Technical Education in the Basque Country: An Historical Perspective, 1776-1900

Anduaga Egaña, Aitor
Basque Museum of the History of Medicine & Science.
UPV/EHU-University of the Basque Country. Faculty of Medicine.
Sarriena, z/g. 48940 Leioa

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This paper presents a historical analysis of technical education and the development of vocational training; each of them has been considered as a consequence of the industrialisation that took place in the Basque Country between 1776 and 1900. Three main areas are dealt with. The principal arguments of the analysis are as follows: the decisive function the Spanish State had in convergence and centralisation through education prior to 1850; and the emergence of the engineering culture that made the institutionalisation of technical education at the end of the 19th century possible.

Key Words: Basque Country. Education. Vocational training. Technical teaching. History of Science. Industrialisation. Euskalerriaren Adiskideen Elkartea *[Association of the Friends of the Basque Country].*

Basque historiography has not gone sufficiently into depth into the analysis of the technical education and the role played by technological development in the country's industrialisation. Earlier than thought, in 1956, the writer Ildefonso Gurruchaga referred thus to this centuries old proverty:

> El pueblo vasco ha sido poco aficionado a escribir y conocer su historia, pero no es forzoso ni deseable que en el futuro siga igual, pues esta «ahistoria», más que virtud es defecto que le acarrea grave daño.[1]

To a certain extent, this comment continues to be relevant. The history of technical education in the Basque Country continues to be a misty, unfinished painting, in which the details and features of a basically industrial society –and its social bonds– are waiting to be painted in.[2]

This article is a preliminary, explorative piece of work. It focuses on three main areas:

a) The emergence of modern, technical education in a society of estates based on guild education through two routes: the enlightened one, and the one of the commercial bourgeoisie.

b) The role of the Spanish State in the convergence and statalisation of these two currents for developing education around 1850.

c) The germination of a clearly local and bourgeois institutional framework for promoting industrial training and, together with this, the development of an engineering culture in the Basque Country.

1. THE EMERGENCE OF MODERN TECHNICAL EDUCATION

Modern technical education was born and developed at the time of the Enlightenment within the 18th century economic societies. During the last third of the century in fact, the establishing of enlightened values and ideas encouraged the promotion of technical education. The social development of «usefulness» arose as education and association initiatives came of age.

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1. "The Basques have not been keen to write about and find out about their own history, but it does not have to be that way in the future, nor is it desirable that it should be that way, because this «ahistory» rather than a virtue, is a defect that causes them great damage." GURRUCHAGA, Ildefonso. "Aprendamos nuestra historia." In: *Tierra Vasca*, 1 July 1956, 5 - SAN MIGUEL, M. L. *Ildefonso Gurruchaga. Aprendamos nuestra historia*. 1st published. San Sebastián: Editorial Saturrarán, 2002, quoted on page 101.

2. An exception is, for example, AZURMENDI, Joxe. "Irakaskuntza eta pentsamendua Euskal Herriko historian." In: INTXAUSTI, Joseba (Editor). *Euskal Herria: Historia eta Gizartea / Historia y Sociedad.* Donostia: Lan Kide Aurrezkia, 1985, pp. 357-386. See also: SAENZ DE SANTAMARÍA, Carmelo. "La educación institucionalizada en el País Vasco en los siglos XVIII y XIX." In: *IX Congreso de Estudios Vascos. Antecedentes próximos de la Sociedad Vasca actual. Siglos XVIII y XIX*. San Sebastián: Eusko Ikaskuntza-Sociedad de Estudios Vascos-Basque Studies Society, 1983, pp. 281-292.

With that enlightened coming of age came the end of the principal model of the *Ancien Regime* and the estate-based society. The old university system (symbolised by the University of Oñati in the Basque Country) was immersed in a long process of decline and restructuring in the 18th century, and this process was prolonged by the 19th century political and social crises. Nevertheless, in no way was that effort at restructuring able to handle the new practical sciences, the prospect of technical knowledge, its introduction into private industry and its support in the factory, as viewed at the turn of the century. This partly explains why the old system based on the guild (or workshop school) lasted so long until the new technical school was established.[3]

Technical education achieved its greatest social reputation in the last quarter of the 18th century, precisely because the action was given special emphasis, while being identified at the same time with industry and with the application and use of enlightened ideas. It was eleven years after Xavier Mª de Munibe opened that famous constituent assembly in Bergara, in February 1765 the Association of the Friends of the Basque Country (RSBAP-Real Sociedad Bascongada de Amigos del País-Euskalerriaren Adiskideen Elkartea-Royal Society of Friends of the Basque Country) gave them a response to the hopes for technical education. In 1776, in fact, he set up the Royal Patriotic Seminar (Errege Mintegi Patriotikoa) in Bergara; it was a school which engaged professors of chemistry, metallurgy and mineralogy (in addition to studies in commerce, drawing, agriculture, seamanship and architecture). Bringing in teachers was part of an enlightened tradition and, to a great extent, the tradition was to send scholarship holders abroad and to make use of contacts throughout Europe.[4]

This civil recruitment of professionals from abroad by certain intellectual and educated nobles contrasted with the traditional and scholastic-humanist teachers. This means a regeneration of the ancient noble elite in the social sphere, and in the academic field it means a shift from the principle of Aristotelian authority to the principles of practicality and specialization as a professional value. In a word, a new professional elite was emerging through the introduction of significant changes in the traditional education of «the nobility»: pragmatic orientation and scientific training.[5]

Despite being unknown, the 18th century "Seminarian"[6] became a recognised social figure. Evidence of this is the fact that the Count of Floridablanca gave permission, thanks to the support the Spanish Crown gave the RSBAP,

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3. ARPAL, Jesús, ASUA, Begoña, DÁVILA, Paulí. *Educación y sociedad en el País Vasco*. 1st publ. San Sebastián: Editorial Txertoa, 1983, pp. 15-17.

4. PELLÓN, Inés; GAGO, Ramón. *Historia de las Cátedras de Química y Mineralogía de Bergara a finales del siglo XVIII*. Bergara: Bergara Town Council, 1994, pp. 18-22.

5. ARPAL, Jesús. "La formación científico-técnica en la sociedad estamental: a propósito del Seminario de Bergara (Guipúzcoa)." In: *Actas del III Congreso de la Sociedad Española de Historia de las Ciencias y de las Técnicas*. San Sebastián: Ed. Guipuzcoana, 1986, I, pp. 9-19, 12.

6. The name given to former pupils of the Royal Patriotic Seminar (Errege Mintegi Patriotikoa) in Bergara.

for the "Seminarians" to be accepted as cadets in any of the regiments of the army. What is more, Munibe requested that the positions of all the directors of Mines, Foundries, Royal Factories and Mints be competed for from the ranks of the people who had completed studies in chemistry, metallurgy and mining in Bergara.[7]

Mining was one of that cluster of scientific and technical subjects that stood out from among the areas in the group. The setting up of the first mining school in the world, the one in Freiburg, Germany, was a centre of attraction for the members of the Association of the Friends of the Basque Country. The Association of the Friends of the Basque Country granted scholarships to students in Freiburg: the son of the Count of Peñaflorida himself in 1772, for example, or the Elhuyar brothers José and Fausto in 1778; the fact that they had been there strengthened the economic and strategic nature of mining.

This strategy could be reflected by the publication entitled *Extractos de las Juntas de la Real Sociedad Bascongada* [Abstracts of the Meetings of the Royal Society of Friends of the Basque Country]. In 1778, for example, the importance of periods spent abroad, the benefit of the teaching and the links the teachers had with mining were highlighted. On the other hand, when speaking of the sciences of chemistry, mineralogy and metallurgy, this was how they were described:

> (…) las tres nuevas clases de enseñanzas que se están difundiendo en el país y que producirán los mismos beneficios y efectos que en otras partes, pues en los Reinos del Norte el gran comercio de metales se debe a los saberes de estas ciencias, que se adquieren en los Colegios de Minas.[8]

2. THE SECOND ROUTE: CONSULATES AND COMMERCIAL COMMISSIONS

The second route of technical education we have from the end of the 18th century onwards was that of the consulates and commercial commissions, which supported the schools of commerce and seamanship. Unlike the broad scientific and technical perspective that the RSBAP gave to education (which, among other things, had its origins in a local nobility linked to power), the consulate perspective suited the interests and mentalities of the commercial bourgeoisie: liberal in their ideological attitude, pro-industrialist in the

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7. LABORDE, Manuel. *El Real Seminario de Vergara en la Historia de las Escuelas de Ingenieros Industriales de España.* 1st publ. San Sebastián: Sociedad Económica Vascongada de los Amigos del País, 1966, p. 9.

8. "(…) the three new types of teaching that are being spread in the country and which will produce the same benefits and have the same effects as elsewhere, for in the Kingdoms of the North the great trade in metals is due to the knowledge of these sciences which is acquired at the Mining Schools." See citation: MANSILLA, Hermenegildo. "Contribución vasca a los estudios técnicos superiores. La herencia del Instituto de Vergara y la Escuela Técnica Superior de Minas de Madrid." In: RUBIO, Guadalupe (Editor.) *La tradición técnica del pueblo vasco: El hombre y su medio. Homenaje a Julio Caro Baroja*. 1st Publ. in Madrid, 1995, pp 157-164, 160.

economic sphere, and pragmatic as far as the content of education was concerned. Their fields of action also differed: the former operated mainly inside the country, whereas the latter operated on the coast.

