão Superior da Guerra* (Lisbon, 1890), p.18.

¹⁷ Decree, 12 January 1837.

¹⁸ Decrees, 11 and 13 January 1837.

At the Army School, along with three courses devoted to military training, two engineering courses, one on military engineering and a second on civil engineering were taught. The fact that a civil engineering course was taught at the Army School may seem quite awkward, at a first glance, but it just extends the eighteenth-century trend of having engineers with a dual profile: ‘among us, engineering officers are assigned to two different kind of professional tasks: civil and military. We will have still to wait for a long time until a new class of civil servants, i.e. Civil Engineers, may relieve them from the first kind of tasks.’¹⁹

The degree in military engineering took three years with seven chairs divided into sets of lectures; the course of civil engineering had only two years and was built on the military course, using part of its curriculum, namely: the 1st lecture of the 6th chair, *General rules on the building of military bridges*; the 5th lecture of the 2nd chair, *Building materials*; 4th chair, *Stability and mechanics applied to machines and hydraulics*; 5th chair, *Civil architecture*; 6th chair, *Topography and drawing*; 7th chair, *English*. In both cases, students had to attend their preparatory studies either at the Polytechnic School and the Polytechnic Academy or at the University of Coimbra. Preparatory studies included scientific topics, considered essential to the metier of the future engineers, such as mathematics, botany, mineralogy, geology, metallurgy, astronomy, geodesy, physics, chemistry, mechanics (and machines and specially steam machines), drawing (geometry, human figure, flora and fauna, and machines) and law. The Polytechnic Academy of Porto offered a five-year course on Bridges and Roads, but its curriculum was subordinated to the military curricula of the school.

Despite these limitations, the creation of the Polytechnic Schools and the changes in the curricula of the Army School were essential for the growth and strengthening of civil engineering,²⁰ by nurturing a spirit of a group rooted in a sense of difference from their military counterparts.

¹⁹ *Diário do Governo*, N^o 239 (1839), 1476.

²⁰ For details on the Polytechnic School and on the Army School see Luis Miguel Carolino, “The Making of an Academic Tradition: The Foundation of the Lisbon Polytechnic School and the Development of Higher Technical Education in Portugal (1779–1837)”, *Paedagogica Historica: International Journal of the History of Education*, 48 (3) (2012): 391–410; Marta Macedo, *Projectar e construir a Nação. Engenheiros, ciência e território em Portugal no séc. XIX* (Lisboa: ICS, 2012); Maria Paula Diogo, Ana Cardoso Matos, “Aprender a ser ingeniero: La enseñanza de la ingeniería en el Portugal de los siglos XVIII y XIX” “Learning how to be an engineer in Portugal (eighteenth and nineteenth centuries)”, in A. Lafuente, A. Cardoso Matos, and T. Saraiva (eds.), *Maquinismo Ibérico – Tecnología y cultura e n la península ibérica, siglos XVIII–XX* (Aranjuez: Doce Calles, 2006), pp. 141–165.

Asserting a professional identity: the Portuguese Association of Civil Engineers

Nevertheless, the real upsurge of civil engineering was made possible not *via* academic training, but in the field, based on the construction of the railway, the very heart of *fontismo*. As already mentioned, the *Regeneração* set the pace of a new economic strategy, aimed at developing the industrial sector. The core of this strategy was the efficiency of a network of communications that would enhance the circulation of goods; the railways were considered, therefore, as the most powerful tool to achieve modernity and, in so far as progress was materialised in a technical apparatus, engineers, the professional group that mastered technological knowledge and practise, became one of the main pillars of the ‘new’ Portuguese society.

