"The Future Belongs to Engineers"? The "Production" of Engineers in Romania, 1881 – 1939*

Dragoș SDROBIȘ

Abstract

The study aims to trace the numerical evolution of the engineering profession until 1939 focusing on the social and economic dimension. In this sense, my approach relies on the theory of professionalisation, the basic premise being that the profession is a constructed social identity and a social mobility elevator created by the state. According to this theory, the development of a specific educational training system is an essential prerequisite in this process. The study also discusses the main traits of polytechnic education in Romania, with a special focus on the Polytechnic School in Bucharest. Finally, the study analyzes the situation of the engineers' body in Romania during 1938, using data extracted from the Asociația Generală a Inginerilor fron România [The General Association of Engineers in Romania] (AGIR) yearbook, with the aim of highlighting the contribution of polytechnic schools in Romania to the numerical development of the engineering profession. The preliminary conclusion of this study is that engineers prepared the ground for the development of a new approach to economics, society, and politics that contributed to the increasing role played by the state in the late 1930s.

Keywords: higher education, engineers, Polytechnic School of Bucharest, AGIR, polytechnic students.

A profession for building a country: Introduction

In his memoirs, Constantin Argetoianu, a famous politician of Greater Romania with a style full of irony, recounts the only meeting he ever had with one of the founders of modern Romania, Ion C. Brătianu. This brief meeting took place in the late 1880s when the Liberal leader served as prime minister. It was the period of the "great liberal government" (1876-1888), during which Romania gained its independence and the kingdom was proclaimed. This era was all about a new beginning, during which everything was to be built from scratch.

What impression did the meeting with the Prime Minister of independent Romania leave on the young Argetoianu? "All the way he made nothing but jokes, telling all kinds of anecdotes. He asked me if I liked school (I was in 5th or 6th grade, I don't remember well) and if I had decided on a career. <<You should become an engineer, boy, because the future belongs to engineers. We

* The author would like to thank to the anonymous reviewer, and to Andrei Cușco and Petru Negură for their helpful comments and suggestions.

have a lot to build and we don't have professionals. We can't achieve anything with our arms alone. We also need people with a sound head, clever ones!>>"[1], thus ended the Prime Minister his exhortation for the young student.

For young Argetoianu, the Prime Minister's urgings did not matter much. He studied law in Paris, pursuing a career in diplomacy for a while. Instead, all three sons of Ion C. Brătianu – Ionel, Constantin, and Vintilă – studied engineering in France. Ion C. Brătianu's daughter, Sabina (married Cantacuzino), later remembered the dispute between her parents regarding the career path the family's three sons were to follow. Her mother was convinced that Ionel, for example, due to his elegant eloquence, would be suitable for a lawyer's career, a profession thanks to which "he will eliminate poverty from our home". Brătianu the father was totally against such a scenario: "It is the only profession I forbid my boys to choose, under the threat of curses and disinheritance. No conscience resists the temptations of pleas and political debates. In the Chamber (of Deputies), the lawyers made my days miserable enough"[2].

At the end of the nineteenth century, during the apex of the Second Industrial Revolution, the engineer embodied progress. Upward social mobility – as a characteristic feature of modernity – fascinated many young people, who hurried to dedicate themselves to the profession of 'building' reality. Elie Radu, for example, a famous Romanian engineer, was deeply impressed by the comfortable train journey between Vereşti and Iaşi in 1871. He was only 18 years old, and it was then that he decided to become an engineer. He studied in Belgium, graduating from the Polytechnic School in Brussels[3], and, after returning to his homeland, he supported the creation of the National School of Bridges and Roads. A similar case, highlighting the fascination for science and technology, was that of the liberal leader Eugeniu Carada, who seems to have "had a taste and a particular skill for engineering". That was why he regretted that he did not pursue any studies in this field. His only consolation was that he occasionally read scientific papers[4].

Engineering modernity

This article aims to trace and examine the development of engineering studies until 1939. In this sense, my approach will be based on the theory of profes-

[1] Constantin Argetoianu, *Pentru cei de mâine* (Bucharest: Humanitas, 1991, vol. I), 177.

[2] Sabina Cantacuzino, *Din viața familiei I.C. Brătianu 1821-1891*, 3rd edition, ed. Elisabeta Simion (Bucharest: Humanitas, 2013), 149.

[3] Petre Trofin, "Profesorul Elie Radu mare inginer constructor," *Construcții. Revistă de informare și dezbatere tehnică și economică*, no. 11 (1986): 26.

[4] Cantacuzino, *Din viața familiei I.C. Brătianu*, 116.

sionalisation. The basic premise is that the profession is a constructed social identity and a social mobility elevator created by the state[5].

In western historiography, studies on the profile of the engineer were revived in the 1980s by the French historian and sociologist André Grélon[6]. In his opinion, the reassessment of the figure of the engineer had to be done by analyzing six defining aspects: "les représentations publiques des ingénieurs; leurs fonctions; leur rapport à l'innovation; leurs modes de raisonnement; leurs formes d'organisation; enfin, le développement de la formation des ingénieurs"[7]. Using both the tools of the historian and those of the sociologist, André Grélon aimed to capture the dynamism and the comprehensive profile of this new social and professional typology.

Based on this approach, I focus on how the Romanian case illustrated the last defining feature mentioned by Grélon in connection with the professionalisation of engineers, i.e., the development of their educational training system in Romania. In this sense, I examine the characteristic features of technical education in Romania – from the proclamation of the kingdom in 1881 until the establishment of the royal dictatorship in 1938; I discuss the academic life inside the Polytechnic school. Finally, I focus on the statistical aspect regarding the engineers "created" by the superior technical institutions in Romania.

Thereby, my approach opens up new directions of exploration and research. First, my article aims to broaden the analysis of the Romanian higher education system. Romanian historiography traditionally privileged the level of univer-

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[5] There are many theories regarding the evolution of professions in industrial societies, from Abraham Flexner's "canonic" definition of profession to the theory of "system of professions", formulated by Andrew Abbott in 1988. A recent work which provides an insight into the evolution of theories of professionalisation is Claude Dubar, Pierre Tripier, Valérie Boussard, *Sociologie des professions*, 3rd edition (Paris: Armand Colin, 2011). Its main conclusion is that all activities tend to evolve and to become professional. Therefore, a history of professions should not rely on and limit itself to the history of education and transfer of knowledge, since such an approach would be nothing more than a tautology. A sociological history of professions should reveal the moments of interaction between different social groups struggling to achieve a new and secure social status: "Ce n'est pas seulement ni d'abord l'activité du travailleur qui fait sa profession, mais sa reconnaissance, toujours à reconquérir, par tous ses partenaires" (Dubar, Tripier, Boussard, *Sociologie des professions*, 320).

[6] See the special issue of *Culture technique* (no. 12) from 1984, suggestively titled "Les ingénieurs". It was coordinated by André Grélon, who has since developed a new direction in the field of sociology of professions. Professor André Grélon holds the chair of *Sociologie des professions techniques* at L'École des Hautes Études en Sciences Sociales (Paris).

[7] Gouzévitch, Irina et al., "Introduction. « L'ingénieur dans tous ses états »: l'essor d'un champ de recherche pluridisciplinaire et transnational," *Quaderns d'història de l'enginyeria* XV (2016): 4.

sity studies, especially the humanities[8]. Given the fact that the historiographic rehabilitation of the interwar period after 1990 also implied the recuperation of a "lost generation" (symbolised through the triad of Mircea Eliade – Emil Cioran – Eugène Ionesco), and since political radicalism was closely related to the activity of student circles, the university became a legitimate, even fascinating, subject of inquiry. For some historians, the university seems to have "contained" all the ingredients of a pre- and interwar Romanian "microcosm", covering issues such as upward social mobility, the rise of political extremism or the building of a new society in the aftermath of World War I. For this type of research, the work of Irina Livezeanu is still a fundamental reference.

The second aim of the article is to evaluate the role of (higher) education in the professionalisation process in Romania. Analysts of the educational architecture and social reform projects from the turn of the nineteenth and twentieth century described this period as a time of crisis for educational systems, with many voices claiming to "orientate higher education towards practical knowledge and useful careers for the public good"[9]. This crisis was purportedly caused by the introduction of the compulsory education system, the change of the model of social elite reproduction (i.e., the transition from the aristocratic pattern to a democratic mechanism of elite selection) and the need to adapt the existing schools to the new requirements of industrial societies. This was the moment when pedagogy became a subject of international debates since such exchanges and transfers were viewed as a prerequisite for achieving prosperity and progress: "During the 19th century, the construction of a complex and coordinated educational system, which included a wide range of school levels based on sex, social origin, religion, age, individual skills or merit, became the general

[8] In the communist historiography, the subject of (interwar) universities was tackled in a propagandistic manner, in order to reveal the failures of the bourgeois system, which led to the proliferation of fascism in Greater Romania. See, for example, the works of Stelian Neagoe, *Triumful raţiunii împotriva violenţei. Viaţa universitară ieşeană interbelică* (Iaşi: Junimea Publishing House, 1977) and *Viaţa universitară clujeană interbelică*, 2 vol. (Cluj-Napoca: Dacia Publishing House, 1980). After 1990, the topic was discussed în the framework of fascism studies focusing on Romania, for instance in: Zigu Ornea, *Anii 1930. Extrema dreaptă interbelică* (Bucharest: Fundaţia Culturală Română Publishing House, 1995); Irina Livezeanu, *Cultură şi naţionalism în România Mare 1918-1930* (Bucharest: Humanitas Publishing House, 1998); Marta Petreu, *Diavolul şi ucenicul său: Nae Ionescu – Mihail Sebastian* (Iaşi: Polirom Publishing House, 2009). A sociological approach was developed by Lucian Nastasă in his *"Suveranii" universităţilor româneşti. Mecanisme de selecţie şi promovare a elitei intelectuale. Profesorii Facultăţilor de Filosofie şi Litere 1864-1948* (Cluj-Napoca: Limes Publishing House, 2007).

[9] Walter Rüegg, "Themes," in, *A History of the University in Europe. Vol. III: Universities in the 19th and early 20th centuries 1800-1945*, edited by Walter Rüegg (Cambridge: Cambridge University Press, 2004), 3.

long-term trend characterising most of the European school systems"[10]. Educational decision-makers thus aimed at a deeper understanding of the process of "segmentation of the education system" (Fritz Ringer). This fragmentation was viewed as a consequence of the universalisation of the pedagogical activity (that became free and compulsory) and of the school's adaptation to the new socio-economic reality (industrialisation, increasing social mobility). In his analysis, Fritz Ringer looked into the "educational transformations of the late 19th and early 20th centuries primarily in terms of their *social effects*, rather than primarily in terms of their *economic causes*"[11]. Ringer's approach mostly relied on Pierre Bourdieu's theory of elites' social reproduction. The turn of the nineteenth and twentieth centuries witnessed an important growth of students' enrollments in secondary and higher education institutions. However, this did not lead to an educational revolution in terms of students' social origin.

For the young people with a 'lower' social background in Romania between 1881 and 1939, higher education was more than just a stage in their studies. Higher education was increasingly conceived as a 'social elevator', granting privileged access to a professional career. The first question that arises in this context is the following: what were the rationales and motivations that pushed them towards a certain field of study? And, consequently, did the state have a clear policy for the recruiting and development of the elite, of what we call today "human capital"? Or was it simply a "segmentation of education", thus perpetuating the socio-cultural gaps within the population? From the perspective of these questions, the analysis of technical higher education can serve as a tool for evaluating the effectiveness of Romania's general educational policies. Additionally, a focus on the public perception of the engineers can reveal some interesting insights about what it meant to be an engineer in modern(ising) Romania.