When troops of the French National Convention took Bergara by force in November 1794, the activities of the Seminar were interrupted and the RSBAP became immersed in a crisis. The Peninsula War upset and limited its teaching even further. But in the context of the socio-cultural setback brought about by the establishing once again of the *Ancien Regime*, enlightened projects survived with greater or lesser strength, in particular in areas on the periphery of the Spanish State. The Consulates and commercial commissions precisaly guaranteed the historical continuation of technical education, in particular, that of the sciences that had to do with corporate interests which did not pose a threat to the Government.[9]

2.1. Schools of Commerce

In the Basque Country the first endeavour to set up a school for the teaching of commerce took place in 1800. That year the Consulate of Bilbao proposed courses in mathematics, geography and languages in order to improve the training of Biscayan merchants. But the wartime circumstances at that time prevented the project from going ahead. It was the first in a series of endeavours that took two decades until the official inauguration of the School of Commerce was held in 1818. After securing the approval of the General Council of Castile, the new statutes established the creation of four new professorships: of mathematics, drawing, French and English. Even if it was "particularly oriented towards commerce", the syllabus drawn up at the start of the century had fewer ambitions than those of the beginning of the century (for example, accounting was not taught).[10]

In fact, the first boost can be noticed in the teachers. The famous cleric Alberto Lista y Aragón obtained the professorship in mathematics by public examination in March 1819.[11] In the barely two years that he was in the post,

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9. On the theory of the bourgeois groups who, under the mechanisms of Absolutism, promoted the post-enlightenment movement which survived, see: ESCOLANO, Agustín. "Restauración y posilustración. Las enseñanzas técnicas y científicas en el primer tercio del siglo XIX." In: Ruiz Berrio, J. ed. *La educación en la España contemporánea. Cuestiones históricas.* 1st publ. Madrid: Sociedad Española de Pedagogía, 1985, pp. 37-48, 37.

10. The best documented and most detailed monographic work on the School of Commerce of Bilbao is PONS Y MERI, José. *Reseña de la Escuela Superior de Comercio de Bilbao*. 1st Publ. Bilbao: Librería de Segundo Salvador, 1893. Also essential is: BARRENECHEA, José Manuel ed., *Primeras instituciones educativas de formación empresarial en Bilbao: Textos históricos*. 1st Publ. Vitoria-Gasteiz: Servicio Central de Publicaciones del Gobierno Vasco (Central Publishing Service of the Basque Government), 2004, esp. pp. XIX-LIX. The introductory chapter of this book gathers together and expands Pons's work.

11. JURETSCHKE, Hans. *Vida, obra y pensamiento de Alberto Lista*. 1st Publ. Madrid: Consejo Superior de Investigaciones Científicas (National Research Council), 1951, pp. 80-81.

he wrote some short mathematical texts for the school which were paid for by the Consulate. They included, *Tratado elemental de aritmética*, *Tratado de álgebra elemental* and *Tratado elemental de geometría, Aplicación del álgebra a la geometría y trigonometría rectilínea* (1819), all of which were published in Bilbao. His attitude was very similar indeed to that of the teachers at the big –and only– schools of this kind existing in Europe at that time.[12]

But in the Constitutional Triennium (1820-1823) with the restoration of absolutism under Fernando VII, everything that seemed abundant and fruitful with Lista could not, however, conceal the subsequent frustration and pessimism, that characterized the most outstanding schools of that education elite (those of Bilbao and Bergara). During the twenty years that followed, a bewildering period of revolutions and coup d'états was experienced, including the 1st Carlist War that was to have such a profound effect on the Basque Country. A feeling of sorrow and historic failure about that period flowed out of the pages of the excellent *Reseña* written towards the end of the century (in 1893) by José Pons y Meri, the Headmaster and Teacher of the School of Commerce. If we add to it the loss of data and documents, we find ourselves in a dark, tragic moment.

> (…) no estaban los tiempos para que las gentes pensaran en instruirse, lo cual requiere una perfecta tranquilidad material y moral de que carecían, sino en salvar su vida e intereses de los peligros que de continuo corrían en aquella general catástrofe.[13]

2.2. Schools of Seamanship

The other type of school along this second route was the establishing of instruction linked to the sciences of seamanship corresponding to the commercial bourgeoisie. They were promoted by the Consulates of Bilbao and San Sebastian. Seamanship had been prominent since the start of the 16th century. The Consulate of Bilbao had been promoting courses in seamanship since 1511 at least; so they were coeval with the canons handed down at the University of Oñati in 1543. But like those of Oñati, the darker moments outnumbered the brighter ones along the way.[14]

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12. ALLENDE, Fermín, TORNE, Mª Ángeles, VELARDE, Pedro Mª. "Centros docentes bilbaínos para la formación de profesionales de la empresa: un perfil histórico." In: *Bidebarrieta. Anuario de Humanidades y Ciencias Sociales de Bilbao*, nº 1, 1996, pp. 315-334, 320.

13. As PONS (1893), *op. cit.*, p. 79, said: ''it was not a time for people to think about getting an education, which requires perfect material and moral tranquillity, which they lacked, but to think about saving their skins and their interests from the dangers they were continually coming up against in that wholesale catastrophe."

14. For a more general perspective on this type of school: DUO, Gonzalo. *Las escuelas de náutica de Bizkaia, Gipuzkoa y Laburdi: siglos XVI-XX, análisis histórico documental.* Vitoria-Gasteiz: Servicio Central de Publicaciones del Gobierno Vasco (Central Publishing Service of the Basque Government), 2001.

What is very significant is the fact that a School of Seamanship was set up by the Consulate of Bilbao, the City Council of Bilbao and the Lordships of Bizkaia[15] half a century before the founding of schools of pilotage in all the maritime consulates of Spain was legalised (Decree of 08-07-1787). The school known as the «Museo Matemático» came under the headmastership of the enlightened man from Lekeitio José Vicente Ibáñez de la Rentería.[16] The reasons for setting it up had been clearly laid out two years previously in the Byelaws of 1837 of the Consulate of Bilbao; at the same time an administrative requirement was established for the people who wanted to become officers on the high seas: *"*ninguno podrá ser admitido sin presentar certificado de los capitanes o pilotos con los que has practicado dos años el pilotaje, llevando su punto y rumbo" ["no one can be admitted without producing a certificate from the masters or officers with whom you have practised pilotage for two years, "llevando su punto y rumbo" (steering a straight course)]. As the officers on the high seas were expecting to conquer the Indies, they hoped to be "instruidos y sepan lo que es necesario saber en el cuadrante e astrolabio, para la junta de la práctica con la Teórica*"* [instructed and know all that has to be known about the quadrant and astrolabe, so that they can unite practice with theory].[17] In other words, the School provided the necessary technical instruction.[18]

The teachers who later occupied the seamanship professorships –in Bilbao, Miguel Archer (1739-1752), Ignacio Albiz (1753-1798), Agustín Albiz (1798-1813),…– regarded "seamanship instruction" as something more than a military obligation [In this respect it should be remembered that the Navy made use of the control of pilotage; in fact, the Schools of Seamanship were under the Navy Ministry until 1849]. As the 18th century progressed, the teaching acquired new tasks: seamanship instruction to prepare officers for the navy, but for the merchant navy fleet, too. Many teachers who taught at the Basque schools of Seamanship spread this idea: that the schools should give a naval profession to local young people.

For the RSBAP (Royal Society of Friends of the Basque Country), too, seamanship studies embodied high values of enlightened thought, in other words, usefulness, prosperity and scientific nature. Not in vain, in Bilbao the RSBAP

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15. AGIRREAZKUENAGA, Joseba. "Educación, sanidad y ciencias sociales." In: *Bizkaia, 1789-1814*. Bilbao: Bizkaiko Foru Aldundia (Provincial Government of Bizkaia), 1989, pp. 243-267, 251-253.

16. IBAÑEZ, Itsaso, LLOMBART, José. "La formación de pilotos en la Escuela de Náutica de Bilbao, siglos XVIII y XIX." In: *Itsas Memoria. Revista de Estudios Marítimos del País Vasco,* Untzi Museoa (Maritime Museum) (Donostia-San Sebastian), nº 3, 2000, 747-772,

17. Citado en DUO, Gonzalo. "La enseñanza de náutica en el País Vasco." In: *Itsas Memoria: Revista de Estudios Marítimos del País Vasco*, nº 3, 2000, pp.729-745, 731.

18. There is an interesting unfinished and unpublished piece of work on the School of Bilbao: BASAS, Manuel. *Breve historia de la Escuela de Náutica de Bilbao y de otras de Vizcaya*. Bilbao, 1968. This piece of research was transcribed in its entirety: DAVALILLO, Alfonso. *Evolución histórica de la Escuela Náutica de Bilbao*. 1. publ. Vitoria-Gasteiz: Servicio Central de Publicaciones del Gobierno Vasco (Central Publishing Service of the Basque Government), 1985.

organised and maintained a seamanship classroom, awarded two prizes every year (amounting to forty and twenty pesos, respectively) "for the students of the schools of seamanship of Bizkaia and Gipuzkoa, who, in the opinion of the professor of mathematics of the Seminar", do and resolve the proposed problems best. But now, unlike the instruction offered in the consulates, that nobility, influenced by encyclopaedism (and due to making the profession's technical knowledge and worthiness official) felt that technical education was linked to public happiness, prosperity, virtue and progress. Technical education became noble between the Aristotelian and Thomist hegemony of the *Ancien Regime*. In the view of the enlightened, technical training followed a "revolution", one that do contrasts with the continuous "evolution" of the commercial bourgeois elite.

In these two cases the academic assessment of the last third of the 18th century appears to give reasons for rejoicing. Despite major documentary gaps, it seems that the production of officers suited the requirements and needs of the merchant navy.[19] The Consulate of Bilbao awarded the largest number of officers' licenses at that time. A total of 507 got officers' licenses for the high seas between 1783 and 1802 (an average of 25 per year), and 150 of them were from the left bank of the river. The RSBAP emerged strong in 1797: the seamanship classroom in Bilbao had 14 students (that same year the Consulate awarded 44 officers' licences). Both attitudes appear to coincide with the level of development of seagoing vessels in Bizkaia. Yet the following decade fewer licenses were awarded coinciding with a dramatic fall in numbers. Between 1803 and 1812 only 121 students obtained their licenses (an average of 16 officers per year); two thirds of them got licenses to make voyages to America and a third to do trips to the north of Europe.[20]

After absolutism was established once again, the organic dependence the School of Seamanship had with the Navy Ministry disappeared completely in 1826 (even though in practice that Ministry maintained effective control). The official separation of the navy took place during that unhappy decade together with many political "ups and downs" in Spain. As a result of the influence on the schools of seamanship, it is worth mentioning the proclamation of the first Trading Code in 1829, among other things. As a result of this the Consulate was abolished, and in its place the Royal Commercial Commission of Bilbao was established. Did all these ups and downs enable a change in the control over official seamanship to take place under the direction of the three corporations of Bizkaia in the 18th century until the emergence of the harsh centralism that became apparent halfway through the 19th century? This does not appear to be the case. The School of Seamanship of Bilbao continued under the jurisdiction of the new Commission. The three corporations of Bizkaia continued to

19. These data are in the Municipal Archive of Bilbao and were obtained from the records on "Exámenes y nombramientos de pilotos"; they have been put together in the work DUO (2000), *op. cit*., pp. 734-738.