In 1853, Fontes Pereira de Melo signed a contract with the *Companhia Central e Peninsular dos Caminhos de Ferro Portugueses* (Central and Peninsular Railway Company); the leader of this company, the Englishman Hardy Hislop, chose an English engineer, Thomas Rumball, to design the first railway line (Lisbon–Carregado). Although in this initial phase the work of Portuguese engineers was not very visible (only minor adjustments to the initial plans were made by João Crisóstomo de Abreu e Sousa (1811–1895) and Joaquim Tomás Lobo d'Ávila (1822–1901), the next stage of the railway network proved to be an excellent opportunity for Portuguese civil engineers to show their proficiency. The Northern and East lines were already planned and directed by the Portuguese engineers João Evangelista de Abreu (1827–1869), trained at the French school *École des Ponts et Chaussées*.²¹ Later, in 1859, when the *Companhia Real dos Caminhos de Ferro* (Royal Railway Company) was founded, a Portuguese engineer Manuel Afonso Espregueira (1835–1917) was appointed as director.

In technological terms, this focus on railways fostered the development of a specialised professional community engaged in technical activities. The role of engineers changed as a result of their involvement in the building of the railways. Contact with foreign technological communities and, above all, the opportunity to establish the importance of their specific skills and to apply them on equal terms with their European peers made it possible for Portuguese

²¹ Maria Paula Diogo, “João Evangelista de Abreu”, *Annuaire de l'École des Ponts et Chaussées*, 2008; Ana Cardoso Matos and Maria Paula Diogo, “Le rôle des ingénieurs dans l'administration portugaise: 1852–1900”, *Quaderns d'Història de l'Enginyeria*, Vol X (2009), 351–365.

engineers to see themselves as professionals. Railway construction allowed them to show their know-how and to practise their skills. The fact that public works, such as the railway line, were the main hope for Portuguese modernization and that they embodied the welfare of the general public, significantly raised the status of engineers as a professional group. On the other hand, this very same close relation between engineers and public works shaped the face of the technological community in Portugal.

The new professional field of civil engineering was, however, difficult to carve within the academic sphere, creating a gap between the educational and the professional realms. Despite frequent but minor changes concerning the course curricula, civil engineering continued to be considered as part of military training, having no autonomous status. Thus, public works kept being carried out by military engineers, who were part of the 'technical services', which were in charge of 'the defence of the country, civil works, roads, geological and other surveys, draining, improvement of ports and the supervision and management of arsenals.'²² This hybrid profile, however, was increasingly inadequate to the country's needs. The question of how to train civil engineers remained for a long time an unsolved business. In 1854, Júlio Máximo de Oliveira Pimentel (1809–1884), a well-known chemist and teacher at the Polytechnic School as well as a Member of the Parliament, submitted a project that aimed at converting part of the military training institutions into Scientific and Technical Professional Schools: the Army School (for cavalry and artillery officers and military engineers), and the Navy School (for navy officers and shipbuilders) would be kept as part of the military training, but a Public Works School (for public works engineers, architects, geographical and hydraulics engineers and mining engineers) and an Industrial School (for mechanical, chemical and metallurgy engineers and foremen) were created. This highly controversial project, which challenged both the traditional Portuguese model of engineering education and the role played by the polytechnic schools by creating schools fully dedicated to several branches of non-military engineering, was not approved.²³

²² *Diário do Governo*, N^o251 (1859), 1361

²³ The proposal of closing down the Polytechnic Academy of Oporto and other schools and the minor role ascribed to the Lisbon Polytechnic generated strong opposition, in particular from the teaching staff of the Oporto Polytechnic, who addressed a petition to the members of Parliament. This petition was later published in the *Jornal da Associação Industrial Portuense* (n^os 19 (pp. 296–304), 20 (pp. 312–320) & 21 (pp. 330–336)), with the title *Breve Memória sobre a Instrução Publica Superior no Porto e nas Provincias do Norte, offerecida aos Senhores Deputados da Nação Portugueza pelos Lentes da Academia Polytechnica*.