The engineer: a "strange" profile in an agrarian society

At the beginning of the nineteenth century, the engineer was indeed a strange – somewhat exotic – figure in the Romanian lands, since this area was far away from the epicenter of the industrial revolution. Nevertheless, technol-

[10] Damiano Matasci, "International Congresses of Education and the Circulation of Pedagogical Knowledge in Western Europe, 1876–1910," in *Shaping the transnational sphere: experts, networks and issues from the 1840s to the 1930s*, edited by Davide Rodogno, Bernhard Struck and Jakob Vogel [Contemporary European history series, volume 14] (New York-Oxford: Berghahn Publishing House, 2015), 222, 231.

[11] Fritz Ringer, "Introduction," in *The Rise of the Modern Educational System. Structural Change and Social Reproduction 1870 – 1920*, edited by Detlef K. Müller, Fritz Ringer, Brian Simon, 3rd edition (London – Paris: Cambridge University Press & Editions de la Maison des Sciences de l'Homme, 1989), 3.

ogy began to attract many young people from the Principalities of Moldavia and Wallachia. Among the first Romanians who completed technical studies abroad, we find Alexandru Golescu, a graduate in 1839 of the École Centrale des Arts et Manufactures in Paris. After his return to his homeland, he discovered that his new profession did not enjoy much esteem, since "the peasants laughed and said that the boyar became a road measurement worker"[12]. The first Romanian mining engineer seems to have been Ion Ghica, who graduated from the École nationale supérieure des mines in Paris in 1841, while the first local architect was Alexandru Orăscu, a graduate of the Polytechnic School in Berlin. Orăscu is also known for designing the plans for the building of the University of Bucharest.

Among the first internally generated attempts to organise an engineering system of education, the project of Petrache Poenaru should be mentioned. After almost 10 years of study abroad (especially in France, where he had studied topographic engineering), Petrache Poenaru was commissioned in 1831 by Pavel Kiseleff, the Russian Governor of the Romanian Principalities (1829-1834), to draft a plan for organising a modern higher education system. Inspired by the Enlightenment ideas, with which he had come into contact in the French capital, Poenaru saw education as an essential factor in the development of Romanian society. He was also inspired by the French model in his project for the organisation of higher education in Wallachia. However, due to the lack of a local tradition for such an education, Poenaru had to implement his system under the label of "special courses". He also gave up the project for establishing a medical school, while the project of a high school focusing on the sciences ultimately resulted in "applied mathematics". The purpose of the latter school was to train civil engineers. Four years later, in 1835, applied mathematics courses were inaugurated at St. Sava College in Bucharest, where "engineers and topometry specialists were to be trained since these are much-needed professions in the country at a time when each of the boyars wanted to delimit and to have an exact plan of their estates" [13]. Starting with 1837, the first graduates of agronomic engineer's courses (*ingineri hotarnici*) trained in Wallachia would enter the local economy. It seems that, in an agrarian society, the only purpose of the engineer was to simply measure the land.

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[12] Ion Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," in *Școala Politehnică din București. Aniversarea a 75 de ani de învățământ tehnic în România, 50 de ani de la reorganizarea Școlii Naționale de Poduri și Șosele, 10 ani de la înființarea Școlii Politehnice* (Bucharest: Cartea Românească, 1931), 148.

[13] George Potra, *Petrache Poenaru, ctitor al învățământului în țara noastră* (Bucharest: Editura Științifică, 1963), 100, 118.

Only after 1859 – the year of the Romanian state's foundation through the union of Moldavia and Wallachia – did the profile of the engineer began to claim to be recognised as a distinct profession in Romanian society. In 1866, P.S. Aurelian edited the *Politecnicul* magazine, which was followed nine years later by a similar project initiated by Petru Davidelu – the *Inginerul* magazine. These were timid and disjointed attempts to consolidate an engineering ethos in the Romanian context. What were the reasons for which technical studies were essentially ignored in the Romanian space, while many youngsters devoted themselves to a legal career? To answer this question, a long-term explanation is required, which would take into account the medieval heritage of the Romanian society and the agrarian background of the economy. These were features shared by all the societies in Eastern Europe in the eighteenth century. This region was a periphery of Western Europe that had to face disruptive transformations when confronted by the capitalist economy[14].

"The diploma and the job": the origin of the appetite for legal studies

The origin of this situation is to be found in the provisions of the Treaty of Adrianople of 1829, which opened the Romanian agrarian production to international trade. Although profitable in the first stage, it seems that international trade profoundly affected the social and economic status of the Romanian political elites. The solution preferred by the latter was to build the modern Romanian state as a mechanism for defending their own social and economic status. One of the most important analysts of this phenomenon was Ștefan Zeletin, who emphasised the consequences of the Treaty of Adrianople for the local society as a whole: entering in the area of international trade meant the transformation of peasant labor into a commodity, with the boyars seeking to secure their economic status along with their social and political privileges. This is how Ștefan Zeletin attempted to explain the elite's propensity for state careers. In Zeletin's own words, "Romanians did not become bureaucrats either out of pleasure or out of lack of dexterity for productive work [...]; they were forced to seek refuge

[14] See Andrew C. Janos, *East Central Europe in Modern World. The Politics of the Borderlands from pre- to post-Communism* (Stanford, Staford University Press, 2000). In his analysis, Janos pursue the theory of "great transformation" of Karl Polanyi, showing that the elite in underdeveloped agrarian societies from Eastern and Central Europe were "contaminated" by the extrinsic forces of Western developed societies, like consumption and fashion. The main problem of the elite in this part of Europe was that the "patterns of consumption were incongruous with existing modes of production", degenerating into a "development of the underdevelopment" (Janos, *East Central Europe in Modern World*, 61).

in this parasitic occupation because urban production had been ruined"[15] by the economic contacts with the Western countries. Recent studies have shown that the impact of the Treaty of Adrianople did not actually play such an important role in the rise of cereal exports from Moldavia and Wallachia, since Romanian exports increased especially after 1860[16]. The problem was that the rising cereal exports after 1860 coincided with a fall in cereal prices in Western Europe, and in particular in Great Britain, the main European importer of Romanian grain[17]. This resulted in the impoverishment of the Romanian peasant, who was forced to supply a greater production, usually through extensive agriculture, i.e., more labor. The winners were about 5,000 landlords, who held more than half of the agricultural area of the Old Kingdom in 1905[18].

Such a nefarious economic development of agrarian relations in the countryside played a major role in the underdevelopment of the urban centers. The exports of cereals were conceived as a mechanism of value extraction for the benefit of the tiny elite, hampering the industrialisation process. The local bourgeoisie had no place in the "chain of exports": "Thus, while the history of the modern Western state may well be described as one of the rising middle classes in quest of larger national markets, the history of the peripheral states is one of the declining middle classes trying to escape the vagaries of the market and hoping to find safe haven in political, rather than economic, entrepreneurship"[19].

Some statistics on the development of the bureaucratic apparatus in Eastern Europe are relevant in this regard. Hungary, a country with a population of about 14 million in 1867 (as part of the bi-cephalous monarchy of Austria-Hungary), had 16,000 civil servants, but their number reached approx. 98,000 in 1900, and almost 120,000 in 1910, in a context in which the population increased by only 20%. Around 1890, Romania had approx. 87,000 civil servants, for a total population of about 8 million inhabitants. By 1902, the body of civil servants reached approx. 102,000 and, in 1912, there were more than 139,000. In the Eastern European agrarian societies, "public employment is said to have exceeded 5 percent of the total labor force, compared to 1.5 percent for Germany and 0.9 percent for England and Wales"[20]. The main problem was, therefore,

[15] Ștefan Zeletin, *Burghezia română. Neoliberalismul*, edited by Cristian Preda (Bucharest: Nemira, 1997), 175-176.

[16] Bogdan Murgescu, *România și Europa. Acumularea decalajelor economice 1500 – 2010* (Iași: Polirom, 2010), 121.

[17] Murgescu, *România și Europa*, 122.

[18] Murgescu, *România și Europa*, 126.

[19] Janos, *East Central Europe in the Modern World*, 66.

[20] Janos, *East Central Europe in the Modern World*, 87.

that this large number of bureaucrats was in contradiction with the low degree of economic development and, implicitly, with the absence of social complexity. In addition to these two drawbacks, the financial demands of this *sui generis* social class were far beyond the financial capabilities of these peripheral economies. The resources needed to maintain this class varied between 25 and 40% of the budget of the respective countries. To this, the mechanisms of fundraising – legal or illegal – practised by economic entrepreneurs or even politicians should be added.

Mihai Eminescu called this new category the "proletarians of the pen" (*proletari ai condeiului*). In the public eye, an equivalence between "diploma and job" emerged. Holding a university degree – preferably received abroad – meant securing a career in the state apparatus. The statement attributed to Petre P. Carp, according to which "the Romanian is born a scholarship holder, lives as a civil servant and dies as a retiree of the Romanian state" was not far from the truth.

The brief contextual picture presented above explains the interest of young people in south-eastern Europe for a legal career. Such a trajectory all but guaranteed the prerequisites of social prestige, political or administrative upward mobility, and, implicitly, of financial security. Reasons for this situation are also to be found beyond the borders of the Old Kingdom, and even outside the agrarian-based south-east European economy. In France, for instance, the reputation of the legal profession increased following the introduction of higher educational standards, especially after 1870. The compulsory classical baccalaureate, with Latin as a mandatory discipline in legal studies, along with its intrinsic theoretical approach, made the legal career a special choice in the Third French Republic. Even so, it soon became a professional path that had to moderate its democratic tendencies through a meritocratic filter. Thus, financial lack of interest and high educational standards contributed to strengthening the legal career as a distinct source of identity in the new world of liberal professions[21]. The same state of affairs was to be found in German society, where engineers viewed themselves as discriminated against by the old professions, which benefited from greater social prestige. This was obvious in the professional structure of the state bureaucracy, dominated by law graduates. Engineers found themselves in an inferior position concerning the humanities since the latter had a better reputation within public opinion[22].

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[21] Julie Fette, *Exclusions. Practicing Prejudice in French Law and Medicine, 1920-1945*, (Ithaca&London: Cornell University Press, 2012), 16.

[22] Wolfgang König, "Education and Social Standing: German Engineers, 1870-1930," *L'ingénieur dans tous ses états»: l'essor d'un champ de recherche pluridisciplinaire et transnational. «Quaderns d'història de l'enginyeria»*, vol. XV (2016): 113-121.

At the outbreak of World War I, after more than eight decades of economic contacts with the West, Romania was a rather poor state. Even if modernisation had become an irreversible project, the effects of this phenomenon were rather unequal in a country situated on the periphery of the capitalist economic system. A predominantly agrarian economy, in which rural income inequality was at very high levels, existed against the background of a social landscape dominated by an oversized administrative apparatus, often perceived as useless and as a source of political corruption. As N. Xenopol remarked in a 1916 paper devoted to Romania's national wealth, Romanian society appeared "in an unfavourable light: a rather small class of the rich; alongside some very rich people, owning huge agricultural or forestry estates, financial institutions, and large commercial or industrial companies, thus enjoying very large profits; a small middle class; in the countryside, next to a class of wealthy peasants – whose number, fortunately, increases every year – we encounter a large mass of peasants and agricultural laborers, with a precarious financial situation; finally, throughout the whole country, we find a large number of public servants living on low-wages"[23].