20. Officers' records in 1804 specified which seas the officers licenses were valid for. Thus they were divided between the Seas of the North, Europe and America.

appoint seamanship teachers availing themselves of the power they had been given to do so.

But paradoxically, with the separation from the Navy, control over teaching standards were relaxed. The three corporations appointed Modesto Gutiérrez de la Peña, a teacher of mathematics at the school in Bilbao, to the position of Master of Seamanship Studies in 1823, to replace Manuel Magniller, an officer in the Royal Navy; the appointment was not to the liking of the Ministry for the Navy. Organic dependence meant that the Head of the Association of Navy Officers could oversee the schools of seamanship in order to ensure the best teaching. What stands out is the fact that the three corporations of Bizkaia received complaints about the teaching of the master Gutiérrez four years after separation from the Navy. This event led to the introduction of the regulations "Reglamento para la Escuela de Náutica" in 1833, with part of it being revised in 1836. The reasons for drawing up these regulations had to do with the abandoning of the standard of teaching referred to above, and at the same time with the need to be in line with Navy requirements, that requirement being understood as affecting general seamanship teaching:

> (…) [para que los estudiantes] puedan adquirir todos los necesarios conocimientos para constituirles buenos pilotos, se esmerará el profesor en la enseñanza de los alumnos, adoptando […] para cada uno de los dos cursos los métodos, libros, planos y sistemas que más convengan y puedan contribuir a la formación de completos pilotos mercantes, conciliándolo con lo que se practica en los Departamentos de la Marina Real, á fin de que en todos tiempos se hallen en disposición de disfrutar de las ventajas que concediese el Gobierno a los que hubiesen hecho sus estudios en la escuela de Náutica de Bilbao sobre una forma análoga á la que se requiere para pilotos de la Real Armada.[21]

In addition to the school of Bilbao, the Consulate of San Sebastian was the other institution that promoted seamanship studies. Its first initiative was in fact to build a School of Seamanship the moment the Consulate was set up in 1756. The aim was to build a special school "for officers of the high seas for sailing overseas." The Bylaws of both the Consulate of Donostia (published in 1766) and the previous ones (the famous Byelaws of the Consulate of Bilbao of 1737) were clear rules reflecting the importance of the schools.[22]

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21. "…[so that the students] can acquire all the necessary knowledge to become good officers, the teacher will do his best in teaching the students by adopting […] for each of the two years the methods, books, maps and systems that are most suitable and which can contribute to the training of all-round merchant navy officers, bringing it into line with what is practised in the Royal Navy Departments, so that they may at all times be in a position to enjoy the advantages the Government may grant to those who have completed their studies at the School of Seamanship in Bilbao in a way that is analogous with what is required for Royal Navy officers."

"Artícle 11 del Reglamento para la Escuela de Náutica del 10 de agosto de 1836", Archivo General del Señorío de Vizcaya, Sección Instrucción Pública, Registro 75, Legajo 6, Nº 3-2 — IBAÑEZ and LLOMBART (2000), *op. cit.*, p. 751, quoted.

22. These two Byelaws required aspiring officers to study theory for six months and do two years' practice, "llevando su punto y rumbo" [steering a straight course]. See: *Ordenanzas de la I. U. Casa de Contratación y Consulado de la MNML C. de San Sebastián*. Oyarzun, 1814, ch. 23.

Nevertheless, in the decades that followed their main features were a lack of resources, interruption of the courses and the stagnation of the teacher in his position. For reasons unknown, after a long suspension around 1894, the Consulate endeavoured to build "a school of drawing, geometry, trigonometry and seamanship tools" with sailing and sea trade in mind. It paid for a teacher of mathematical and seamanship studies in 1820 and that is the way it continued until the Consulate was closed down in 1829.[23]

In short, the Trade Consulates of Bilbao and San Sebastian with the support of local corporations filled the lack of a university in the Basque Country, if one can put it like that, as the RSBAP did from 1776 onwards. Nevertheless, they tried to build schools in the most important towns on the coast which would respond to the socio-economic requirements of that time. So the initiatives were aimed at promoting the studies that would impact directly on their specific corporative interests: commerce and seamanship studies.

3. CONVERGENCE AND STATALISATION OF THE TWO CURRENTS FOR THE DEVELOPMENT OF EDUCATION

The establishing of secondary education as a distinct level came about in the 19th century, and took place when the liberal State was established and moderate liberalism emerged the victor in 1845. With the establishing of *Institutos Provinciales (Provincial Institutes)* –the Spanish version of the *Lycées françaises*– a model of "secondary education" that was valid as preparation for university was created. In particular, it was created without any concern for professional matters. Thus, soon after the bourgeoisie had come to power, it set up and organised a state system of public education in support of its interests. The aim was for education to be for everyone, but only primary education; secondary education would be for the middle and upper classes.[24]

The creation and development of this education model in the Basque Country stood out with the same features as those highlighted in the Spanish State: secularization, uniformity, centralism, statalisation and classism. The Spanish State took it upon itself to control and inspect all the schools, both public and private ones. Yet in the Basque case this process was tinted by the colour of a country that was bringing together industry, craftsmanship and the maritime traditions; a country that required education to be in line with such activities, and one that had been making efforts in response to the intrinsic needs of the bourgeoisie. Witness to that tradition was the fact that, two years before being inaugurated the Provincial Institute of Bilbao, the number

23. ARROYO, Ricardo. *Apunte para una historia de la enseñanza de Náutica en España*. Madrid: Centro de Publicaciones del Ministerio de Transportes, Turismo y Comunicaciones (Publishing Centre of the Spanish Ministry for Transport, Tourism and Communications), 1989, p. 234. See also: DUO (2001), *op. cit.*, pp. 156-162.

24. VIÑAO, Antonio. "Educación secundaria y transformaciones socioeconómicas." *Revista de Educación*, nº 238, 1975, pp. 5-14, 240.

of applicants for technical education was higher than that for classical education: 260 students (248 at the Consulate's schools and 12 at the School of Seamanship, while there were 80 at the Humanities School of Bizkaia).[25]

Even though it is true the Minister for Internal Affairs Pedro José Pidal, established in 1845 the rules drawn up for studies known as "segunda enseñanza, superiores y especiales" (secondary, higher and special education), little attention was paid to special education.[26] Quite the opposite, it seems that personal initiatives of the local corporations furthered technical and industrial education in the Basque Country.[27]

In fact, two years after the Higher Institute of Gipuzkoa was created out of the old Seminar of Bergara (1845), Manuel Ozaeta and the Count of Villafranca, on behalf of Bergara Town Council and the Seminar, respectively, requested the Spanish government for personnal to build a "Basque Institute for Science and Industry." This concern grew as time went by, and the following year a group of Deputies and Senators of Gipuzkoa, all former Seminarians (including the Marquis of Toca and 50 former students) expressly requested *"una Escuela Científica e Industrial principalmente dedicada a la enseñanza de las ciencias y de sus más importantes aplicaciones"* [... a School for Science and Industry mainly devoted to the teaching of the sciences and their most important applications].[28]

In the view of the supporters of the initiative it was essential to create

> (…) una Escuela destinada a dar impulso a la Agricultura, al Comercio y a las Artes donde se formen jóvenes capaces de levantar y dirigir grandes maquinarias, manufacturas y todo género de establecimientos industriales. En suma, una Institución científica general que reuniera las ventajas que ofrecen

25. DÁVILA, Paulí, GANBORENEA, Txomin. "La enseñanza secundaria en Bizkaia. Origen y evolución, siglos XIX y XX." In: Objetos científicos no imaginados. Fisikaren irakaskuntzarako tresnak Bizkaian. Bilbao: Provincial Government of Bizkaia, 2002.

26. From the 156 articles that make up the Pidal and Gil de Zárate scheme, only three were on special studies, i.e. studies which were valid for working in the professions called *"carreras y profesiones que no estaban sujetas a la recepción de grados académicos"* [careers and professions that were not subject to the receiving of academic qualifications]. According to the scheme, the Government would only pay for studies that had to do with the following activities: "construcción de caminos, canales y puertos; el laboreo de las minas; la agricultura; la veterinaria; la náutica; el comercio; las bellas artes; las artes y oficios; y la profesión de escribanos y procuradores de los tribunales" [civil engineering, mining techniques, agriculture, veterinary science, seamanship, commerce, fine arts, arts and crafts; and the profession of scribes and clerks of the court]. See: *Gaceta de Madrid*, 1-5, 27 September 1845.

27. Even though the idea of setting up provincial institutes coincides with the usual *modus operandi* followed in the State, as a result of the requests of the local or provincial corporations, the Basque initiatives, to tell the truth, placed greater emphasis on vocational training. 50 institutes were set up in Spain between 1835 and 1849.

28. For details on the training in the project: CABALLER, María Cinta, LLOMBART, José, PELLÓN, Inés. *La Escuela Industrial de Bergara (1851-1861).* San Sebastián: Colegio Oficial de Ingenieros Industriales de Gipuzkoa, 2001, pp. 65-73.