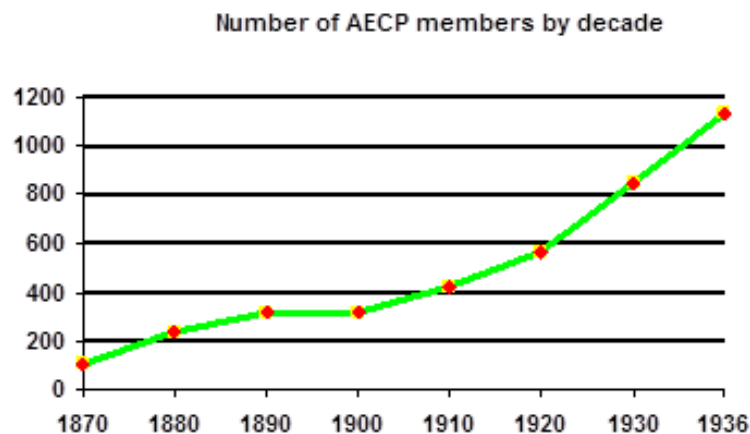
In 1859, the Parliament resumed the debate on the training of Portuguese engineers. The obvious lack of schools was, once again, the keystone of the discussion. However the solution that was considered the most suitable was not to create new schools in Portugal but to send the best students abroad. The Ministry of Public Works was bound to send at least three students per year to study abroad. The *École des Ponts et Chaussées*, the *École des Mines* and the engineering schools at Ghent, Freiberg and Liège were considered the top schools at the time, and thus the ideal scientific and pedagogical milieu to complete their engineering training. After this period abroad students were expected to return to the motherland ‘with the training required to fulfil the noble functions of an engineer and through useful work payback Portugal what the country had invested.’²⁴

The government created the Civil and Auxiliary Engineering Corps in 1864, acknowledging the importance, both in number and in work, of Portuguese civil engineers, most of them engaged in public works. Although the Civil and Auxiliary Engineering Corps was abolished in 1869, civil engineers were already powerful enough to build their own professional association – the *Associação dos Engenheiros Cívicos Portuguezes* (Portuguese Association of Civil Engineers).²⁵ This professional association had two main goals: first, to build a well-grounded corpus of engineering knowledge, in order to clearly establish the borders of the professional field (only those who held the intellectual keys for the understanding of the specific language, theoretical concepts and practical know-how of engineering—now fully considered as a science—could call themselves engineers); secondly, to show to the general public how engineers played a crucial role in a modern and industrial society. Portuguese engineers thus came to view themselves as a specialized group within society as a whole, essential to the handling of technological knowledge and practices by way of which the entire process of modernization would gradually take place; they sought, therefore, the creation of a well-defined professional consciousness as well as the public recognition of engineers as a social-cultural entity.

²⁴ Diário do Governo, N^o251 (1859), 1361. For more details see Ana Cardoso Matos and Maria Paula Diogo, “Bringing it all back home: Portuguese engineers and their travels of learning (1850–1900)”, *HoST – International Journal of History of Science and Technology*, 1 (2007).

²⁵ For more details see Maria Paula Diogo, *A Construção de uma Identidade Profissional – A Associação dos Engenheiros Cívicos Portuguezes (1869–1937)*, PhD thesis, FCT/UNL, 1994; M. P. Diogo, “In search of a professional identity – The Associação dos Engenheiros Cívicos Portuguezes”, *ICON*, 2 (1996), 123–137.

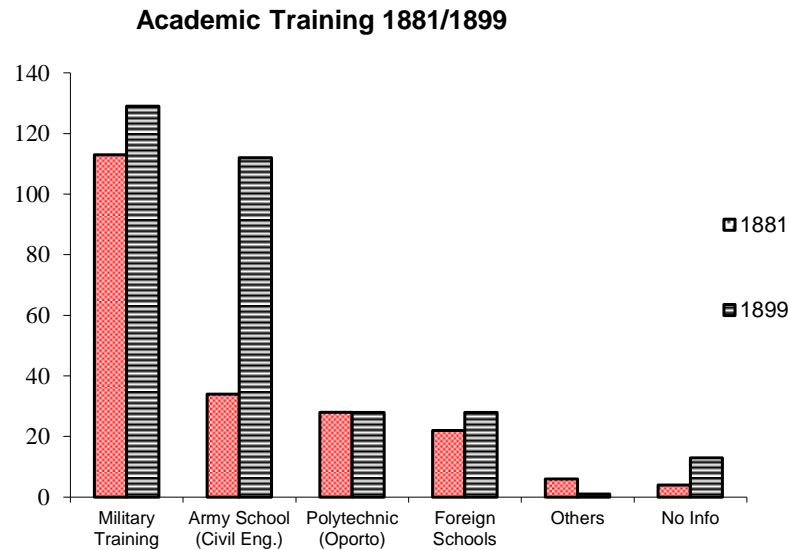
The first President of the Portuguese Association of Civil Engineers, founded by 107 members (the number of members continued to grow throughout its 68 years of activity) was João Crisóstomo de Abreu e Sousa, the engineer closely related with the railways and a firm supporter of the Regeneration project.²⁶ The choice of João Crisóstomo as leader of the Association, in addition to recognizing his professional merit, consecrates symbolically the strong links between the growth of national engineering, railways and modernity.