Delineating the "space for crafting engineers"

Precisely to differentiate themselves in this landscape in which everything depended on the state budget, the Romanian engineers had started to build another public image of themselves, which was supposed to reveal a new and practical utilitarianism. The "Strousberg affair"[24] was a crucial moment for the engineering profession. By cancelling the railway concession granted to the German group Strousberg, Romania laid the foundations of a state company that needed professionals in order to accomplish the mission of merging the two halves of the country through railroads. The Romanian engineers took over the construction process of the railway network in the Old Kingdom. This was one of the reasons for which engineers demanded state support in setting up, protecting, and promoting this new profession. Their main argument was the work they could point to as the result of their efforts: the first railway built entirely by Romanian engineers (the Buzău – Mărășești

[23] N. Xenopol, *La Richesse de la Roumanie*, apud Gheorghe Iacob, *Modernizarea României 1859-1939. Legislație și strategie economică* (Iași: Editura Universității „Al.I. Cuza", 2012), 19-20.

[24] In 1868, Romania hired the Prussian group Strousberg to build the railroad Iași – Galați – Bucharest – Turnu-Severin, which was supposed to link Northern and Southern Romania through the capital city, Bucharest. For a brief overview of the political, economic and diplomatic dimensions of this affair, see Constantin Botez, *Epopeea feroviară românească* (Bucharest: Sport-Turism, 1977), 80-93.

line, 1881), the Cernavodă bridge built by Anghel Saligny (1895) or the modernisation of the Constanța harbor, including building silos (1904-1909), under the coordination of the same great Romanian engineer. All three projects were essential assets for a country that depended on cereal exports. Unlike the excessive bureaucratic class, which had taken over the state budget, engineers justified their claims by the fact that their work upheld and promoted an essential social value, i.e., the well-being of the community. It should be noted here that the same argument had been used by French engineers in 1828 when they were recognised by the state as an independent profession. The main justification of the latter was that engineering "c'est l'art de diriger les grandes sources de pouvoir de la nature pour l'usage et le bien-être des hommes"[25]. In industrialised countries like Great Britain, France or Germany, the phenomenon of professionalisation that began in the nineteenth century was closely intertwined with economic development. It thus became a relevant chapter in the historiography of "useful science"[26].

In 1864, the courses of the School of Bridges, Roads, Mines, and Architecture in Bucharest were inaugurated. The school's purpose was the training of specialists who were supposed to fulfill technical functions in the bureaucratic apparatus of the Romanian state. Due to the lack of students (especially in the architecture department), the institution rapidly declined. From 1867, the institution was known as the School of Bridges and Roads, with a dwindling number of students who enrolled and graduated. The engineer Scarlat Vârnav, the former director of the school, remarked in 1888 that "the school established in 1864 cannot be viewed, in any way, as a proof of progress, [since] the student body was admitted and evaluated based on a curriculum of very elementary notions of science, [thus] leaving the school without sufficient technical knowledge". For those who did graduate, professional training consisted mainly of "the practice they performed as graduates"[27]. Because of this situation, the first series of graduates of the School of Bridges and Roads were subjected to a 6-year internship in the service of public works, followed by a special examination which allowed them to be admitted to the main body of state engineers. The School of Bridges and Roads had the status of a secondary school, not of a higher education institution.

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[25] Dubar, Tripier, Boussard, *Sociologie des professions*, 81.

[26] Mina Kleiche-Dray et Roland Waast, "Introduction: De la science moderne et de son expansion," in *Les ancrages nationaux de la science mondiale XVIIIe-XXIe siècles*, coordinated by Mina Kleiche-Dray (Paris: Éditions des archives contemporaines, 2018), X.

[27] Apud Nicolae Șt. Noica, *Școala Națională de Poduri și Șosele – 125 de ani* (Bucharest: Vremea, 2010), 14-15.

Legislative initiatives to create a technical school in Bucharest, put forward between 1859 and 1881, were thwarted by financial shortages, and by the fact that young people chose to study in France or Prussia/Germany to obtain the engineering degree. Moreover, foreign companies entrusted with performing large public works projects (especially railways) came to Romania with their foreign-educated engineers, which also slowed the development of technical higher education in the country. Finally, it should be noted that Romania remained an autonomous state under Ottoman rule until 1881. Therefore, establishing economic relations or building railroads were tasks to be implemented with the help of the political powers in Europe at that time, as was the case with the Strousberg company. Such an approach had consequences in the development of modern technical and economic education. The proclamation of independence opened a new chapter in this process of developing an engineering system of education.

"Grounding" superior technical education in Romania: The National School of Bridges and Roads

After 1881, an important role in the reorganisation of the National School of Bridges and Roads (NSBR) in Bucharest was played by the Moldavian engineer Gheorghe Duca, who aimed to train engineers for the state public services. He introduced a new organisation of the educational process that would provide a more rigorous selection of the candidates for such a career on a meritocratic basis. He strengthened the school's staff by appointing several important names to the positions of mathematics teachers. Among them were Spiru Haret and D. Emmanuel, the first Romanians who received doctoral degrees in mathematics from the Sorbonne; Anghel Saligny as a professor of the bridges course; C. Istrati as the instructor for the chemistry course; Constantin Coandă etc[28].

Consequently, a rigorous selection at the entrance exams followed, which initially caused a decrease in the number of candidates. A first measure that would stimulate the social prestige of this field of study was implemented starting with 1885, when military courses were introduced, which provided the graduates with the option to become military engineers. The same year, the wearing of the uniform was introduced, and the prefects were assigned the rank of sergeants-major. On May 10th – Romania's national holiday – the students of NSBR marched in front of the king, which strengthened the positive public perception of this school[29].

[28] Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 187.

[29] Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 190.

The military *esprit* of engineering education was not limited to a mere public façade. The regime of rigid and severe discipline introduced by Gheorghe Duca was reflected at all levels of the students' lives: the quality of the papers and drawings was evaluated, weighting the average grade of the exams. Scholarships were awarded not only as a result of assessing the material conditions of the students but also for the outstanding "merit and diligence of the student"[30]. After 1890, the essential prerequisite for admission became the baccalaureate diploma (except for those who attended the preparatory one-year courses). From 1890 onwards, graduates with a diploma awarded by the School were allowed to be immediately employed as engineers in the Technical Corps of the country[31]. The decree-law of 1890 that regulated the conditions of admission to the State Technical Corps was elaborated by the Minister of Public Works, Alexandru Marghiloman. The engineering diplomas entitled the graduates of NSBR to the degree of 3rd class engineers within the State Technical Corps. The certificates of competence issued by the same institution allowed their enrollment as a "student engineer" (*elev inginer)*. Finally, the diplomas issued to public works supervisors gave graduates the right to be classified as a 3rd class conductor in the State Technical Corps[32].

Regarding the graduates that had studied abroad, their diplomas and certificates had to be confirmed and endorsed by a jury composed of the director and 6 professors of NSBR[33]. In the initial draft of the law, it was specified that the graduates should come from institutions "similar to the School of Bridges and Roads". Since the specialisation of the school in Bucharest focused on training road and bridge engineers, the provisions of the law prevented the recognition of the diplomas awarded for other specialisations, such as architecture, mining engineering, or mechanical engineering. This inconvenience was removed in 1892, when Constantin P. Olănescu (1891-1895), an engineer and

[30] Nicolae Vasilescu-Karpen, "Dare de seamă asupra învățământului în Școala Politehnică din București", in *Școala Politehnică din București. Aniversarea a 75 de ani de învățământ tehnic în România, 50 de ani de la reorganizarea Școlii Naționale de Poduri și Șosele, 10 ani de la înființarea Școlii Politehnice* (Bucharest: Cartea Românească, 1931), 187. A similar article was published on the occasion of the semi-centenary of The Polytechnic Society in Romania,1931. See Nicolae Vasilescu-Karpen, "Învățământul tehnic în România," *Istoricul dezvoltării tehnice în România. Buletinul Societății Politehnice*, year XLV, no. 12 (December 1931): 2297-2234.

[31] Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 105-210.

[32] Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 191.

[33] Arhivele Naționale Istorice Centrale (ANIC), *Fund Ministerul Lucrărilor Publice. Școala de Poduri și Șosele*, file 4/1892, 78-79.

a member of the Conservative Party, headed the Ministry of Public Works. In a memorandum sent to King Carol I, Olănescu drew the king's attention to the fact that the law of 1890 did not allow the inclusion of graduates of various special schools from abroad into the State Technical Corps, although the Romanian state lacked, for example, mechanical or mining engineers. As a result, according to a new decree-law issued on April 21, 1892, the phrase "similar to the national school of bridges and roads" was deleted, to allow the recognition and confirmation of these diplomas and the inclusion in the State Technical Corps of engineers that graduated abroad of various specialisations that did not exist in the curriculum of NSBR[34].

Two years later, a new law on the organisation of the Technical Corps, supervised by the Ministry of Public Works (a body composed only of engineers and foremen) stipulated, in Article 6, the official positions that engineering graduates could fill in the service of the Romanian state, depending on their graduation averages: "Those with a diploma bearing the qualification *very well* or *well* were entitled to serve as ordinary engineers 3rd class, while those with *sufficient* qualification received the degree of engineer-trainee" [35].

The economic crisis that affected Romania in 1899 – 1901 led to a decrease in the rhythm of public building projects, which, in turn, impacted the activity of NSBR. The new director, C. Mironescu, while trying to reinvigorate technical education, introduced some new industrial courses, with the explicit purpose to offer the school's graduates job opportunities in the private sector

[34] ANIC, *Fund Ministerul Lucrărilor Publice. Școala de Poduri și Șosele*, file 4/1892, 81-82. The jury rejected, on May 15th, 1892 the request of a graduate from Vienna Higher Technical School. The main reason was that the petitioner had presented only a certificate of graduation (*absolutorium*), which did not provide any academic degree. Also, the specialisation of the graduate was a good reason for the refusal of the jury to adjudicate: "Since we do not have any program for admission as an Architect in the service of the State, we cannot decide whether Mr. Ion Pamfilie has the title of architect or not". Instead, another application from a graduate in architecture of the Munich Polytechnic School, submitted in November 1892, received the following resolution: "Diploma in the field of architecture of Mr. [...] can be equated, at most, to a curriculum degree of our conductor-designers' school". The jury also rejected the application of a graduate of the School of Mines in Paris, who "could not have obtained the diploma of mining civil engineer [in France] with the grades shown in this certificate, and, therefore, cannot be enrolled as an engineer in the Technical Corps of the State" (ANIC, *Fund Ministerul Lucrărilor Publice. Școala de Poduri și Șosele*, file 4/1892, 94, 100, 128).

[35] The law was published in *Monitorul Oficial*, Part I, no. 58 of June 15, 1894, and amended in 1924, when the Law for completing art. 6 and 53 of the Law on the organisation of the Technical Corps of the Ministry of Public Works was passed (*Monitorul Oficial al României*, Part I, no. 174, 12 of August 1924).

of the economy. Despite these initiatives, the decreasing number of available positions in the Technical Corps of Romania discouraged young people from following a professional career in engineering. That is why, between 1901 and 1909, the number of polytechnic students decreased dramatically. Expanding the use of future engineers in the Romanian economy was necessary, which is why a commission was appointed in 1901 to elaborate the best scenarios for reorganising the school. The members of this commission (including Anghel Saligny) suggested the division of the 4 years of study into two cycles, with the final 2 years devoted entirely to specialised training focusing on three fields: construction engineers and architects; mechanical engineers and electricians; and mining and industrial engineers. Despite this project, after 1910, there was a general tendency toward "relaxing" the rigors of academic life in the School of Bridges and Roads, which made "the foundations of Duca's schools crumble, and the School move towards liberal education, which is the cornerstone of universities"[36].