> en Francia y otros países la Escuela Politécnica, las de Artes y Manufacturas y las de Agricultura y Comercio.[29]

So the social demand for technical education coincides with the social maturity of former Seminarians.[30]

In that claming academic context, within that constant demand, has to be put the creation of the Industrial School of Bergara, one of the three schools "escuelas de ampliación" (together with those of Barcelona and Seville), and in the end, a good manifestation of the degree of strength in Bergara's cultural, scientific and industrial tradition. In the view of Manuel Seijas Lozano, the main "architect" of the plan for industrial education in Spain in 1850, there was an increasingly urgent need to:

> (…) crear escuelas en que los que se dedican a las carreras industriales pudiesen hallar toda la instrucción que han de menester para sobresalir en las artes, o llegar a ser perfectos químicos y hábiles mecánicos. De esta manera [se apartará a la juventud] del estudio de las facultades superiores a que afluye hoy en excesivo número.[31]

In Bizkaia, like in Bergara, the corporations considered a kind of project for a provincial polytechnic institute. The Bergara model of organisation for technical or special education was somehow taken into consideration. The authors were two deputies of the Lordships of Bizkaia (both pro-Basque charter of historical rights, and liberals): Manuel María de Murga, the promoter of the College of Bizkaia in 1842, and Federico Victoria de Lecea, former seminarian and Mayor of Bilbao. Their aim, which was also shared by the other members of the executive commission formed in 1844 to examine the project, was to set up a practical establishment, above all. The Commission "*trató de imprimir a las escuelas un carácter más bien científico e industrial, que literario y de puro adorno"* [endeavoured to imprint on the schools a character that was more scientific and industrial than literary and purely for adornment].[32] That project was not based on tradition alone, but also on the economic links of the studies established by the legislation at that time. As will become

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29. "(…) a school devoted to promoting Agriculture, Commerce and Arts which will train young people to set up and direct large machinery, factories and all manner of industrial establishments. In short, a general scientific institution that will have all the advantages offered by the Polytechnic School, schools of Arts and schools of Agriculture and Commerce in France and other countries (…)." CABALLER et al. (2001), *op. cit*., p. 67.

30. For the influence of the Seminarians on that industrial about-turn, see: *Memoria leída el 1º de octubre de 1871 en la solemne apertura del Instituto Provincial de Guipúzcoa en Vergara por su Director Carlos Uriarte*. San Sebastián: Printed Ignacio Ramón Baroja, 1871, p. 15.

31. "(…) to create schools in which those devoted to the industrial careers can find all the instruction that they need to excel in the arts or become perfect chemists and skilled mechanics. This way [youth will be diverted] from study at the higher faculties to which they are flowing in excessive numbers." Royal Decree of 4 September 1850.

32. ARREGUI Y HEREDIA, A. *Memoria histórica del Instituto Vizcaíno y su Colegio adjunto*. Bilbao: Juan Delmas e Hijo, 1852, p. 21.

clear, when technical and special education was organised in 1850, the authorities of Bizkaia agreed to move the School of Commerce and Seamanship from the Consulate, in addition to reorganising the professorship of Mathematics and establishing ones for physics and applied chemistry: they also planned to set up a school for industry alone which they did during the 1851-1852 academic year.[33]


REAL SEMINARIO CIENTIFICO INDUSTRIAL DE VERGARA.

PROGRAMA

DE

SU COLEGIO Y ENSEÑANZAS

ACADÉMICAS Y ESPECIALES.

REAL SEMINARIO CIENTIFICO INDUSTRIAL DE VERGARA. DIPUTACION PROVINCIAL INSTITUTO GUIPUZCOANO

BILBAO:

POR JUAN E. DELMAS HIJO,

IMP. Y LIT. DE LA DIPUTACION DEL SEÑORIO DE VIZCAYA.

1852.

The table below, which summarises the landscape of technical and scientific education set up by different governments throughout the period of moderate liberalism on the basis of the information available (to which more could be added), displays a selection of institutional measures that express the thesis we have been defending since the beginning. In other words, the one that points to the coming together of special technical studies during the period between 1845 and 1857 and, at the end of the day, their statalisation, which different governments were to use to establish their authority. That confirms the argument of the second focus proposed in the introduction, that is, local groups that were promoting post-Enlightenment technical education, gave up under the centralising liberal pressure. The local promoters, i.e. the RSBAP, the Consulates and the Trade associations, etc., now lost the power and control they had over the initiatives promoted previously. New ideological and political powers –moderate liberalism, disputes between conservatives and progressives, Espartero's revolution, etc.– succeeded in changing the traditional education system. The consequence of these reforms was excessive secondary education and a secularized and highly centralised university. Yet in the Basque Country, as we said, the promoters and the innovators of technical education were *local groups*.

33. GARAIZAR, Isabel. *La Escuela Especial de Ingenieros Industriales de Bilbao, 1897-1936. Educación y Tecnología en el primer tercio del s. XX*. Leioa: Universidad del País Vasco (Univ. of the Basque Country), 1997, unpublished PhD thesis, pp. 72-79.

Table 1: ***Technical, Scientific and Special Education in the Basque Country around the middle of the 19th Century***[34]

	Araba	**Bizkaia**	**Gipuzkoa**	**Navarre**
Secondary Education*	Gasteiz (Vitoria)	Bilbao	Bergara	**Iruñea (Pamplona)**
Agriculture			Oñati (1855)	Tutera (Tudela) (1850)
Commerce		Bilbao (1851)		
Drawing	Gasteiz (Vitoria) (1850)			Iruñea (Pamplona) (1850) Tutera (1850)
Industry		Bilbao (1851)	Bergara (1850) Donostia (San Sebastian) (1852)	
Seamanship		Bilbao (1851) Lekeitio (1858) Santurtzi (1860)	Donostia (San Sebastian) (1852)	

(*) Including Mathematics, Physics, Chemistry and Natural Science.

Among the legislative steps taken at that time, the Seijas Lozano Scheme and the Decrees of 8 and 20 September, 1850 stood out. With the new regulations, technical education, following the Prussian model, was divided into three levels: "elementary, expanded and advanced." Advanced was taught only in Madrid. The measures taken by the ex-Minister of Commerce, Instruction and Public Works exposed the need for rule-based institutional unification of technical education; and that need was realised by merging the schools of commerce and seamanship with the high schools of secondary education.

The liberal reforms did not come about without contradictions, because pro-European ambitions and an economic crisis (colonial and military) took place simultaneously. While, for example, the goals they set out to achieve were big ones, the resources for them were very limited. As if that were not bad enough, the Government, after having expressed its willingness to absorb half the costs of the Institute, reduced its contribution to a third, and a large part of the expenses were paid for by the local corporations. A critical voice at

34. The dates we have added to these schools can be found in: Archivo General de la Administración, Sección Educación y Ciencia (Alcalá de Henares), "Escuelas Especiales (1823-1939)." See: Dossier 6529 (Bilbao); Dossier 6533 (Lekeitio); Dossier 6536 (Iruñea-Pamplona); Dossier 6537 (Donostia-San Sebastian, Santurtzi); Dossier 6539 (Tutera-Tudela); Dossier 6541 (Bergara, Gasteiz-Vitoria).

that time accused the Schools of being "el nuevo engranaje de la rueda del Estado," [the new gears of the State wheel] drummed up to give certificates, in other words, *"títulos para obtener puestos oficiales, en vez de crear hombres aptos e ilustrados para la carrera de comerciante"* [certificates for obtaining official posts, instead of creating suitable and enlightened men for the career in commerce].[35]

In that convergence the Institute of Bizkaia played a decisive role, just as many Institutes of the commercial tradition did: it filled the gap left by the Consulate and the Trading Association. In accordance with a Royal Order of 24 March 1851, it took over the running of the Schools of Seamanship and Commerce, and also the Elementary School of Industry open since 1846. The State Government paid for these studies contributing 40,000 *reals* every year to the Commercial Commission from 1847 onwards.

When the education system was reorganised, one of the first tasks of the Provincial Government of Bizkaia was to build a new school that could handle all the technical, scientific and economic studies. In the words of Antonio Gil de Zárate, a man with a great reputation, the result was categorical: *"el único monumento de su género en Vizcaya", que "puede ponerse en parangón con los mejores de su clase en Europa"* [the only monument of its kind in Bizkaia, which can be compared with the best in its class in Europe].[36] In the view of the former head of Public Instruction, the teaching material

> (…) [no dejaba] nada que desear: hay un excelente gabinete de física y química; otro de historia natural compuesto de 500 ejemplares de mineralogía…; una colección completa de esqueletos y ejemplares para el estudio de la zoología (…);

a botanical garden with 3,200 plants classified, a laboratory and a library with 6,000 books.[37]

Despite everything, the liberal education reform revealed that confrontation existed between State control and local funding. In that respect, the Board of Inspection was responsible for examining the budgets and expense accounts, but the three corporations of Bizkaia were responsible for putting up the money to cover the running costs at least until 1887, when the institutes came under the control of the State budgets. The Provincial Government shouldered the biggest funding burden, but its powers were restricted after the charter [of historical rights of the Basque territories] was abolished in 1876.

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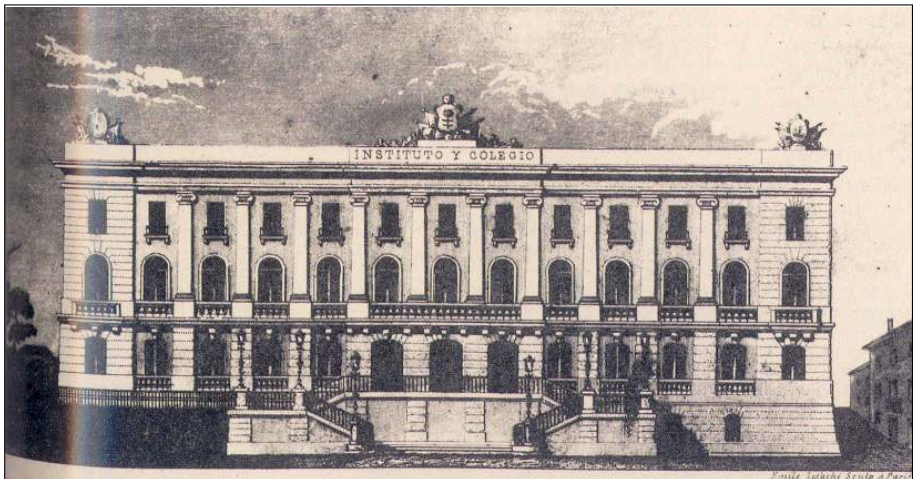
35. GARCÍA GUTIÉRREZ, Agustín. *La enseñanza mercantil en España y en el extranjero e Influencia y participación de las Asociaciones y cámaras de comercio en dicho ramo*. Cádiz: Cabello y Lozón, 1898, p. 78 — BARRENECHEA (2004), *op. cit.*, p. LVIII, cited.