Source: *Revista de Obras Públicas e Minas* (Journal of Public Works and Mines) (1870–1936).

The Association's statutes, written and approved in 1869, established the official architecture of this new professional group reflecting not only the principal areas of engineering in Portugal—railways, harbours, roads, and mines—but also those which were still marginal, such as industry. Civil engineers definitely broke apart from their military counterparts in a conscious and planned strategic move. It was a powerful professional statement, almost a leap of faith of all these engineers who were by training, military engineers. This strategy paid off well and by the end of the century the number of engineers who had a specific training in the civil area already matched those who had a military training.

²⁶ Maria Paula Diogo, “João Crisóstomo de Abreu e Sousa”, *Biografias de Cientista e Engenheiros Portugueses online* (Biographies of Portuguese Scientists and Engineers online); <http://www.ciuht.com/index.php/pt/biografias.html>.

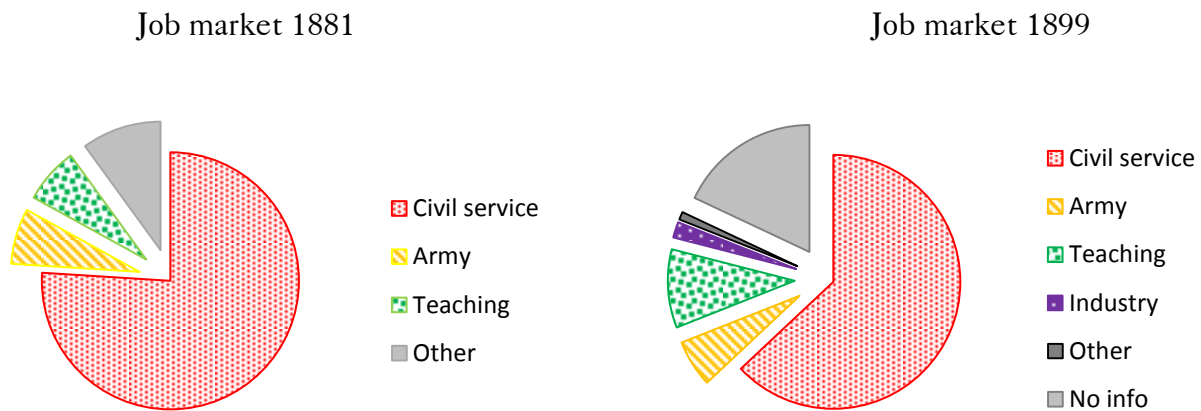


Source: *Revista de Obras Públicas e Minas* (Journal of Public Works and Mines), 1881, XII, 135-136 (March/April):45-58; 1899, XXX, 351-352 (March/April):167-201.

The job market mirrored the very specific conditions that led to the creation of a community of non-military engineers: as railways were the main lever for creating civil engineers in Portugal, the typical nineteenth-century engineer was a civil servant, working either in public works (railways, harbours, bridges) or directly in government (as ministers or members of various committees).²⁷ Although since the early days of the Association engineers endeavoured to establish ‘bridges’ between themselves and industry, it was only in the last years of the nineteenth century that Portuguese industry became slowly aware of the importance of qualified staff for the improvement of its technological level.²⁸ However, and despite the lack of regular dialogue with industrialists, engineers continued to envisage industry as a potential prime area of intervention. In the last decade of the nineteenth century, although public works continue to occupy the most significant slice of Portuguese engineering, they lost their exclusivity and gave way to a diversification of interests centred on industrial activity, sheltered by a favourable economic environment. A new image of the engineer as both the efficient technical and the social leader, which would characterize the twentieth century, was already emerging

²⁷ Cardoso de Matos, Diogo, “Le role des ingénieurs”.