World War I had a major influence on polytechnic education in Romania. Under the impact of the women's emancipation movement, in 1919, the School Board decided to admit female candidates[37]. Nevertheless, the share of women was very low in the polytechnic schools: in 1924/1925, only 13 women were enrolled at NSBR (out of 869 students), and in 1929/1930, their number dropped to 5 (out of 1240). In 1937/1938, the proportion of women studying at NSBR was the highest, i.e., 76 out of 1938[38].

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[36] Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 199.

[37] There were many important moments in the aftermath of World War I that confirmed the success of the women emancipation movement. Women were allowed to sit on school councils and to work in the railroad service. In June 1920 – following the precedent established by Ella Negruzzi – the right to practise law was granted to all women lawyers. Nevertheless, educational and socio-economic emancipation was not followed by political emancipation. See Ștefania Mihăilescu, *Amplificarea și maturizarea mișcării de emancipare a femeii române între 1929 și 1948*, in *Din istoria feminismului românesc. Studiu și antologie de texte 1929-1948*, edited by Ștefania Mihăilescu (Iași: Polirom, 2006), 17. Another negative aspect was the subordination of the wives to their husbands, since they were not allowed to sign a contract or to appear in court without prior consent of the husband. To use the words of Calypso Botez, a feminist activist, for the Romanian women marriage meant "le passage de la capacité à l'incapacité": Calypso Botez, *Raport sur la situation juridique de la femme dans la legislation roumaine* (Bucarest, 1932), 7.

[38] For a detailed analysis regarding the presence of women in the Romanian higher education system during the interwar period, see Dragoș Sdrobiș, "From the Absences of History toward the Unequal of the Equal. Women in the Higher Education of Romania 1919-1939," *Historia Universitatis Iassiensis* vol. V, (2014): 85-117.

The curriculum of NSBR was supplemented by the fields of technical study, which had been previously developed inside universities. The engineers condemned the unpredictable and inflationary development of technical education at universities, perceived as inferior to the training in polytechnic schools: "With the spirit of freedom that reigns in Universities, great thinkers, scientists, and doctors in the technical sciences can be created; however, it is not possible to create a technical army that would fight, from morning to evening, on construction sites, in workshops, in factories, that would monitor and control the labor of workers, that would improve and increase production; there can be no engineers who have not endured discipline, so that they can impose it, and who have been able to obey starting from the school benches so that they can then obey their superiors when exercising their profession"[39]. Engineers justified this monopoly on polytechnic education by the previously developed curriculum and by the spirit of discipline inculcated to the graduates. Both these features were incompatible with the bohemian and, sometimes, the rebellious atmosphere that had taken over the universities immediately after the Great Union[40]. So, what was the didactic praxis that defined the specificity of NSBR?

[39] Ion Ionescu, "Istoricul învățământului ingineresc în România până la înființarea școlilor politehnice," 210.

[40] The 1922 students' movements are iconic for the rebellious atmosphere in universities, while the level of the student body confirms the "bohemian" spirit inside the establishments. Gheorghe Gh. Longinescu, university professor at the Faculty of Sciences in Bucharest and founder of *Natura* magazine, published in 1926 some letters from a former student, who had attended in 1922 the courses of the Polytechnic School in Zurich. The student noticed, first of all, the order and discipline that prevailed in Switzerland, but also the high cost of the studies there. Regarding the exams, they were "a bit more difficult than in Bucharest": "While in Bucharest – I remember well – a student starts to prepare for his exams a month, or at most two, before facing the examination commission, here [in Zurich] you have to work during the entire academic year, because every week there are preparation sessions [*repetitorii*] held in groups of five or six students with teaching assistants, sessions in which grades are given, with a great impact on the final exam grades. I find that these preparation sessions are an excellent way for the student and the teacher to get to know each other, during which issues that cannot be fully understood in class can be clarified; in addition, these sessions prove to be a means of supervising students in order to assess if they actually work". From this account, G.G. Longinescu concluded that a well-established system of fees could help select genuine talents. Although he had initially opposed these fees (since poor students attended the Faculty of Sciences in Bucharest), eventually he agreed to their introduction. The main reason was that ¾ of first-year students were not prepared for these studies, since "out of 125 admitted to the exam, barely 25 succeed to pass the first exam session". See *Natura. Revistă pentru răspândirea științei*, year XV, no. 6, (15 September 1926): 30-31.

"All the incapables were sneaking in!": a time for reform

As mentioned above, engineer Gheorghe Duca played an important role in reorganising the National School of Bridges and Roads in Bucharest. An engineer who graduated in 1869 from the École Centrale des Arts et Manufactures in Paris, Duca then returned to his home country, where he played an important role in supervising the national railway network construction projects. After the revocation of the Strousberg concession, the Romanian state undertook the major technical works involved, with the support of Romanian engineers. As the number of young Romanians who pursued polytechnic studies abroad was very small, Gheorghe Duca was appointed, in 1881, as director of NSBR, with the clear mission to reorganise this institution. It was time for a new beginning.

The reasons for such an assertion are to be found in a report prepared by Gheorghe Duca and submitted to the Ministry of Public Works in 1887. This report emphasised the deplorable state of this school between 1864 and 1881. First of all, in Duca's opinion, there were no clear admission criteria. If abroad the baccalaureate exam and the preparatory year were necessary and inherent conditions, "in our country, the candidates who took the exam – for the most part – had not graduated from secondary school [...] and, although the admission curriculum was very general, they [the candidates] were completely unaware of the required knowledge. The slightest algebraic calculation, the use of logarithmic tables or the simplest problems of basic geometry were matters that simply exceeded their knowledge [...]"[41]. Even so, students who failed the entrance exam had the right to enroll as auditors, and "it was enough to pass in certain conditions, at the end of the first month, the exams regarding the subjects taught in school to be registered as a regular student. This was the way by which all the incapable [candidates] were sneaking in", Gheorghe Duca wrote in an outraged passage. He concluded that the atmosphere of the school was dominated by mediocrity: "The consequence was that, out of an initial class of 20 students, only four or five reached the third or fourth year of study"[42].

Another cause of this degradation was the exceeding number of classes, taught in a rush by a handful of teachers, and with insufficient time allocated for properly learning the basic notions and skills in practical application classes. The result could only be a "superficial acquisition" (*spoială*) of engineering knowledge and skills that made the future professionals believe that they knew enough about their field of expertise, without realising they were just at the beginning of

[41] Radu P. Voinea, "Gheorghe Duca," *Construcții. Revistă de informare și dezbatere tehnică și economică*, no. 11, (1986), 5. The article was re-edited by Nicolae Șt. Noica in *Școala Națională de Poduri și Șosele – 125 de ani*, 30-34.

[42] Voinea, "Gheorghe Duca," 6.

their studies: "We think there is no method more nefarious than this: superficial knowledge is far more harmful than ignorance; when one does not know, he is silent and seeks to learn; but when one thinks he knows, when he is unaware of his ignorance, he certainly makes the strangest mistakes, and it is much harder to rectify the wrong knowledge than to acquire new knowledge [...]"[43].

Similarly to the polytechnic training at the specialised institutions in the West, technical drawing was supposed to be an essential discipline for the NSBR students in Bucharest. The problem was that this discipline did not go beyond the stage of a "desideratum". Again, the deficiencies of secondary education were to blame for failing to provide students with the basics of drawing. For this reason, "project writing was sacrificed for the sake of drawing education"[44]. As for the practical training system, Duca complained that "the students were sent to the district engineers and, instead of working in the field, they were kept in the offices, where they worked as copyists [...][45]". Finally, another negative element was the lack of discipline and the irregular attendance of the courses and examinations. Therefore, in Duca's words, there were "students who had finished the fourth year and had not passed [even] the exams for the first year"[46].

Gheorghe Duca's report clearly showed the poor quality of secondary education, which did not endow its graduates with the necessary basic notions. Aware that his protests alone would not succeed in stimulating a reform of the high school, starting with 1881 Duca established the "preparatory division" of NSBR. This preliminary year became the "true foundation" of technical education. It was initially open to anyone, regardless of their level of knowledge. The selection was ensured through the severe regime of discipline and rigorous examinations. For instance, in 1882-1883, out of 122 students enrolled in the preparatory year, only 18 were admitted to the first year of study at NSBR. Because of the low admission rate, three years later, in 1885, an entrance exam for the preparatory year was introduced, which contributed to even stricter selection criteria of the candidates for the engineering degree[47].

A new curriculum

Before addressing the curricular changes that occurred at NSBR in Bucharest, a brief note regarding technical higher education in Europe is necessary. In the nineteenth century, under the impact of the industrial revolution, an important

[43] Voinea, "Gheorghe Duca," 6.
[44] Voinea, "Gheorghe Duca," 6.
[45] Voinea, "Gheorghe Duca," 6.
[46] Voinea, "Gheorghe Duca," 6.
[47] Voinea, "Gheorghe Duca," 7.

role in the development of technical higher education was played by two famous institutions in France: École Polytechnique and École Centrale des Arts et Manufactures, both based in Paris. Founded during the French Revolution (1794), the École Polytechnique became in 1805, under Napoléon, a military cadre school, which mainly trained specialists for the government apparatus: "[I]n the beginning a Polytechnicien was a kind of generalist, scholar, as <well as> also an inventor, architect and engineer, as well as <an> officer, trained in the basics of various fields of architecture and engineering [...]"[48]. In this case, the subsequent specialisation was the responsibility of other institutions of applied education. The École Centrale des Arts et Manufactures, founded in 1829, was a private initiative, which emerged in the context of a relative liberalisation of French society in the post-Napoleonic period. In their manifesto addressed to the public opinion, the founders of this institution referred to the economic superiority of Britain (as well as the political superiority of that country) as a result of implementing a profoundly liberal program in the field of technical higher education. As a result, École Centrale des Arts et Manufactures emphasised from the very beginning the positive role that civil engineers would play in society, in the context of the rise of capitalism and the scientific and technological revolution[49]. To meet the new challenges of the modern economy, "the school developed a greater tendency towards specialisation [...]. The Centraux understood themselves to be a group of dedicated engineers and architects working at the cutting-edge of social progress, applying themselves to improving the general welfare and comfort, participating in a modern, industrially based nation in the form of an *industrial army*. The Ancien Regime's *Corps royal* was replaced by a civil, democratic and republican *Corps industriel*"[50].

Unlike the two institutions mentioned above, whose major difference concerned the relationship to the state, the German polytechnic schools sought to combine several constitutive elements so as to shape a new balanced approach towards society and state. The most eloquent example is the Polytechnikum in Karlsruhe, which significantly influenced technical higher education establishments in Germany. In contrast to the French technical institutions, the Karlsruhe Polytechnikum "took control of general preparatory education [...].

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[48] Ulrich Pfammatter, *The Making of the Modern Architect and Engineer. The Origins and Development of a Scientific and Industrially oriented Education* (Basel – Boston – Berlin: Birkhäuser, 2000), 89.

[49] André Grelon, "Du bon usage du modèle étranger: la mise en place de l'Ecole des arts et manufactures," *Bulletin de la Sabix. Société des amis de la Bibliothèque et de l'Histoire de l'Ecole polytechnique*, 26 (2000): 47-52.

[50] Pfammatter, *The Making of the Modern Architect and Engineer*, 201-202.