36. GIL DE ZÁRATE, Antonio. *De la Instrucción Pública en España*. Madrid: Imprenta del Colegio de Sordo-Mudos, 1855 –reprinted in 1995, by Pentalfa Ed., Oviedo, T. II, p. 88.

37. "(…) there is an excellent physics and chemistry laboratory; another of natural history made up of 500 samples of mineralogy…; a complete collection of skeletons and specimens for the study of zoology (…)." Ibid., pp. 89-90.



The relative complexity that the mosaic of Basque education was acquiring at that time does not prevent us from noticing many examples of technical gaps. So as far as commercial studies were concerned, even though the number of students doubled in the early years, most of them only studied during the first year and very few finished their courses [in actual fact between 1851 and 1858 no commercial teacher certificates appear to have been awarded].[38] Moreover, the syllabus for commercial studies was not only somewhat unambitious, but also extremely simple, as borne out by the fact that the courses were taught at night. Not in vain, when that set-up was established, the aim of the Government was but to train: "para formar subalternos y dependientes entendidos que a la vez puedan servir de auxilio a las compañías y empresas mercantiles" [to train expert subordinates and clerks who can at the same time help in commercial companies and firms].

Agricultural studies were established in accordance with the education regulations of 1850; as a result, only two elementary schools were set up in the Basque Country, one in Oñati and the other in Tutera (Tudela, Navarre). As happened in other centres of education, they did not survive for long, because few resources were made available to them in order to undertake the setting up of farm models as required by law.[39]

Seamanship education deserves a special mention. From 1847 onwards when the *Ministerio de Comercio, Instrucción y Obras Públicas* [Ministry of

38. PONS (1893), *op. cit*., p. 84.

39. AGIRREAZKUENAGA, Joseba. "Lanbide irakaskuntza XIX. menderdian: nekazaritzako eskolaren sorrera, antolakundea eta amaiera Bizkaian (1851-1860)." *Cuadernos de Sección (Eusko Ikaskuntza-Basque Studies Society). Historia,* nº 8, 1986, 83-97.

Commerce, Instruction and Public Works] was formed, the Commercial Commission of Bilbao lost control of the schools of seamanship and commerce, and from then onwards these schools stopped being free and the students, in order to maintain the Institute, had to pay fees. From then onwards, too, and in the shadow of the constitutionalist atmosphere, there was fierce, two-headed competition for preparing officers. The Royal Decree of 20 September divided the studies for becoming a Merchant Navy Officer into theory and practice. Those while the theoretical studies were regulated by the Ministry of Education, the practical studies, as well as the awarding of licences, were in the hands of the Navy. The plan classified the schools of seamanship into full and special. Full schools (including that of Bilbao) would incorpore into corresponding Institutes, whereas the special ones could only teach the third and final year.[40]

The plan was to provide the schools not recognised by the Decree with regulations, something tantamount to dismantling the local education network. In fact, the ones that continued were no longer under the control of the Board of Commerce and many of the previous Schools of Seamanship were closed down.[41] That is exactly what happened to the one in Bermeo; in a letter sent to the Queen, the Town Council begged her as follows: "[to continue] *la escuela científica completa de Navegación, observándose en ella el mismo método y asignaturas que se prescriven para las de igual clase de los institutos* "[the complete, scientific school of Seamanship, adhering in it to the same method and subjects that are prescribed for those of the equivalent class in the institutes].[42] A later regulation went some way towards rectifying this situation (Royal Decree of 7 January 1851): the schools that could be maintained by town councils could keep on functioning, even though they were private; they would remain under the control of the Provincial Institute; and the students had to sit an exam to obtain their final licences. That was the case of the School of Seamanship of Mundaka under the control of the Institute of Bilbao.

The references cited above show that, irrespective of the benefits of the liberal system of education, uniting under one institute such different studies like industry, commerce, agriculture, seamanship and drawing was detrimental for each one of them. Beyond the restrictions created by the economic and political circumstances, the new schools ended up under the direction of nobody and many, many professorships were filled by Institute teachers.

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40. IBAÑEZ y LLOMBART (2000), *op. cit*., pp. 753-755; DAVALILLO (1995), *op. cit*., pp. 29-30.

41. DUO (2001), *op. cit*. pp. 96-97.

42. Bizkaiko Jaurerriko Artxibo Nagusia, Marina-atala, 69. Erregistroa, Leg. 11 — see: IBAÑEZ and LLOMBART (2000), *op. cit*., p. 754; DUO (2001), *op. cit*. pp. 96-97.

4. THE MOYANO LAW AND COLLAPSE OF PROFESSIONAL EDUCATION

In practice, the incorporation of applied and technical subjects into the Institutes was a marginal, short-lived occurrence. Owing to the absence of money, initiative or drive (as Gil de Zárate pointed out), the fact is, all the legal attempts made to promote intermediate level professional studies came to nought. Perhaps what most symbolises this failure is the law of the Minister of Education Claudio Moyano.

The law known as the *Ley de Instrucción Pública [Public Education Act]* of 9 September, 1857, was the most important legislative reform to affect the Spanish education system in the second half of the 19th century. According to this law, education was divided into four big categories: «primera enseñanza» [Primary Education], «segunda enseñanza» [Secondary Education], «facultades» [Faculties] and «enseñanzas superior y profesional» [Higher and Professional Education]. But once the law had come into force, it was a mere formal solution with no practical effect. Higher education outside the universities was a mess: there were Schools of Engineering, Fine Arts and Notarial Schools, while professional education consisted of the following kinds of schools: Veterinary, Commerce, Seamanship, Agronomy or Colleges for Training Primary School Teachers.

The reasons for setting up such schools had much more to do with training the members of the civil service and they were much more closely linked to professional, corporative and guild aims than to educational ones. As a result, this education was left out of the education system in a framework without links or points of contact. With greater authority and forcefulness than us, Antonio Viñao described the result of that Law thus:

> El resultado final fue el siguiente: una enseñanza profesional inexistente en el nivel inferior (aprendizaje), o, al menos, abandonada a la mera práctica en la fábrica, taller, comercio, etc., e inmersa ya, en cuanto a su regulación y características, en el problema más amplio del trabajo de los menores; una enseñanza profesional-media escasamente desarrollada, sin medios ni apoyo estatal y sin conexión entre sí ni con el resto del sistema educativo; y una enseñanza técnico-profesional superior ligada, en teoría, a las necesidades e intereses de la administración estatal, y, en la práctica, a los recién nacidos y rápidamente consolidados Cuerpos de Ingenieros civiles. Entre cada uno de estos tres niveles, a su vez, una total y absoluta separación.[43]

43. "The final result was as follows: non-existence of professional education at the lower level (apprenticeship), or, at least, abandoned to mere practice in the factory, workshop, shop, etc., and already immersed in the wider problem of the work of minors with respect to its regulation and characteristics; middle professional education barely developed without resources or State assistance and without any connection between it or with the rest of the education system; and a higher technical and professional education linked, in theory, to the needs and interests of State administration, and, in practice, to the recently born and rapidly consolidated Corps of Civil Engineers. At the same time, total and absolute separation between each of these three levels." VIÑAO, Antonio. "Enseñanza y corporativismo: Notas sobre el nacimiento y evolución de las enseñanzas técnicas en el siglo XIX." *Anales de Pedagogía*, nº 2, 1984, pp. 117-134, 125.

Even if the Moyano law established that the State would also fund higher and vocational training schools, town councils and provincial governments were requested to pay for the "installation and maintenance expenses" of the higher industrial schools.[44] Only the Royal Institute of Industry of Madrid was funded wholly through general State budgets. What lay hidden at the bottom of this request was the State's delicate economic situation, because cereal exports to Europe were reduced following the end of the Crimean war in 1856.[45]

The funding problem was crucial. The corporations were forced to provide amounts of money within two years (this ended on 20 October 1859) and economic problems and lack of industrial base led to nearly all the schools having to be closed down. So the General Council of Gipuzkoa decided, in July 1860, they could not maintain the School of Bergara, saying "por ser sumamente considerables los sacrificios que…imponía su sostenimiento" [because the sacrifices required to keep it going were very considerable].[46] The one in Gijón was closed in 1860, the one in Valencia in 1865 and the Seville one in 1866; 1867 saw the closing, too, of the one in Madrid, which had been the flagship of the industrial education system of the State.

Only the school in Barcelona survived thanks to a three-way agreement in August 1866 between the State, the Provincial Government and the City Council. There local institutions largely carried out the task of the State. Could such an agreement have come about in the Basque Country? The fact is the solution in Catalonia had to a great extent been the consequence of the pressures and needs of each sector of production, because they had the strength to request such professionals and technicians.

The School of Bergara was unable to meet the conditions laid down by the Moyano Law in order to be turned into a Higher School, and that was why not a single student gained his qualification in industrial engineering in Bergara. During the nine years they kept it open a total of 391 students registered at the School of Industry (340 of them were from the Peninsula, 33 from overseas and 18 from Europe).[47] Many of them were intermediate level engineers but those who wanted to become industrial engineers had to go to the Schools of Industry in Madrid and Barcelona.

When that Institution was about to come to the end of the road, it is necessary to mention the interesting *Memoria* (Report) written in 1852 by

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44. "Artículo 3 del R. D. de 20 de septiembre de 1858, que ordena los planes de estudios y programas de enseñanza de las escuelas de ingenieros." See: *Gaceta de Madrid*, 23 September, 1858.

45. LUSA, Guillermo. "La enseñanza industrial durante la primera fase de la industrialización española: la Escuela de Ingenieros Industriales de Barcelona." *XXth International Congress of History of Science*, Liège, 20-26 July 1997.