²⁸ Maria Paula Diogo, “Indústria e Engenheiros no Portugal de fins do século XIX: o caso de uma relação difícil”, *Scripta Nova*, 69 (2000).

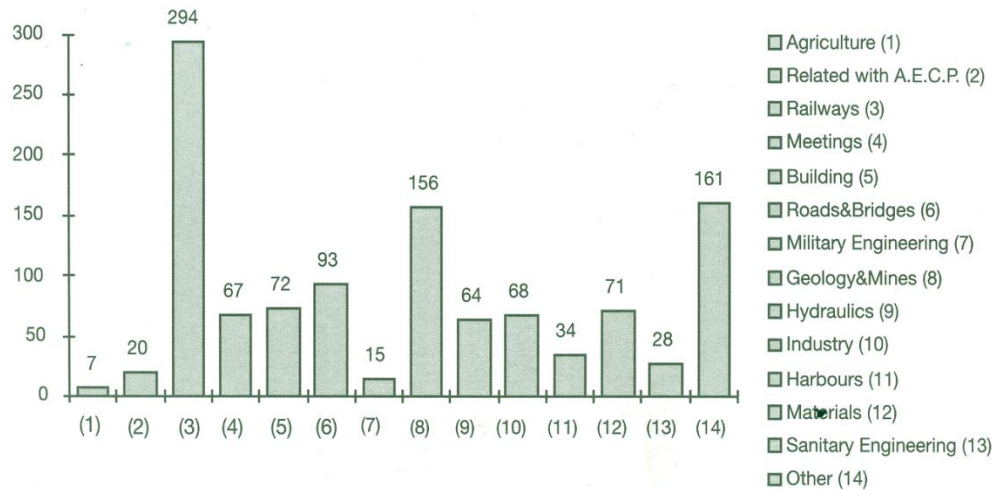


Source: *Revista de Obras Públicas e Minas (Journal of Public Works and Mines)*, 1881, XII, 135-136 (March/April): 45-58; 1899, XXX, 351-352 (March/April):167-201.

The awareness of the importance of industry as one of their fields of expertise was always present amidst the members of the Portuguese Association of Civil Engineers. In 1872, João Crisóstomo de Abreu e Sousa, in two different articles published in the *Journal of Public Works and Mines* clearly established a relationship of cause and effect between the lack of engineers working in factories and the weakness of Portuguese industrial economy. By the end of the nineteenth century, in 1898, the Association published a document named *Alvites* (Proposals) in which the main questions concerning Portuguese engineering and Portuguese industry were summarized: (i) to be able to prosper, Portuguese industry needed to have engineers; (ii) engineers welcomed industry as an important field of work; (iii) changes should be made in academic curricula in order to train engineers who could fulfil the needs of a modern industry. Therefore, the strong *liaisons* between government and engineers depended greatly upon the importance of the public works themselves, and, in addition, upon the weakness of the industrial structure unable to break with old technological routines.

The areas related to public works—mainly railways, harbours and bridges and, later, the electrical systems—are, naturally, the main subject of the articles published in the *Journal of Public Works and Mines*. Industrial topics remain scarce, confirming, with some few rare exceptions, the gap and fragile dialogue between engineers and a non-engineer friendly industrial milieu, still shrouded in old technical routines.