Another difference is to be seen in the standardised education for engineers not only engaged in civil service but also private industry"[51]. The vision of the Karlsruhe Polytechnikum reflected the desire for economic development and adaptation to the local conditions, "thus acting not as an example to be exactly copied but as an inspirational model for integrating different characteristics and needs"[52]. The fact that technical higher education in Germany acquired equal status with the university (being granted the right to organise doctoral studies in 1899[53]) explains the growing influence of German polytechnic schools in Europe and beyond.

Returning to the topic of this article, NSBR had a curriculum that relied on the idea of specialisation during the years of study. Therefore, the institutional direction was much closer to the German pattern, unlike the French one, where polytechnic students received a general science education, as a basis for further specialisation within the "applied schools".

One can also point to a new pedagogical pattern fostered by engineering schools. It concerned the combination of theory and practice that had played a key role in the transmission of knowledge. It was increasingly seen as a process of accumulation and dissemination. This was the "new scientific spirit" developed in the German area. Alexander von Humboldt and "consequently the followers of the so-called Humboldt university model no longer saw the professor as a teacher who lectured on the current state of the art in an orderly, textbook fashion, but rather as a model that the student should follow so that he might scientifically grasp an object to arrive at new, rationally scrutinised, knowledge"[54].

This allowed for the creation of a "professional scale", according to which a certain level of technical and scientific knowledge granted a graduate access to different positions. Building on the Western model of "producing" specialists, towards the end of the nineteenth century the Romanian authorities were concerned with ensuring an efficient chain for training specialists. They elaborated a standardised curriculum, planned a predictable educational process, and established certain minimum requirements for admission in NSBR and for promoting every year of studies.

Regarding the admission criteria, the French model was emulated by NSBR. Besides the fact that the candidates had to be high school graduates, the basic discipline of the entrance exam was mathematics, along with physics or chemistry. In fact, during the preparatory year, mathematics dominated the

[51] Pfammatter, *The Making of the Modern Architect and Engineer,* 233.
[52] Pfammatter, *The Making of the Modern Architect and Engineer,* 235.
[53] Pfammatter, *The Making of the Modern Architect and Engineer,* 237.
[54] Rüegg, "Themes," 21.

curriculum (9 hours per week). Starting with 1885, an admission exam for the preparatory year was introduced. During the first and second year of study, the emphasis was placed on technical drawing, whereas the final years focused on drafting engineering projects[55].

In the first stage of the school's development, courses for engineers and public conductors were held in common. Strange as it may seem, the main reason was that the school did not have an adequate location that would allow students to be divided into groups. Only in 1886, with the inauguration of the NSBR building on Griviței Road in Bucharest, one could say that technical education was organised under proper conditions. The new building had an amphitheater for teaching courses, shared by the engineering department and the "preparatory division". It also featured physics and chemistry laboratories, a museum, a library, and a boarding school for students coming from outside Bucharest[56].

Classes were held Monday through Saturday, from 8:30 a.m. to 11:30 a.m. They resumed at 1 p.m. and finished at 4 p.m. (or 5:30 p.m., in some cases). These were the disciplines studied in the 1891/1892 academic year:

> *Year I - physics, differential calculus, topography, chemistry, mineralogy, stereotomy, regulations*
> *Year II - electricity, mechanics, statics, roads, industrial physics, civil engineering, military art*
> *Year III - cars, resistance, hydraulics, bridges, railways, civil engineering, artillery*
> *Year IV - hydraulics, endurance, navigation, steam cars, railways, bridges, economy, fortifications.*

The end-of-year exams were held between May 20 and June 25. A periodical monthly general assessment for each subject was used to monitor the level of students and to intervene with the necessary corrective measures. Regarding the grades system, NSBR used the French model, with grades from 1 to 20, 12 being the minimum passing grade. During the holidays, students were required to serve as interns in state institutions or the private sector[57]. As for graduation requirements, the criterion for receiving an engineering degree was to obtain a general average of at least 15 (out of 20) for all the years of study. Those performing below this minimum grade received only a graduation certificate, which gave them the right to a career as a public works supervisor[58].

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[55] Voinea, "Gheorghe Duca," 7.

[56] Nicolae Noica, "100 de ani de la punerea pietrei de temelie a clădirii Școlii Naționale de Poduri și Șosele," *Construcții. Revistă de informare și dezbatere tehnică și economică*, Bucharest, no. 11 (1986): 32. See also Nicolae Noica, *Școala Națională de Poduri și Șosele – 125 de ani*, 21.

[57] ANIC, *Fund Ministerul Lucrărilor Publice. Școala de Poduri și Șosele*, file 7/1892, 72, 128, 193, 211.

[58] Noica, *Școala Națională de Poduri și Șosele – 125 de ani*, 21.

Military discipline

Inside the school, students were subjected to a military regime. They benefited from military training, an innovation – as mentioned above – introduced by a law of 1895, which gave future engineers the right to become military officers in reserve. The reason for introducing military training for NSBR students can be connected to the broader process of creating a loyal bureaucratic elite, as also occurred in other countries[59]. At this point, no evidence could be found to prove that the access of candidates of non-Romanian ethnic origin to engineering studies was restricted.

Coming back to the military regime inside NSBR, students were forbidden to smoke or bring newspapers or magazines of any kind inside this institution. There were numerous cases of students being warned or even punished for non-compliance with the curriculum and the school rules, as well as for some other, sometimes hilarious reasons, such as the fact that the bed was in disarray or the fact that they were still in their room at the beginning of class. Regarding clothing, the boarding school students were obliged to wear the uniform in public spaces and to formally salute the Romanian army officers[60]. The engineering students in military uniform thus symbolised and promoted at the social level the new ideal of masculinity: virile figures, in uniforms worn according to the "German fashion", and physically fit.

Technical higher education in Greater Romania, 1919-1939

In the interwar period, the educational process in the field faced only small adjustments[61]. The curriculum of the newly renamed Polytechnic School of Bucharest continued to focus on science education, but also included general

[59] Darina Martykánová, *Reconstructing Ottoman Engineers. Archaeology of a Profession 1789-1914* (Pisa: Plus – Pisa University Press, 2010), 48-49, 70-72. The author tackles the case of the Ottoman Empire, where a Superior School for Engineering was founded in 1883 to prepare future civil engineers. However, the educational process was performed exclusively by the army. This peculiarity turned out to be an efficient "filter" for discouraging the non-Muslims to pursue an engineering career in the Ottoman Empire. Confronted with an increasing wave of centrifugal national emancipation movements, the Ottomans sought to counter this trend by the "ottomanisation" of the bureaucracy. For Ottoman decision-makers, this system was a way of protecting the future Muslim elite from the cosmopolitan and multicultural spirit generated by education in Western countries. The author notes that this cultural policy would have a boomerang effect on the regime of Sultan Abdul Hamid II: the nationalisation of youth laid the basis for the Young Turk movement, which eventually hastened the end of the Ottoman Empire.

[60] ANIC, *Fund Ministerul Lucrărilor Publice. Școala de Poduri și Șosele*, file 8/1889, 13, 28, 46-48.

[61] Vasilescu-Karpen, "Dare de seamă asupra învățământului în Școala Politehnică din București," 1-18.

courses. In addition, technical courses related to the speciality were taught. Their share varied from one speciality to another, with the main purpose of finding a balance between scientific and technical education. The purpose was to develop in the future engineer the two main characteristics necessary for the active life: technician and manager.

Such a system of organising the educational process placed the technical higher education in Romania between the French model (which emphasised encyclopedic education, as a basis for a future applied specialisation) and the German model (which relied on a very strong practical specialisation from the first years of study). However, Nicolae Vasilescu-Karpen pointed out that, such a system "overburdens the programs of some of the sections with a knowledge that, at least apparently, does not seem indispensable for a future career"[62]. For this reason, Karpen would have preferred the full adoption of the German model of polytechnic education, which relied on an early training and systematic specialisation of the graduates, following the pace of scientific development and the requirements of division of labor[63].

As director of the Polytechnic School in Bucharest between 1920 and 1940, Nicolae Vasilescu-Karpen advocated for this institution a status similar to universities. Karpen graduated first in his class from NSBR in 1891. After a short stint in the Technical Corps of the Ministry of Public Works, he left for Paris, where he attended the recently established École Supérieure d'Électricité, from which he graduated in 1902. Karpen also received his doctorate in physics in 1904. On his return to Romania, he obtained a position at NSBR, where he worked in the newly established department of electricity and electrical engineering. Although he had trained as an engineer and scientist in the French environment, Karpen greatly admired the German model, where polytechnic

[62] Vasilescu-Karpen, "Dare de seamă asupra învățământului în Școala Politehnică din București," 4.

[63] German professional literature had an increasing influence in imposing the German model of technical education in Romania, despite the fact that most members of the teaching staff at the Polytechnic School of Bucharest had pursued engineering studies in France. From the 127 members of the teaching staff of the Polytechnic School of Bucharest during 1881-1930, 66 graduated from institutions abroad, with 46 graduating exclusively in France. "Even if the group of teachers who studied in Germany is much smaller, it should not be overlooked that a large part of teachers who did not study directly abroad have a high esteem for the German technical literature, which is so rich and systematised. As a consequence, a clear distinction on this ground (French vs. German influence) can no longer be made, since it's the French who resort to German technical books". Another reason for this growing influence of the German model was the dizzying development of electro-mechanical engineering in this country. Luca Bădescu, "Legătura între tehnica română și străinătate," *Istoricul dezvoltării tehnice în România. Buletinul Societății Politehnice*, year XLV, no. 12 (December 1931): 2395.

schools had managed to achieve a status equal to that of universities. Through his efforts, in 1920, the law establishing the Polytechnic School in Bucharest was adopted. This was a sign of progress, even if the school was not recognised as a higher education institution. Karpen was among the most fervent promoters of the idea of a Polytechnic University, which he supported in all possible ways. His main discontent was that the Universities of Iaşi and Bucharest had established their own Technical Institutes, through which they awarded "university engineer" degrees, although this was not equivalent to the engineering degree issued by NSBR[64]. From his point of view, the polytechnic schools were the real "faculties of science", a statement he made in response to Petru Bogdan's reception speech at the Romanian Academy in 1931[65]. His efforts proved successful only in 1938, when, by law, the polytechnic schools were recognised as higher education institutions, on a par with universities[66].

Regarding the curriculum in the Polytechnic School, it should be pointed out that the French influence was still obvious as mathematical studies, viewed as "a unique tool for shaping the fair and exact judgment indispensable to the engineer"[67], were given a prominent position. It should be noted here that one of the most enduring popularisation magazines in the field of mathematics in Romania, *Gazeta matematică* [*Mathematical Gazette*] stemmed from the initiative of some engineers, graduates of NSBR[68].

Mathematics was followed in the curriculum by physical and chemical sciences, mineralogy, geology, and botany, since "the engineering technique is an emanation of these sciences"[69]. Finally, to prepare the engineer for future management positions, courses in economics, law, accounting, trade, and the

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[64] Regarding the "unfair competition" between universities and polytechnic schools for granting the title of engineer in interwar Romania, see Dragoş Sdrobiş, "Building a Profession. An Insight on the Professionalisation of Engineers in Romania 1919-1940," *New Europe College Ştefan Odobleja Yearbook*, (2017-2018): 249-256.

[65] *Sub cupola Academiei. Discursuri de recepţie ale inginerilor,* edited by Mihai Mihăiţă, (Bucharest: AGIR, 2011), 193.