46. CABALLER et al. (2001), *op. cit*., p. 98.

47. CABALLER et al. (2001), *op. cit*., p. 188.

German Losada, the School's Vice-Director and civil engineer during the early years of the School. Viewed as a piece of popularisation work, we can find in it the opportunities and advantages for the country through the establishing of industrial education. For centuries, careers in medicine and law were the most popular among young people. But in Losada's view, engineering had overtaken medicine and law in certain respects; among other things, free and lower cost studies, shorter courses and the value attached to the qualifications were synonymous with the securing of work and employment. According to his calculations, the Peninsula "needed", on the whole, 200 engineers and 40 of them corresponded to the area of the Bay of Biscay. In short, that technical demand in a broader context would explain the longing of the Basque bourgeoisie to consolidate the development of the manufacturing industry. So the revaluing of Industry could have different social consequences. In this case, as Losada reminds us, the industrial schools were turned into what had been the universities up until that moment: "centros activos de trabajo y de saber, en cuyos museos, en cuyos anfiteatros, en cuyos talleres se formarán los regeneradores de nuestra prosperidad fabril" [active centres of work and knowledge in whose museums, in whose lecture theatres, in whose workshops were to be trained the regenerators of our manufacturing prosperity].

Fifteen years later the assessment was totally negative. We could say that the Moyano law had set out to turn all the industry schools into higher schools. The result was to close down all the schools[48], including the elementary schools and the vocational training schools, which, paradoxically, were well accepted. Ironically, the engineers themselves denounced that, even if it was true there was a lack of industrial engineers capable of running the factories being built, the lack of technical and qualified people was even more dire. The pages of the magazine *Gaceta Industrial* were calling for: "el desarrollo y capacitación de obreros y técnicos medios, en contra de una superproducción de titulaciones de ingenieros superiores" [the development and training of workers and middle technicians as opposed to the overproduction of degrees of higher engineers].[49] That inhibition of the State –that could have spread to many areas of the industrialisation process– was one of the reasons why Spain lagged behind in a field in which the seeds had in fact been planted fairly early on.

The disappearance of industrial schools coincided with many other "reversals" in the education system that the minister Claudio Moyano wanted to renew. Through a Royal Decree of 18 March, 1857, Moyano set up Elementary Schools of Commerce, which were designed to train technicians, in thirteen towns, including Bilbao and Bergara, and offered higher education to Madrid. The Moyano Law integrated Schools of Commerce into Institutes (or in Industrial Schools, if they existed) and they continued to be funded by the

48. Except the Barcelona one, as pointed out.

49. CABALLER, María Cinta, GARAIZAR, Isabel, PELLÓN, Inés. "El Real Seminario Científico e Industrial de Vergara, 1850-1860." *Llull: Revista de la Sociedad Española de Historia de las Ciencias y de las Técnicas*, nº 20 (38), 1997, pp. 85-116, 106.

State and provinces. For that reason their decline was less evident than that of the industrial schools.

Nevertheless, the Moyano law had serious consequences. On the one hand, scientific knowledge was totally limited, as borne out, for example, the fact that any young person could get the technician's certificate "[con] algún conocimiento de aritmética mercantil" [with a smattering of mercantile arithmetic], or it was possible to gain a certificate as a teacher of commerce without knowing any foreign languages.[50] On the other hand, commercial education was damaged by the low prestige of applied studies. The Moyano Law in fact divided secondary education into «general» and «de aplicación» (applied) sections and commercial studies were included in this second group (along with agriculture, arts, industry and seamanship). Two castes emerged as evidence of the division created by this law: one linked to those doing general studies; and the other, on a more modest level, to those doing applied studies. There is no doubt that the drive for commercial education was weakened by centralisation and by the exaltation of uniformity.[51]

Despite all, the assessment of the School of Commerce of Bilbao was acceptable. We could say that during the years it was under the control of the Institute (1858-1887) the School managed to produce an acceptable generation of commercial technicians. In the 30 generations up to 1887, 700 students applied, and 500 of them passed all the subjects. So out of the 226 students who sat the exam, only 118 requested to be given their technician's certificates (even though 196 passed everything). The rest of the schools in the State were "en el mayor abatimiento" [in the depths of depression] (according to José Pons). That difference between "those who passed" and "those who had their certificates" indicates that the certificates were not socially valued very much and the hopes raised by the laws in force for technicians were not very tempting.[52]

5. ARTS AND CRAFTS SCHOOLS

The ambiguity of the Moyano Law left a gap in the area of vocational training. It was precisely during the last quarter of the 19th century after the Monarchy had been restored in the field of the application of *Conciertos Económicos* (Economic Pacts) that the industrialization process called for and praised skilled labour. The social demand for vocational training coincided with the Basque Country's industrialization map.

50. PONS (1893), *op. cit*., p. 39.

51. BARRENECHEA (2004), *op. cit*., pp. LX-LXI.

52. BARRENECHEA (2004), *op. cit*., pp. LXI-LXII.

The industrialisation map also coincided with the map of the towns that also built Schools of Arts and Crafts.[53] Rather than being by chance, the coincidence shows that those schools had adapted to local and social needs, expressed through the diversification of the curriculum according to production sectors. With a bigger or smaller presence and style, depending on the requests of each town, in Bizkaia and Gipuzkoa, especially, schools for training workers and women abounded.[54]

The action taken by these two provinces could point the way. Due to the lack of legislation on their regulation, municipal and provintial corporations promoted and funded a broad, dense network of vocational training schools. Their promoters clearly distinguished between the basic model of curriculum (what was taught and established in the towns in the "small" Schools of Arts and Crafts) and the curriculum of the specializations or branches (industry, commerce, art; established in the capitals). Even though similar institutions were established in Europe and in many regions of the State, what stands out particularly in the Basque Country is the large number of schools created: between 1879 and 1930 a total of 17 and 15 schools were built in Gipuzkoa and Bizkaia, respectively.

The main aim was to create *a professional elite* from among the unskilled workers and specialised workers (engineer or technician), like the elites that emerged in countries like Germany or Belgium. Vocational training there, was based on the workshop and on an industrial network that was capable of training workers. While in France vocational training was linked to training in culture. From 1803 onwards it started to grow in importance through the *Écoles d'Arts et Métiers* but became important in 1880 with schools of studies and courses of the *Sociétés polytechniques*.[55] In Spain and in the Basque Country the evolution in vocational training followed a route similar to the French one, in the initial approaches, at least. Soon, however, reality showed a situation of great decline (compared with vocational training developed by countries of a similar socio-cultural milieu): the creation of higher elementary education, few vocational initiatives and many people leaving school. This evolution was

53. Essential for finding out about the development of these kinds of schools, in Bizkaia and Gipuzkoa in particular, see DÁVILA, Paulí. *Las Escuelas de Artes y Oficios y el proceso de modernización en el País Vasco, 1879-1929*. Leioa: Servicio de Publicaciones de la Universidad del País Vasco (Publishing Service of the Univ. of the Basque Country), 1997. For a synthesis of this specific, rigorous piece of work, the following can be consulted: DÁVILA, Paulí. "Las Escuelas de Artes y Oficios en el País Vasco, 1879-1929." *Historia de la Educación: Revista Universitaria*, nº 18, 1999, 191-215.

54. DÁVILA (1997), *op. cit*. P. 87. makes the coincidence between the industrialisation map and the geography of the map of schools clear.

55. CHARMASSON, T., LELORRAIN, A. M., RIPA, Y. *L'enseignement technique de la Révolution à nos jours. Testes officiels avec introduction, notes et annexes. Tome I. De la Révolution à nos jours*. Paris: INRP, 1987.

consistent with the illiteracy of a large swathe of the Spanish population, and the gap between elementary and secondary education in the 19th century.[56]

Foremanship was the most important of the branches in which the common goal for a professional elite became reality. Established within the School of Arts and Crafts of Bilbao, the creation of first School for Foremen in the Basque Country between 1902 and 1912 was a clear plan to close the gap between engineers and workers; there was also a plan to bring into line the qualifications of a course of studies that had not been developed very much. That figure of the "middle worker" symbolised by the foreman or boatswain was assigned a dual task: it was linked to the area of professional capability; and linked to the work of monitoring and overseeing the activity of the workers under them. So the opening of that school responded to a specific industrial need: that of the middle worker, "que si por una parte conocen el oficio manual de sus subordinados, tengan una base teórica para interpretar directamente los planos e instrucciones teóricas del Ingeniero "[who should not only be familiar with the manual work of their subordinates, but also have a theoretical basis to be able to interpret, directly, the plans and theoretical instructions of the Engineer].[57] All the hopes raised by the school could barely be satisfied, because the students, immersed in their daily work, had their work cut out learning the minimum required.

Pablo de Alzola (1841-1912) perfectly understood the problem of the lack of an elite. When he became mayor of Bilbao in 1877, this civil engineer from Donostia-San Sebastian clearly saw what had to be done by vocational training in the industrialised society of the future. For some reason Alzola blamed the division between the moneyed classes who could pay for their studies and the artisans on the fact that there was no public education, and the artisans only had "partial training at a preliminary level" and then "ended up in the routine of trades".[58] From there it would be a small step to demand the "professionalisation" and "moralization" of the artisan workers. In fact, the School of Arts and Crafts of Bilbao (which was officially opened by Alzola on 10 February 1879) turned vocational training into something worthy and gave it prestige, and its importance –as he pointed on in his inaugural address– was to be found in primary education, the basis of the whole education system.[59]

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56. In France, on the other hand, higher elementary education fulfilled the task of vocational trainer by acting as a bridge between elementary education and the industrial workshop. See: BRIAND, J. P., CHAPOULIE, J.M. *Les collèges du peuple. L'enseignement primaire supérieur et le développement de la scolarisation prolongée sous la Troisième République.* Paris: C.N.R.S.-I.N.R.P., 1992.

57. See: *Estado y desarrollo de la escuela de Artes y Oficios de Bilbao durante el primer decenio*. Bilbao: Printed by La Casa de Misericordia, 1890, p. IX.

58. ALZOLA, Pablo de. *El arte industrial en España*. Bilbao: Printed by La Casa de Misericordia, 1892, p. 227. This work, a valuable, contemporary critique, was one of the most important works on the situation of technical education in Spain.