Articles published in the *Journal of Public Works and Mines* by subject



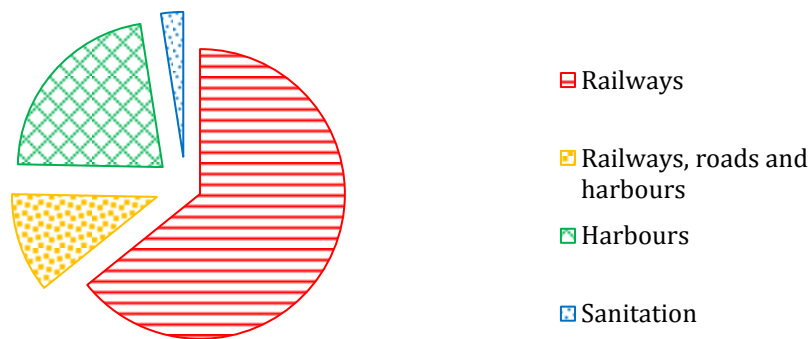
Source: *Revista de Obras Públicas e Minas (Journal of Public Works and Mines)* (1870–1936).

Public works were also the main focus of Portuguese engineering in Africa. Early in the 1870s it was already possible to foresee the deep changes that were to take place in the traditional colonial order. One should recall in this respect the political agendas of Disraeli and Cecil Rhodes for the British Empire, of Leopold II of Belgium for the Congo, of the conflicts between the Boers and Great Britain (Orange and Transvaal), of France for its African possessions, and of Bismarck for the colonial expansion of Germany. The Berlin Conference (1885) was the natural consequence of the voracious appetite of European industrial powers for new sources of raw materials and markets, imposing the principle of the effective occupation of overseas territories, instead of the traditional rule of historical prerogatives.²⁹ Confronted with the intention of dividing Africa among the great powers of Europe, Portugal was forced to rethink its political agenda of exploration and effective occupation. The strategy for Portuguese domination was soon associated with technological domination; as on the mainland, railways, roads, harbours and telegraphs were envisaged as preferential marks of the Portuguese presence in Angola and Mozambique. Portuguese engineers were undoubtedly one of the main pieces in the Portuguese strategy concerning the African colonies. Their commitment was very clear and was perceived not

²⁹ There is an extensive bibliography on this topic, notably the classic by Thomas Pakenham, *The Scramble for Africa* (London: Abacus, 1992).

only as a patriotic duty, but also as a professional imperative: the effective occupation of the African territories, by using technical expertise, asserted the Portuguese engineers as the main tool of the colonial policy, allowing them to show, within the national context, their proficiency and creating a wider market for young engineers to develop their careers.

Articles published in the *Journal of Public Works* on African topics



Source: *Revista de Obras Públicas e Minas (Journal of Public Works and Mines)* (1870–1936).

For nineteenth-century Portuguese engineers, the national technology-driven agenda in Africa embodied different messages and expectations. As far as the international scene was concerned, Portugal consolidated its presence in Africa and kept its colonies; concerning the national context the profits of this strategy were quite clear: national pride was secured, Portugal undertook once again the flag of the ‘civilising mission’ and Portuguese engineers could expand their expertise to the colonies, becoming the main protagonists of the Portuguese intervention in African territories. In this process of asserting a professional identity for Portuguese engineers, the Portuguese Association of Civil Engineers undertook internationalization as one of its banners. Being part of a transnational community was both a legitimizing strategy and a channel for updating their skills. Portuguese engineers were closely in touch with their fellow engineers abroad, either by reading specialized journals or by going to international meetings or to the World Exhibitions. These contacts, mainly with France and Spain, allowed Portuguese engineers

to keep updated with the main issues concerning engineering and, above all, gave the Portuguese engineers a sense of being part of a wide, international ‘family’.

Going abroad to study at different stages of their careers was also part of this same strategy. Although the choice of ‘buying’ foreign scientific and technological knowledge in the European market-place had evident costs to Portugal, namely by delaying the implementation of national centres for developing expertise and skills,³⁰ the role played by Portuguese engineers who went abroad to attend foreign schools was crucial to the modernization agenda of the nineteenth century. In a peripheral country such as Portugal the quest for new and updated technological knowledge relied deeply on the efficiency of a network of formal and informal channels, which acted as vehicles for learning and spreading new skills, new machines and new expertise. Studying abroad was part of this overall strategy aiming to appropriate foreign knowledge and to adapt it to local needs and expectations.³¹

The locomotive of progress: public works and civil engineers

Several conclusions may be drawn from this analysis. In a peripheral economy such as the Portuguese one, the weakness of the private industrial sector (with low productivity and old technological routines) forced the government to play a decisive role in the modernization agenda of the nineteenth century. Since 1850, Portuguese economic policy was grounded upon the transportation network; public works (railways, harbours, bridges, roads, etc.) therefore played a crucial role both in the structure of the national job market and in the structure of the engineering community.