[66] See *Legea pentru modificarea şi completarea legilor privitoare la învăţământul superior şi special în vederea raţionalizării*, in *Monitorul Oficial al României* (no. 257 of 4th of November 1938).

[67] Vasilescu-Karpen, "Dare de seamă asupra învăţământului în Şcoala Politehnică din Bucureşti," 5.

[68] The reason for such an initiative had to do with the very poor results achieved by the candidates at the entrance exam for NSBR in the autumn of 1894. The magazine was founded to fill their gaps in mathematical knowledge. Therefore, its aim was for "all our high school students to benefit" from *Gazeta matematică*, while also ensuring a better preparation for the candidates to an engineering degree. See "Istoricul Gazetei matematice", last modified January 6, 2021, http://www.gazetamatematica.net/?q=node/26.

[69] Vasilescu-Karpen, "Dare de seamă asupra învăţământului," 5-6.

scientific organisation of labor were also introduced. Education for continuous training was not neglected either. English and German language courses were offered, thus securing the future professionals' immediate access to the technical literature produced by the great industrial powers. There was plenty of evidence that the poor linguistic and economic skills of the graduates of polytechnic studies in Romania turned out to be a major hampering factor for getting a job, in comparison to the graduates of similar institutions abroad[70].

The profile of the polytechnic student in Greater Romania

In a speech given on the occasion of the 75th anniversary of technical higher education in Romania, the director of NSBR, Nicolae Vasilescu-Karpen, spoke extensively about the students' social and cultural profile. Thus, about 98% of the students of the polytechnic school were high school graduates (baccalaureates). To these students was added an insignificant number of graduates of commercial high schools or professional secondary schools. The admission curriculum consisted of disciplines previously studied in high school. It was valid both for the preparatory year and for the first-year exam. The preparatory year did not require mandatory attendance of the Polytechnic School, since students could choose to enroll for that year of study at the university-based faculties of sciences or at a higher technical school. However, those who passed the admission exam came almost exclusively from the ranks of the students of the preparatory year[71]. This shows the efficiency of this preliminary preparation program. Unlike the universities, the Polytechnic Schools in Bucharest and Timișoara had a fixed quota of students that could enrol in the first year of studies. This quota was related to the available number of seats in laboratories and in seminar or lecture rooms. Thus, the admission contest proved to be an effective selection tool for future engineers.

An interesting analysis of the admission contest at the Polytechnic School of Bucharest[72] dates from 1943. It was drawn up by the rector of the institution, Professor C.C. Teodorescu. Aiming to highlight the specificity of polytechnic

[70] Vasilescu-Karpen, "Dare de seamă asupra învățământului," 5-6.

[71] Following the secondary education reform of 1928, the period of study was reduced to 7 years (from the previous 8). As a result, it was decided to introduce a preparatory year at the Polytechnic School, starting with the 1929-1930 academic year, specifically in order to supplement the scientific training of the candidates for the title of engineer.

[72] The Law on the "Rationalisation of Higher Education in Romania", passed in the fall of 1938, stipulated that the polytechnic schools in Bucharest and Timișoara were established as higher education institutions. The Iași Polytechnic was also established on this occasion. See *Monitorul Oficial al României*, Part I, no. 257, 4th of November 1938.

training, Teodorescu emphasised the role played by the admission examinations, which represented the main "means of selecting the elements that knock on the gates of the engineering profession", within which "the scientific training of the candidate prevailed"[73]. In other words, the criterion of merit was already part of the peculiar polytechnic rhetoric.

In September 1943, the regular admission exam was organised, with 1458 candidates attempting to secure a place at the Polytechnic School of Bucharest. Out of them, 751 were admitted, which resulted in a success rate of 53%. Analyzing the average grades the candidates got at the baccalaureate and entrance exams, rector Teodorescu emphasised the strong correlation between those two types of evaluation. Less gratifying was the fact that the majority of high school graduates (67% of the total enrollment) had received poor results at this exam, while the share of candidates with good and very good results at the baccalaureate exam amounted to about 10% of the total number of candidates. "With such results, the problem of the elites' [training] appears to be very difficult to solve", the rector noted.

Candidates enrolled for the admission examination at the Polytechnic School of Bucharest 1943

Baccalaureate average	Enrolled candidates	Admitted	Rejected	Admitted %
Very good 9-10	33	32	1	97%
good 8-9	103	83	20	80.50%
medium 7-8	290	177	113	61%
mediocre 6-7	861	400	461	46.50%
Total	1287[74]	692	595	54%

Source: C.C. Teodorescu, "Rezultatele unui concurs," *Școala românească*, year IV, no. 3 (March 1944): 179.

Thus, another aspect that had to be taken into account was the age at which young people could start their polytechnic studies. This age "must be young

[73] C.C. Teodorescu, "Rezultatele unui concurs," *Școala românească*, year IV, no. 3 (March 1944): 177.

[74] According to the author, the difference between the 1458 enrolled candidates and the 1287 processed registration files results from the fact that he did not have access to the original documents of the candidates. The candidates who did not feature in the statistics were enrolled in other admission examinations at the same time, meaning they left copies and/or incomplete registration forms for the admission contest organised by the Polytechnic School of Bucharest. Therefore, rector C.C. Teodorescu decided to use only the complete registration files for his analysis, i.e. those of 1287 candidates.

enough for them, so they can graduate and start working at a more fruitful age"[75]. Regarding this issue, C.C. Teodorescu published a separate work a year later. For these purposes, he used the data collected on the occasion of a statistical survey on the entire student body in Romania, initiated by the Ministry of National Culture and Confessions in the fall of 1943. Since the Central Institute of Statistics did not manage to publish the results of this survey, Teodorescu himself processed the data relating to the students of the Polytechnic School in Bucharest. This was possible because he had asked for the filling in of the questionnaires in two copies. The collected data revealed some fundamental characteristic features of the young people pursuing their higher technical education in Bucharest[76].

The average age of the students of the Bucharest Polytechnic School during the first year of study was about 21, and during the fifth year (the final year of studies) it was 26. The almost 2-year gap between the average age of completion of secondary education (19) and the age of admission to polytechnic studies was due to the rigorous character of the entrance exam to the Polytechnic. The good news was that, due to its curriculum, the Polytechnic School guaranteed a predictable trajectory in the training and promotion of students. "The engineering degree is therefore earned at the average age of 26"[77], noted rector C.C. Teodorescu. The lower average age of the students in the Faculty of Civil Engineering could be explained by the fact that this specialisation was pursued especially by students who had good results during their high school studies. At the opposite end was the Faculty of Electro-mechanics, where "belated students"[78] from the former Electro-Technical Institute at the University of Bucharest, abolished by the 1938 law, were enrolled, thus increasing the average age of the student body.

The collected data revealed the large number of students who graduated from high schools in Bucharest (1131 out of the total 2578 students, i.e., 42.2%). The students living in the capital were to be mostly found at the Faculty of Architecture (60%), while at the Faculty of Forestry there were only 21.3% Bucharest graduates. A large percentage of Bucharest-born students were to be found at the Faculty of Agronomy (44.2%), a somewhat strange situation that could

[75] Teodorescu, "Rezultatele unui concurs," 184.

[76] C.C. Teodorescu, "Chestionarul statistic pentru studenți," *Școala românească*, year IV, no. 9-10 (September – October 1944): 517-550.

[77] Teodorescu, "Chestionarul statistic pentru studenți," 527.

[78] By "belated students", Teodorescu meant the almost bohemian character of the engineering studies carried out at the universities until 1938, with no strict conditions for passing exams. It should be pointed out that starting with 1943, the maximum age for enrollment as a student was 24. Teodorescu, "Chestionarul statistic pentru studenți," 523.

be explained by the fact that "the sons of the big landowners, of whom many live in the capital city" chose this field of study[79].

A peculiar reason for the high academic level reached by the Polytechnic School of Bucharest was the weight of students recruited from Bucharest high schools (representing more than 40% of the student body). Since teachers in Bucharest high schools were believed to be very well prepared, the prestige of the Polytechnic School of Bucharest was based on the quality of the student body. Despite this fact, Teodorescu noted that "the recruitment of students [should] involve all academic centers of the country, because, for the most part, they [the graduates] tend to return to locations close to their families after graduation[80]". Regarding the social origin of the students, almost 60% came from urban areas, with half of them being born in Bucharest. Almost 40% of the students came from rural areas, in a country where the general share of the rural population was about 80%. The numbers for each historical province further highlight the essential problems of interwar Romania, such as the urban-rural cleavage and the socio-economic discrepancies among regions, also showing the better quality of secondary education in the capital city.

Distribution of the Polytechnic School of Bucharest student body according to historical regions 1943-1944

Historical region	no. of students	% students
Bucharest	1131	42.2%
Wallachia	513	19.2%
Transylvania	294	11.0%
Moldavia	239	8.9%
Oltenia	200	7.5%
Bessarabia	128	4.8%
Banat	44	1.6%
Bukovina	44	1.6%
Dobrogea	35	1.3%
Abroad	50	1.9%
TOTAL	2678	100.0%

Source: C.C. Teodorescu, "Chestionarul statistic pentru studenți," *Școala românească*, year IV, no. 9-10 (September – October 1944): 535.

As for the parents' profession, "the students belong [...] mostly to the category of intellectuals or civil servants, who send their sons to study, to fill a

[79] Teodorescu, "Chestionarul statistic pentru studenți," 533.
[80] Teodorescu, "Chestionarul statistic pentru studenți," 535.

position in the bureaucratic system"[81]. The last relevant aspect touched upon in his work by rector Teodorescu concerned the foreign languages known/spoken by the students. Almost half of the students who filled in this statistical questionnaire declared they were proficient in 2 foreign languages, 12% declared that they knew only one foreign language, while another 12% only spoke their mother tongue. It should be pointed out that about 20% of the students spoke at least 3 foreign languages, which was a clear indicator of the geographical origin of those students coming from the multicultural areas of Romania. Thus, 165 students declared that they spoke Russian, and another 120 were fluent in Hungarian. Despite this, although more than 200 students came from Transylvania, the number of Hungarian speakers was well below this figure. Based on this estimate, the author concluded that "Hungarian is not perceived as a language of the culture that could be used in scientific training, so that young people no longer feel the impetus to study it"[82]. By contrast, the impact/popularity of the Russian language among polytechnic students went beyond an explanation invoking mere regional origins. It wasn't just the Bessarabian students who spoke this language. The use of Russian was encouraged by the fact that an increasing number of textbooks or technical magazines were published in Russian[83]. However, French was by far the most widespread foreign language among the young high school graduates in Romania; it was followed by German.

Number of foreign languages spoken by students of the Bucharest Polytechnic School 1943-1944

Faculty	none	1	2	3	≥4	Total
Constructions	64	180	405	125	30	**804**
Electro-Mechanics	60	97	261	100	28	**546**
Mining and Metallurgy	22	30	64	21	4	**141**
Industrial Chemistry	33	82	177	65	17	**374**
Forestry	59	66	124	38	9	**296**
Agronomy	59	96	115	46	6	**322**
Architecture	37	64	119	54	14	**288**
TOTAL	**334**	**615**	**1265**	**449**	**108**	**2771**

Source: C.C. Teodorescu, "Chestionarul statistic pentru studenți," 546.

[81] Teodorescu, "Chestionarul statistic pentru studenți," 539.
[82] Teodorescu, "Chestionarul statistic pentru studenți," 548.
[83] Teodorescu, "Chestionarul statistic pentru studenți," 548.