59. DÁVILA (1997), *op. cit*., pp. 255-289.

Yet the aim of that school was not so much to hand out professional qualifications but to adapt the studies to the country's needs:

> Hemos procurado penetrarnos de las verdaderas necesidades del País, del estado de su industria, de la vocación y aptitud de sus hijos; deduciendo en consecuencia, que el desarrollo de las explotaciones mineras, de las fábricas siderúrgicas y de la navegación de vapor exigen la instalación de la enseñanza de maquinistas, y que la afición de los vascongados a la ciencia y arte de la construcción, hace en extremo conveniente que se planteen los estudios de aparejadores.[60]

It was during the 1870s in fact that vocational training acquired the status of a social demand, because of its close link with industrialisation, simultaneously identified with progress and modernisation in the public and political sphere. Similar education projects soon appeared in other parts of the Basque territory. In Gipuzkoa and in San Sebastian, in particular, the project for a "Basic Industrial School" was constituted –its soul was Nicolás de Bustinduy (1849-1928), an industrial engineer–.[61] The aim was "to spread science among the workers, in particular." Or, as he put it, to

> (…) vulgarizar la ciencia y sus aplicaciones, formando la educación del artesanado, maestro de taller, contramaestre de fábrica, maquinista y capataces, propagando los conocimientos indispensables a la industria de nuestro país.[62]

Although the City Council and Provincial Government turned down the proposal in 1873 and 1876, respectively, the project did serve to prick the consciences of the authorities. Evidence of that were two lectures given at the Ateneo Guipuzcoano three years later: one by Paulino Caballero, professor of the Provincial Institute, on the *"Influencia de las ciencias en las artes e industrias"* [The Influence of the Sciences on Arts and Industries] and the other by José Olano, the city's first deputy mayor, on the need to set up such a school in San Sebastian.[63] The school was finally inaugurated in 1879 with Bustinduy

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60. "We have endeavoured to delve into the true needs of the Country, the state of its industry, the vocation and aptitude of its sons; consequently deducing that the development of the mines, the iron and steel works and steam shipping require the establishment of instruction for engineers and machine operators, and that the Basques' love of science and art of building makes it highly advisable that studies for surveyors should be considered." ALZOLA, Pablo de. *Acto solemne de la inauguración del curso 1879 a 1880 y repartición de premios a los alumnos de la Escuela de Artes y Oficios de Bilbao*. Bilbao: Juan E. Delmás, 1879, p. 21.

61. CABALLER, María Cinta. "Noticia de las Publicaciones del Ingeniero Industrial Nicolás de Bustinduy y Vergara (Eibar, 1849 - San Sebastián, 1928)." In: BLANES, Georgina, GARRIGÓS, Lluís (coord.) *Actes de les IV Trobades d'Història de la Ciència i de la Tècnica*. Alcoi-Barcelona: Sociedad Catalana de Historia de la Ciencia y de la Técnica, 1997, pp. 359-368.

62. "(…) to popularize science and its applications, by shaping the education of the artisans, the master of the workshop, the factory foreman, engineer or machine operator and overseers, and spread the knowledge that is indispensable for the industry of our countr." Donostiako Udal Artxiboa. Dossier 554-5, 21 September 1873 — DÁVILA (1997), *op. cit*., p. 183 cited.

63. CABALLER, María Cinta. "Noticia de la creación y primeros años de funcionamiento de la Escuela de Artes y Oficios de San Sebastián." In: FRAGA, X. A. (ed.) *Ciencias, educación e historia. Actas V Simposio Historia e Ensino das Ciencias*. A Coruña: Ediciós do Castro, 1997, pp. 233-240.

as its director. Unlike the school in Bilbao, it was a mixture of the orientations of industry and commerce. But in the two cases, they were two solutions (the former, a municipal-provincial one; the latter, a more commercial and municipal one) aimed at addressing the challenges faced by the local bourgeoisie of vocational training resulting from the industrial revolution.[64]

6. CONSOLIDATION OF THE ORGANISATIONS: THE BIRTH OF AN ENGINEERING CULTURE

Industrialization laid bare the insufficiencies of technical education in Spain. With the closing of the industrial schools in the 1860s the sum of money the government of State assigned to industrial education amounted to a total of only 13,000 pesetas (for the School of Barcelona); yet it invested about 3,110,000 pesetas in ten universities. This imbalance, according to Alzola, created *"más bien que ingenieros prácticos, un plantel de sabios en ciencias exactas"*...[rather than practical engineers, a bunch of experts in exact sciences], which did not in fact happen anywhere else. In his influential work analysing the situation of technical education entitled *El arte industrial en España* (1892), the former deputy Alzola appropriately expressed the philosophy that underpinned education practice in the country. He said that the studies of artisans at the Arts and Crafts Schools *"enaltece a las diputaciones, ayuntamientos y asociaciones que han hecho mucho más que el Estado para difundirla"* [...extols the provincial governments, town councils and associations who have done so much more than the State to spread it].[65] And he added:

> El Estado debía sostener en España cuando menos dos escuelas de Ingenieros industriales, con sus correspondientes de Peritos, pero como no es probable que las establezca, una vez que suprimió todas las de Ingenieros de aquella especialidad, entendemos, que tendrán que pensar las corporaciones provinciales y municipales de Barcelona, Vizcaya, etc. en suplir las deficiencias que se observan.[66]

Pablo de Alzola became one of the guiding lights of engineering culture.[67] He was the son of a textile factory owner and had interests in Bergara, where

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64. DÁVILA (1997), *op. cit*., pp. 175-254.

65. ALZOLA (1892), *op. cit*., p. 255.

66. "(...) within Spain the State should support at least two schools of industrial engineers with their corresponding schools of technicians, but as it is unlikely to set them up, now that it has abolished *every single* school of Engineers in that specialty, we understand that the provincial and municipal corporations of Barcelona, Bizkaia etc. will have to think about remedying the shortcomings that have been detected." Ibid, p. 256.

67. On Alzola see: BARRENECHEA, José Manuel (ed.). *Pablo de Alzola y Minondo. Selección de textos*. Donostia-San Sebastian, 2002, esp. pp. XIX-CCLXXVII; ALONSO, Eduardo J. "Visión del 98 de un burgués vizcaíno: Pablo de Alzola." In: SÁNCHEZ MANTERO, Rafael (ed.) *En torno al "98." España en el tránsito del siglo XIX al XX*. Huelva: Universidad de Huelva, 2000, II, pp. 105-115; BASURTO, Román. "Pablo de Alzola, el Bismarck vasco." In: Bel, G., Estruch, A. (coord.) *Industrialización en España: Entusiasmos, desencantos y rechazos: Ensayos en homenaje al profesor Fabián Estapé*. Madrid: Civitas, 1997, pp. 227-248.

he completed his first studies at the Industrial School there, and obtained a degree in "civil engineering." After briefly holding a position in Malaga, he accepted the position of port engineer and captain of Bilbao. But unable to settle into the bureaucratic routine, he left the job in 1871 and planned to devote himself to private activities. It was in that sphere while running errands for public institutions that Alzola really developed his engineering studies: the project like La Orconera mining railway, built to transport minerals from the top of La Arboleda down to the banks of the Nervion river; emblematic works like the bridge of San Anton (1877) or the Ensanche (expansion area) (1878) for Bilbao, naturally. For some (for Alzola) this city was a paradigm of modernity –the reflection of the North American capital city, as he pointed out in his little book *La cuestión del Ensanche* (1893)– while for others (for Miguel de Unamuno) it was a model of speculation and lack of consistency.[68]

Alzola was, like nearly everyone else, the image of his time; of a time in which engineers became a public figures, in which they promoted activities that would be useful and give pleasure at the same time, and they were ready to serve the development of society and develop artistic taste –Bilbao (which he described as the *Metropolis of the Bay of Biscay*) was transformed from a small, provincial town into and powerful, modern city.[69] While he was mayor between 1877 and 1879, he focussed his attention on two areas as far as the municipal administration was concerned: education and public works. The style of his conduct reminds us of the practice followed by the enlightened Basques. It was no coincidence that Alzola, like Bustinduy, had been a Bergara Seminarian, and most likely that was where he acquired his interest in "useful" and "applied" education from. Scientific knowledge, he said, *"constituyen la base fundamental para el progreso de la industria"* [...constitutes the essential basis for the progress of industry.] He was aware that progress would be downriver, not just through the mines and the iron and steel works, but also through vocational training. That was why in January 1895 he sat on a joint committee formed to set up a School of Industrial Engineers in Bilbao.

Alzola's participation was no more than a part of a big initiative of the City Council and Provincial Government to promote higher technical education in Bilbao. In 1893 the Provincial Government of Bizkaia had already defended the need for a school that could promote industry in the province. The arguments used in those initial meetings were very clear: the need for specialised technicians to apply modern technology, the advance of new methods of manufacturing, the lack of manager engineers for the plants, the lack of specialists in electricity and chemistry, and, above all, the dependence on foreign technicians.[70]

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68. For a bibliography on Alzola: AMEZAGA, Elías. *Autores vascos.* Algorta: Hilargi, 1987, I, pp. 193-196.

69. ICAZA ZABALA, Juan José. "Perfiles vascos en la ciencia y la ingeniería del periodo 1850-1950." *Nuevos Extractos de la Real Sociedad Bascongada de los Amigos del País (RSBAP)*, Sup. 4-B, 1996, 87-140, pp. 101-106.