In this context, which was the typical profile of a nineteenth-century Portuguese engineer, Portuguese engineers were above all public administrators, most of them civil servants and a considerable number played a role as politicians serving in numerous committees and

³⁰ This situation is not at all unique to Portugal. Engineering communities both from southern Europe countries and the Russian Empire, as well as Latin Americans and others, had to face the presence of foreign engineers at the service of the state. See Ian Inkster, “Engineering Identity, Intellectual Property, and Patterns of Invention”, in A. Cardoso de Matos, M.P.Diogo, I. Gouzévitch, and A. Grelon (eds.), *The Quest for a Professional Identity: Engineers between Training and Action* (Lisbon: Edições Colibri, 2009), pp. 357–380.

³¹ Maria Paula Diogo and Ana Cardoso Matos, “Being an engineer in the European Periphery: three case studies on Portuguese engineering,” *History of Technology*, 27 (2007), 125–146.

governments. In addition, Portugal's weak economic structure, based on routine, low-level technical methods, was not conducive to creating a welcoming climate for a profession that specialised in technical innovation. Modernisation required innovation, which in turn meant investing in machinery and training. None of these conditions existed in Portugal at the end of the nineteenth century. Nevertheless, Portuguese engineers were definitively aware of their unique role in the 'new Portugal', a country eager to meet the European standards of industrialization and economic development. By the time it celebrated its 30th anniversary, the Portuguese Association of Civil Engineers presented itself to the general public as the main protagonist of an epic that told the story of a modern, progressive Portugal.

Portuguese civil engineers were, during the second half of the nineteenth century, a true *noblesse d'état*.³² They managed to achieve this status both by their training and professional strategy, as well as by their strong relationship with the state. The formal transmission of technical knowledge and skills in a restricted set of high schools, namely the Polytechnic and the Army School, the value of the diploma as a piece of legitimation of authority, the building of a professional society that secured an *esprit de corps*, and the homogeneity of its members, produced an elite destined to occupy dominant positions. The transmission of knowledge and practices of technical competence conceal a process of transmission of social and political power among individuals with the same academic and professional qualities, very close to the consecration of a title of nobility. It is within this framework, in which the elites are the main stakeholders of the state, that the reproduction of the corps is so important, as it secures the reproduction of the state itself. The case of Portuguese civil engineers is an excellent example of Bourdieu's analysis³², going beyond the topic of education and reaching the realm of professional careers.

Portuguese civil engineers asserted their professional essence through a very active participation in building the liberal state, particularly during the second half of the nineteenth century. They were the anchors of the *Regeneração* and embodied, as a professional group, its ideology and its project for Portugal mostly supported by a technocratic agenda, close to the saint-simonian ideal of a government composed of technical experts³³ and not far from William

³² Pierre Bourdieu, *La noblesse d'État : grandes écoles et esprit de corps*, Paris, 1989.

³³ Claude Henri de Rouvroy (Comte de Saint-Simon), *Introduction aux travaux scientifiques du XIXe siècle (1803)*, *Mémoire sur la science de l'homme* (1813), *De la réorganisation de la société européenne* (1814).

Henry Smyth's concept of ruling the people through the agency of engineers and scientists.³⁴ Engineers and public works assumed a key role as leaders of modernity, by providing the technical expertise and building the technical landscape that would hopefully allow Portugal to recover its place in the arena of developed European countries.

³⁴ William Henry Smyth, "Technocracy—Ways and Means to Gain Industrial Democracy," *Industrial Management*, 57, (1919).