Languages spoken by students of the Bucharest Polytechnic School 1943-1944

Language	no. of students	% students
French	2250	81.2%
German	1452	52.4%
Italian	397	14.3%
English	325	11.7%
Russian	165	6.0%
Hungarian	120	4.3%
Greek	49	1.8%
Bulgarian	44	1.6%
Other language	79	2.9%
No foreign language	334	12.1%

Source: C.C. Teodorescu, "Chestionarul statistic pentru studenți," 548.

The conclusions reached by C.C. Teodorescu, based on the analysis of the student body at a time when Romania – and the whole world – was at war, do not differ much from the previous situation. First of all, the high quality of the training provided by this educational institution should be emphasised. A specific feature of the Polytechnic School of Bucharest was the increasing role played by laboratory practice and activity. The weight of this kind of didactic activity grew after 1900 in all technical higher education institutions across Europe and the entire world. This trend was supposed to overcome the epistemic divide between scientists in universities and those in polytechnic institutions. The aim was to prove that technology was no longer dependent on science. Instead, a relation of mutual and complementary reinforcement was being established: "Technology's aims differed from those of science in that they were essentially practical, but its theoretical foundations were equally demanding and intellectually dignified"[84].

Starting with 1930, polytechnic schooling had been divided into two cycles: science education (mathematics, physics, chemistry, natural sciences); and technical education. Each cycle lasted for 4 semesters. A final semester was devoted to the completion of individual projects or practical assignments necessary for the graduation exam. Taking into account the preparatory year, after 1930 the average optimal time for earning the engineering degree was at least 5 and a half years. Between 1920 and 1931, out of the 833 graduates of the Polytech-

[84] Anna Guagnini, "Technology," in *A History of the University in Europe 1800-1945*, edited by Walter Rüegg, vol. 3, (Cambridge: Cambridge University Press, 2014), 619.

nic School of Bucharest, 445 had completed their studies in a period of between 4-5 years[85]. The natural question that arises in this context is the following: how many engineers did technical higher education in Romania succeed to train?

The "production" of engineers by the polytechnic schools of Romania, 1881 – 1937

The evolution of technical education must be linked to the socio-economic development of Romania. Victor Axenciuc analysed the prerequisites for the development of the modern capitalist system in the Old Kingdom. He used numerous statistical data with the declared purpose of dismantling certain myths regarding the presumable "negative effects" of Romania's entry into the international capitalist system. For example, Romanian economists like P.S. Aurelian or Ștefan Zeletin decried the disappearance of traditional "trades" because of the "invasion" of the local market by foreign industrial goods or because of the increased factory production. The data collected by Axenciuc refute such assertions, proving that, between 1860 and 1912, the number of craftsmen "increased 1.5 times, and their production grew 3.3 times"[86]. In other words, the lamentations of economists like P.S. Aurelian or Ștefan Zeletin were just rhetorical figures of speech, rather than reflections of reality. "[H]ence, it is rather risky and unscientific to write economic history based on quotes and political opinions"[87], Axenciuc concluded. Statistical data for the Old Kingdom for 1859-1860 reveal the existence of about 60,000 employees, out of a total population estimated at 3.5 million inhabitants, which "would amount only to 1.7% of the total population"[88]. Thus, Ștefan Zeletin's thesis on the specificity of the development of capitalist relations in the Romanian lands immediately after 1829, i.e. after the Treaty of Adrianople, was unsubstantiated[89].

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[85] Nicolae Vasilescu-Karpen, "Învățământul tehnic în România", *Istoricul dezvoltării tehnice în România. Buletinul Societății Politehnice*, year XLV, no. 12, (December 1931): 2320.

[86] Victor Axenciuc, *Formarea sistemului industrial modern 1859-1914. Demarajul industrializării*, (Bucharest: Editura Academiei Române, 2008), 13.

[87] Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 13.

[88] Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 35.

[89] The censuses conducted in Moldavia and Wallachia in 1859-1860 listed the following categories of employees: about 23,000 workers, 23,000 civil servants, 6,000 teachers, to which were added several thousand employees in trade, transport etc. In terms of occupations, out of 3.9 million inhabitants, 71.2% were farmers or stockbreeders; 124,000 were craftsmen or manual workers; about 30,000 were merchants; 22,800 were servants; 6,100 were teachers; 18,500 were priests and monks, while the number of intellectual professionals (engineers, doctors, lawyers) did not exceed 1,000 people (Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 56-57).

The lack of trained staff needed for industrial production led to an increase in the number of foreign specialists (skilled workers, technicians, officials, etc.) in the Romanian economy. The lack of Romanian specialists was mainly due to the weak development of vocational education. Consequently, that developed a real "vicious circle: there were no teachers and no specialists for vocational schools, and, for their training, there were no specialised educational institutions"[90]. After 1886, however, the authorities pursued a policy of promoting and encouraging the local labor force in the industry, which partly explains the state's involvement in the reorganisation of NSBR, starting with the mandate of Gheorghe Duca (1881-1888), mentioned above.

According to the data summarised by Axenciuc, between 1871 and 1916, NSBR "gave" the national economy 524 engineers, who mainly filled positions in state institutions, along with another 468 technical supervisors. For this reason, the private industry had to look for Romanian engineers trained abroad or even had to employ foreign engineers. "[U]ntil 1916, state institutions and enterprises had the largest demand for technical staff in the country; as a result, most engineers and technicians were employed in the service of the state"[91]. According to the law of the Technical Engineering Corps, only the registered engineers had the right to fill a position in the Romanian state institutions. To achieve this goal, however, the pool of engineers provided by NSBR was not sufficient, which is why a fairly large number of engineers were still trained outside the country. Romania's economic boom during the first two decades of the twentieth century explains the increase of the membership of the Technical Engineering Corps from 197 members to 882 registered engineers[92]. Between 1878 and 1920, when NSBR was reorganised, the number of engineers "produced" by this institution amounted to 575[93].

The interwar period brought major changes to the organisation and functioning of technical education in Romania. First of all, on July 10, 1920, the National School of Bridges and Roads was transformed into the Polytechnic School of Bucharest. A few months later, in November 1920, a new Polytechnic School was founded in Timișoara. Although polytechnic schools were viewed as "technical higher education institutions, on a similar cultural level with universities", these establishments had still not achieved equal status with universities. Therefore, the fields of study were divided into "sections", the heads of these institutions

[90] Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 57.
[91] Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 220.
[92] Axenciuc, *Formarea sistemului industrial modern 1859-1914*, 220.
[93] See "Tabloul absolvenților Școlii de Poduri și Șosele începând cu seria 1878," in *Școala Politehnică din București*, (Bucharest: Cartea Românească, 1931), 237-260.

were called "directors" (not "rectors"), and those who attended the courses were called "pupils" (*elevi*) (not "students")[94]. The Bucharest Polytechnic School consisted of six "sections" (not "faculties"): construction, electro-mechanics, mining and metallurgy, industry, forestry, aviation and weapons. In the newly-established Polytechnic School in Timișoara, there were only two sections for the training of mining and electro-mechanical engineers, as seen in the table below.

Number of Graduates of the Polytechnic Schools in Bucharest and Timișoara, 1921-1937

Year	Constructions		Electro-mechanics		Mining	Industry	Forestry	Total
	Bucharest	Timișoara	Bucharest	Timișoara	Bucharest	Bucharest	Bucharest	
1921	0	0	1	0	0	0	0	**1**
1922	14	0	30	0	12	0	0	**56**
1923	9	0	9	0	3	0	0	**21**
1924	7	1	46	14	7	12	0	**87**
1925	7	18	54	4	52	22	0	**157**
1926	12	18	35	11	24	6	0	**106**
1927	10	15	33	24	18	7	6	**113**
1928	35	48	30	36	31	16	51	**247**
1929	41	30	29	48	24	13	42	**227**
1930	35	14	15	16	27	9	20	**136**
1931	29	12	22	32	18	9	52	**174**
1932	32	10	28	22	28	9	46	**175**
1933	33	30	25	19	16	12	52	**187**
1934	36	32	22	12	18	10	34	**164**
1935	39	31	41	9	12	11	19	**162**
1936	51	27	42	12	6	10	16	**164**
1937	69	26	23	7	25	7	19	**176**
	459	312	485	266				
Total	**771**		**751**		**321**	**153**	**357**	**2353**

Source: Data processed by the author based on information extracted from *Anuarul Școlii Politehnice Regele Carol al II-lea București 1934-1937* (București, 1938), 857-889; and *Anuarul Școlii Politehnice din Timișoara pe anii 1933/34 – 1936/37* (Timișoara: Editura Școlii Politehnice, 1937).

[94] See "Decret-lege de înființare și organizare a școalelor politehnice din România," *Monitorul Oficial al României*, no. 61 of 19th of June 1920.

There was an exponential growth in the average annual output of engineers. If, in the pre-war period, the graduates' average was about 14 engineers per year (575 engineers graduated overall between 1878 and 1920), in the interwar period the graduation rate reached about 140 engineers per year. Also, since the Polytechnic School of Bucharest had a large number of specialised fields of study, it could offer a wide range of options for those who wanted to pursue engineering studies in their home country.

Despite these relative advances, the question was: did the two Polytechnic Schools manage to ensure the necessary number of engineers for the Romanian economy? This question troubled the administration of these Polytechnic Schools in Romania, for at least two reasons. First, as mentioned above, Nicolae Vasilescu-Karpen strove to consolidate the social prestige of technical education, since the universities were attracting the largest number of students. The polytechnic schools often accused the universities of unfair competition. They primarily targeted the technical institutes attached to the Faculties of Sciences in Iași and Bucharest. These institutes claimed to award a special engineering degree, i.e., "university engineer", that did not grant the same rights as the engineering degree awarded by the Polytechnic Schools. Second, a very large number of engineers were trained abroad, at well-established institutions with solid traditions in this field. Therefore, the existence of two distinct institutions for training future engineers was viewed as a waste of human and financial resources. Karpen expressed his opinion clearly during a conference held in 1929, in the framework of "Săptămâna Culturii Raționalizate" [Week of Rationalised Culture] organised by Institutul Român de Organizare Științifică a Muncii [Romanian Institute for Scientific Management of Work]. In his speech, Karpen highlighted the major role played by technology in the progress of mankind, a path that Romania must follow immediately, giving up the "eternal plowing" (*veșnica plugărie*), an economic feature that kept the state in a relationship of dependence from Western industrial powers. Stimulating technical higher education had to begin with its rational reorganisation. Here, Karpen referred explicitly to university technical institutes which undermined the seriousness and importance of polytechnic education. It was time to overcome this "irrational" situation in favour of a concentration of all technical higher education in polytechnic schools[95].

Nevertheless, the polytechnic schools in Romania did their best to avoid the phenomenon of mass access to education, faced by all higher education institutions after 1918, both in Romania and all over Europe. Therefore, the

[95] ANIC, *Fund Institutul Român de Organizare Științifică a Muncii*, file 19/1930, 101-103.

polytechnic schools established enrollment quotas, according to the number of places available in classrooms and laboratories. The problem, however, was that the labor market for engineers soon became oversaturated: a large number of engineers graduated from institutions abroad, while the 1929-33 economic crisis led to a sharp decline in the demand for engineers. According to some estimative data presented in 1930 by Karpen, out of the 612 engineers working at the Autonomous Administration of the Railways (CFR), 300 had earned their engineering degree abroad[96]. The important mining and oil companies in Romania in Reșița, the Jiu Valley, or Prahova Valley suggested a reduction of the enrollment quotas. Karpen estimated the number of engineers in Romania, in 1930, at about 4000 people. Taking into account that the average duration of an engineer's career was 25 years, it resulted that Romania needed "a maximum output of 200 engineers per year. This is currently the output of engineers from the two Polytechnic Schools in the country; they can therefore respond to the current needs of the country"[97], Vasilescu-Karpen concluded.