70. GARAIZAR (1997), *op. cit.*, esp. cap. IV, pp. 106-179.

Certanly, the Spanish universities were unable to grasp that qualified technicians were needed for developing industry, a fact that had serious consequences for promoting local engineers and company managers. From a production point of view, what are significant are the contrasts existing in the historical connection between industrial development and higher technical education in countries that were so advanced, like Belgium, France or Germany. Basque industrial companies were particularly in the habit of engaging foreign technicians for positions of technical responsibility. Of the 1,386 technicians appearing in the statistics (on foreign technicians working in Spain in 1901) promoted by the Count of Romanones, 250 worked in companies in Bizkaia.[71]

Right from the start, the Joint Committee commissioned to write the Specifications Project to set up the school took all these factors into consideration, including the debate between centralism and the autonomy. The meetings began in 1895 with this main debate: the official character to give to the school –as Laureano Gómez de Santa María, the engineer and director of the Schools of Arts and Crafts of Bilbao, proposed– or to build a free school without the intervention of the State –as proposed by Alzola and the engineers Enrique Disdier and Guillermo Pradera–. In the end, they opted for a middle road, a road between independence and official recognition: independence, in fact, moved it further from the syllabuses of the homonym School of Barcelona, seeking for in the schools of Belgium, France and Germany; and official recognition, because they wanted to award the Diploma of Industrial Engineer and placed the emphasis on metallurgical, chemical and mechanical training.[72]

What is significant is that shortly after the opening of the School was approved, in January 1899, Bilbao City Council and the Provincial Government of Bizkaia, as the funding institutions, set up a Board of Trustees with the aim of overseeing the School. Its tasks were to administer, raise and inspect the fund, as well as appoint the director and teachers (after the Government had given its approval). The powers vested in the Board were totally unusual in the state education system; this was borne out by the fact that it was Bizkaia –and not Madrid– that paid for the costs of the institution (55% corresponding to the Provincial Government and the rest to Bilbao City Council). With the authority given to that organisation, autonomy seemed to be guaranteed.

At the beginning of this section I referred to the creation of cultural engineering linked to technical education. But using isolated examples to argue the greater or lesser strength of a culture is always risky (apart from being ambiguous); it is better to use something resembling a quantitative indi-

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71. "R. O. de Instrucción Pública de 10 de julio de 1901, disponiendo se abra una información sobre reformas docentes de carácter técnico." See also "De enseñanza industrial. La circular del Conde de Romanones." *Revista Minera, Metalúrgica y de Ingeniería*, nº LII, 1901, 359-360.

72. OLASCOAGA, Fernando. *La Escuela de Ingenieros Industriales de Bilbao. Apuntes para la historia de su creación*. Bilbao: Imp. Luís Dochao, 1909.

cator. An indicator that can be used is the number of engineers who were members of the Board of Trustees, because the Board reflected the power of the industrial bourgeoisie that had just emerged. So the first meeting was made up of the following people: Enrique Aresti (Head of the Provincial Government of Bizkaia), Felipe A. Celada (Mayor of Bilbao), Eduardo Victoria de Lecea (lawyer), Federico Echevarría (politician), Evaristo Churruca (civil engineer), Ernesto Hoffmeyer (*idem*), Serafín Baroja (mining engineer), Manuel Goyarrola (senator), Diego Espada (pharmacist), Valentín Gorbeña (civil engineer), Guillermo Pradera (industrial engineer), Plácido Allende (mining engineer), Ángel Jimeno (mining engineer), Jesús Arístegui (pharmacist) and Alfredo Urquizu (industrial engineer).[73] So the Board was largely made up of engineers and politicians.

As regards profile and power, two groups can be distinguished: of the fifteen who were local members of the board, eight were engineers, five politicians and entrepreneurs, and two pharmacists, who were, moreover, people of great influence in the industry of the area, especially those among the first group. In absolute numbers, the members who held investments in many economic sectors numbered about ten and had influence in and participated directly in 53 companies that had recently been set up. Likewise, these members were immersed in these production sectors, according to their importance: mining companies, railways, electricity and gas, general commerce, metallurgy, trams, machinery and metal construction, paper mills, cement factories, potteries and bricks. We could say that no specific sector controlled the School.[74]

As occurred in the Industrial Engineering School of Bilbao and the Schools of Arts and Crafts, in which it could be seen that the local bourgeoisie played a prominent role in the demand for schools of technical education, especially as a consequence of the industrial and economic development of Bizkaia, enthusiasm for modernisation re-emerged in commercial studies, too. Through the reforms promoted by the Minster for Education Carlos Navarro y Rodrigo (Royal Decree of 11 August 1887), the Schools of Commerce of Madrid and Barcelona were granted the category of "Higher". The Decree "Elementary Schools" also established in Bilbao and other towns.[75] As in the positive aspect of the new system, we can cite the independence of the schools of commerce with respect to the institutes, as well as their state funding. But the steps supported by Alzola once again deserve a special mention; he was the Head of the Provincial Government of Bizkaia at that time; in fact, thanks

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73. *Memoria de la Junta de Patronato de la Escuela Especial de Ingenieros Industriales de Bilbao, a 31 de diciembre de 1901*. See: GARAIZAR (1997), *op. cit*., p. 149.

74. GARAIZAR (1997), *op. cit*., pp. 367-368. For further details: GARAIZAR, Isabel. "1897: la burguesía industrial vasca ante la necesidad de una Escuela Superior de Ingeniería Industrial." In: BATLLÓ, Josep, PUIG AGUILAR, Roser, DE LA FUENTE, Pere (coord.). *Actes de les V Trobades d'Història de la Ciencia i de la Tècnica: (Roquetes, 11-13 desembre 1998)*. Barcelona, 2000, 359-369.

75. LUCINI Y CALLEJO, Enrique. *La Carrera Mercantil: Recopilación de las Leyes, Decretos… referentes a las Escuelas de Comercio y a los Profesores y peritos mercantiles: Contiene además una reseña histórica de la Enseñanza Mercantil*. Madrid: Ricardo Álvarez, 1894, pp. 195-196.

to his steps the Government of Madrid gave the Bilbao school the category of "Higher School of Commerce" (Royal Decree of 18 September 1888).[76] As a result, the school was given the power to award certificates of technicians in commerce and teachers of commerce. Without a doubt, that expansion was proof of the leading role assumed by the Province through the Provincial Government with respect to the establishing of higher education, and proof of this is the commitment by the Provincial Government to pay for the maintenance costs and teachers' expenses resulting from that expansion.[77]

In the proposal submitted by many members of the Bilbao bourgeoisie to the Society of Jesus, the need to supply the city of Bilbao with higher technical education was clearly apparent in 1879. They held that the studies should be moved from the School in La Guardia to Bilbao and the change of location was carried out in 1883 through the company set up by the name of «La Enseñanza Católica» (the first appearance of the existence of the University of Deusto).[78] But what was highly significant were the initial arguments being put forward with reference to technical studies, and less to humanities studies: so, for example, Father Manuel Isasi referred to *"clases preparatorias para carreras especiales"* [preparatory classes for special courses]; the Superior General of the Jesuits Father Peter Beckx spoke about *Institutio in scientiis quas vocant speciales*, in 1880, and the following year about *Collegium facultatum specialum*.[79]

The concern of the local bourgeoisie in favour of industrial training is clear in the formation of «La Enseñanza Católica». So in 1883 they set up the Council of Trustees: seven merchants, four employers, a lawyer and a teacher of commerce. Among them stood out José Moyua and Tomás J. Epalza, promoters of iron and steel factories, and José Villalonga and Juan Mª Ibarra, founder members of «Altos Hornos de Bilbao» [Blast Furnaces of Bilbao]. The remaining members were a significant sample of the early capitalists who channelled the start of industrialisation in the Basque Country in the 1850s.[80]

Even though humanities subjects (law and arts) predominated when the *Centro de Estudios Superiores* was officially opened in 1886, it has to be said that at the beginning the promoters were planning an engineering school for Bilbao and the province. Owing to that contrast, the study plan of Deusto

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76. BARRENECHEA (2004), *op. cit*., pp. LXXII-LXXVIII.

77. ALLENDE, TORNE y VELARDE (1996), *op. cit.,* pp. 322-323.

78. Details of the early period splendidly described by SAENZ DE SANTAMARÍA, Carmelo. *Historia de la Universidad de Deusto*. Bilbao: La Gran Enciclopedia Vasca, 1978, pp. 21-104.

79. For a broader background on the significance of the Jesuits in the 19th century Spanish education system, see: REVUELTA, M. *La Compañía de Jesús en la España Contemporánea. Supresión y reinstalación (1868-1883).* Madrid: Universidad Pontífica de Comillas, 1984; & REVUELTA, M. "Libertad de enseñanza y colegios de jesuitas durante el sexenio revolucionario (1868-1874)." In: *Studia Historica*, 1984, 393-409.

80. GARAIZAR (1997), *op. cit*., pp. 95-105.

did not always have the clear support of the industrial bourgeoisie and the local institutions. The Committee of Promoters of the Provincial Government of Bizkaia rejected a proposal for economic cooperation requested by the University of Deusto in 1884, because the grants requested did not coincide with "the commercial and industrial essence that belongs to Bilbao", and if the grants were awarded, "commerce and industry could be diverted and the large elements Bilbao needs to enrich industry and commerce could go another way."[81]

These difficulties were solved in a compromise, whereby humanities studies were complemented with studies for preparing engineers and architects. So in order to enter the General Training School, prospective students had to pass in the subjects of arithmetic, algebra, geometry, trigonometry, analytical geometry, languages and drawing, which were the conditions of access for all the technical courses in Spain. But that school naturally established the need to learn religion as well as the recommendation to study philosophy and general culture as well.

There is no doubt that the School of Industrial Engineering of Bilbao significantly increased the number of students at the School of Training of Deusto. As a result, there was a rise in the number of students who wanted to do technical courses in other schools. As proof of this increase, in 1904 nearly twenty years after the Deusto School of Training was established, the number of applications reached nearly 600 (that was 45% of all those who registered at the University); whereas in 1886 there were only 29, in other words, a third of the total.[82] In brief, it had constituted a dynamic in favour of the development of technical education.

Finally, the fact that engineers (civil engineers, in particular) were among the promoters of the most important projects for technical education that were realized in the Basque Country in the second half of the 19th century –mainly Alzola, Bustinduy and Churruca (the three former Seminarians), and Gómez de Santa María and Pedro de Icaza– indicates their profound awareness about being able to further an engineering culture that achieved the institutionalisation of these sciences.

81. In the words of the deputy Natalio Alonso. See: BARRENECHEA (2004), *op. cit*., pp. CXLVI.

82. SAENZ DE SANTAMARÍA (1978), *op. cit*., p. 137.