The problem of the number of engineers increasingly concerned the prominent representatives of this profession after 1930. A related problem was the concentration of engineering studies under the aegis of the polytechnic schools. According to the latter's perspective, from a budgetary point of view, the funding of the university technical institutes represented a waste of public resources. In 1935/36, the total expenses for the university technical institutes in Bucharest amounted to 19 million lei, while the two polytechnic schools were allocated 34 million lei from state funds[98]. Additionally, due to the number of graduates released on the labour market, the technical institutes attached to universities contributed to worsening unemployment among engineers. Out of the 240 engineers who graduated from the Polytechnic School of Bucharest in 1934 and 1935, "only 20% found a good job. Others have found a suitable work, but we have also cases of graduates who have become teachers at vocational schools in the countryside. [Furthermore], many of them have been hired and are being paid as workers, because they could not be included in the [school] budget [as teachers]. So, there is indeed a significant amount of intellectual unemployment [among engineers]"[99].

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[96] Vasilescu-Karpen, "Dare de seamă asupra învățământului în Școala Politehnică din București," 10.

[97] Vasilescu-Karpen, "Dare de seamă asupra învățământului în Școala Politehnică din București," 10.

[98] Ștefan Mihăescu, "Organizarea rațională a învățământului tehnic superior," *Buletinul AGIR*, year XVIII, no. 5 (May 1936): 164.

[99] Mihăescu, "Organizarea rațională a învățământului tehnic superior," 164.

The Engineers of Greater Romania

In 1935, the new chairman of the General Association of Romanian Engineers (AGIR), Mihail Manoilescu, set two major objectives for this professional association: the restriction of technical higher education exclusively to the polytechnic schools and the establishment of a special College of Engineers, in which all engineers working in Romania had to be registered on a mandatory basis. The Polytechnic Society, the other important professional organisation of Romanian engineers, led by Constantin Buşilă, joined these efforts[100]. On March 20, 1937, the law for the centralisation of engineering training in the Polytechnic Schools was published in the Official Bulletin. It stipulated the foundation of a third Polytechnic School in Iaşi, the former capital city of Moldavia. One year later, in November 1938, in order to "rationalise" higher education, the first law in the history of Romanian education which regulated the status of all higher education institutions was adopted. Thus, the agronomy academies of Cluj and Bucharest were to be included in the Polytechnic School of Timişoara and Bucharest, respectively; the technical institutes in Bucharest, along with the Academy of Architecture, were to be incorporated into the Polytechnic School of Bucharest; finally, the Agronomy Faculty in Chişinău was to become a part of the newly established Polytechnic School in Iaşi. The reasons for the promulgation of this law were listed by the ad-interim minister of education, Armand Călinescu, who aimed for "a better recruitment of the teaching staff" and "a more serious training of the students". In this respect, the law aimed at setting "a brake on the endless inflation [of engineers] that did not serve either the proper development of science or the good training of students"[101].

After February 1938, when the "royal dictatorship" of King Carol II had been established in Romania, the AGIR became the main professional organisation of the engineers in Romania. The lobbying actively pursued by this association came to fruition in the "Law concerning the title and the exercise of the engineering profession and the establishment of the College of Engineers" published in the Official Bulletin no. 303 on December 30, 1938. According to this law, only engineers who were members of the College of Engineers could

[100] The motion of February 14, 1937, which the Polytechnic Society adopted unanimously, stated that "the abnormal situation of this double system of higher technical education [...] must end as soon as possible". The Society decided to appeal to the government and parliament to implement de centralisation of technical higher education in polytechnic schools. Constantin Buşilă, *Învăţământul superior tehnic* (Bucharest: 1939), 149.

[101] "Legea pentru modificarea şi completarea legilor privitoare la învăţământul superior şi special în vederea raţionalizării," *Monitorul Oficial al României*, Part I, no. 257, 4th of November 1938.

practice this profession. The lists published in the Official Bulletin, including all the engineers recognised as members of this College, are very significant sources because they offer a clear picture of the size of this professional body in that period[102].

The evolution of engineers' membership in the College of Engineers, 1938-1940

Section	A	B	C	D	E	F	G	TOTAL
1938	1279	1943	71	774	816	1014	1508	**7405**
1939	1452	2319	90	774	1056	1130	1595	**8416**
1940	**1592**	**2548**	**90**	**941**	**1241**	**1060**	**1708**	**9180**

Explanatory note: A - construction engineers, B - mechanical and electrical engineers, C - aeronautical, marine and armament engineers, D - mining and metallurgical engineers, E - chemical industry engineers, F - forestry engineers, G - agronomic engineers.

Source: data processed by the author based on the lists of engineers published in *Monitorul Oficial al României*, Part I, no. 288, 289, 290, 291, 292, 293, 296, 298, 299 and 304 of 1938; 253, 259, 266, 270, 278, 285, 290 and 295 of 1939; and no. 9, 31, 38, 217, 234, 242, 266, 290 and 297 of 1940. It should be noted that, after 1938, many minorities were excluded, due to the racial laws, from professional organisations, which may have affected this statistical table (author's note).

The data in this table reveal the impressive number of engineers still trained outside Romania. If one starts from the fact that, in 1930, there were 4000 engineers in Romania (according to the estimated data provided by Nicolae Vasilescu-Karpen), it results that, during the 1930s, the growth rate of the number of engineers was impressive, amounting to about 500 new engineers per year. It should be noted that, in his statistics, Karpen did not refer to the agronomic engineers trained in the Academies of Agriculture in Cluj and Bucharest or at the Faculty of Agronomy in Chișinău. Thus, if we exclude the agronomic engineers from the table above, it seems that, in 1940, there were 3600 more engineers than Karpen's estimate had shown back in 1930. Even according to the most optimistic projections, the two polytechnic schools could not have "produced," between 1930 and 1940, more than a total number of 1800 engineers. This means that, even in the 1930s, at least half of the Romanian engineers were trained abroad.

The role played by the polytechnic schools in Romania in the training of engineers can be better understood by analyzing some raw data included in the AGIR Yearbook for the years 1938-1939. This publication comprises the list of over 3,000 engineers enrolled in the association, including information on the

[102] *Monitorul Oficial al României*, Part I, no. 183 of 10th of August, 1938.

institution attended, their speciality, and their current employment. This data is crucial as it covers 30% of the total body of engineers.

Comparative table between the list of AGIR experts (1938) and the College of Engineers membership (1940)

Speciality	1938	%	1940	%
Agronomy engineers	427	13.5%	1708	18.60%
Forestry engineers	460	14.5%	1060	11.50%
Mining and metallurgy engineers	342	10.8%	941	10.30%
Construction engineers	725	22.9%	1592	17.30%
Electro-mechanic engineers	909	28.7%	2548	27.80%
Industrial and chemistry engineers	299	9.5%	1241	13.50%
Aviation engineers	1	0.0%	90	1.00%
TOTAL	**3163**	**100.0%**	**9180**	**100.00%**

Source: *Anuarul AGIR. Lista de experți 1938-1939*, edited by Octav Păduraru [1939], and *Monitorul Oficial al României*, Part I, 1938-1940.

In the statistics of AGIR experts, 520 engineers declared that they had a university-based higher education, while 2597 mentioned that they had graduated from technical higher education institutions, in different formats (including Academies, polytechnic schools, technical institutes, etc.). Regarding the locality where they graduated, there is available data for 3147 engineers. 2339 engineers declared that they had graduated from technical educational institutions in Romania (Bucharest - 1579, Forestry School of Brănești – 144, Agricultural School of Herăstrău – 109, Academy of Higher Agronomic Studies in Cluj – 82, Faculty of Agronomic Studies in Chișinău-Iași – 227, Polytechnic School of Timișoara – 198). 338 engineers had been trained in the former German Empire. They were followed by those trained in the former Habsburg regions (Hungary, Austria, Czechoslovakia) – 274 people. Finally, the number of engineers trained in the French-speaking area (France and Belgium) amounted to 132 people. 3100 engineers specified their year of graduation, with 2304 people graduating between 1919 and 1938. In terms of occupation, 1880 declared themselves to be practising engineers, 182 – freelancers, and 105 – entrepreneurs. 142 engineers worked in higher or secondary education institutions, filling various teaching positions, while 700 among them held various management positions in state or private institutions, including directors, deputy directors, heads of services, etc. Over 1200 engineers (35%) had their professional residence in Bucharest, while 1562 declared that they resided in the capital city of Romania [103].

[103] The data below have been processed on the basis of the information provided by *Anuarul AGIR. Lista de experți 1938-1939*, edited by Octav Păduraru [1939].

An important objective of the present study was to pinpoint the total number of engineers trained in Romania. According to the AGIR statistics from 1938, 1210 engineers declared themselves to be graduates of the Polytechnic School of Bucharest, while 198 named the Polytechnic School of Timişoara as their home institution. Although I do not have exact data available, it appears that, between 1881 and 1938, the two polytechnic schools trained approximately 3,000 engineers, i.e., around 30% of all engineer professionals in Greater Romania.

A new professional body demanding state intervention in society: In lieu of conclusions

In the opening of the third volume dedicated to the history of universities in Europe, the general editor Walter Rüegg emphasised the expansion of institutions of higher education in different fields between the mid-nineteenth and the mid-twentieth century. The expansion was so impetuous, that "the 200 universities existing in the 1930s were surrounded by some 300 institutions of higher education in the military, technical, polytechnic, commercial, medical, veterinary, agricultural, educational, political and musical fields. But they had not replaced the universities and were attended by a relatively small minority of students"[104]. The reason for such a small attendance is to be found in the "segmentation" (Fritz Ringer) of the secondary education all over Europe. Ringer applies this notion to the "division of the educational system into parallel segments or 'tracks', which differ both in the curricula and in the social origin of the pupils". Consequently, the curricular differences would be laden with "socially hierarchical meanings, which in turn will define the social status of graduates"[105].

This article traces the evolutionary stages of technical higher education in Romania through the lens of the theory of professionalisation. It examines the institutional evolution of the National School of Bridges and Roads in Bucharest from a special education institution to a higher education establishment in 1938. To reveal the peculiarity of the training provided by this institution, the article tackles European influences in shaping its curriculum and fields of study. The goal of the leading figures of technical education in Romania was to

[104] Rüegg, "Themes," 3.

[105] Fritz Ringer, "On Segmentation in modern European educational systems: the case of French secondary education, 1865-1920," in *The Rise of the Modern Educational System. Structural Change and Social Reproduction 1870-1920*, ed. Detlef K. Müller, Fritz Ringer, Brian Simon, 3rd edition (London-Paris: Cambridge University Press & Editions de la Maison des Sciences, 1989), 53.

obtain a symbolic, cultural, and educational status for the polytechnic schools at least equal to that of universities. As we have seen, it was a long process, during which the Romanian university conflicted with the new vision promoted especially by Nicolae Vasilescu-Karpen. For the latter, the training of engineers had to remain the exclusive prerogative of the polytechnic schools.

Another aspect discussed is the development and diversification of the Romanian higher education system. Until 1900, the training of Romanian specialists occurred mainly at foreign education institutions. In the interwar period, young people began to prefer Romanian establishments. One of the reasons was most probably the systematic organisation of Romanian higher education, with various fields corresponding to different career options. In 1938, one third of Romanian engineers were graduates of the national polytechnic schools of Bucharest or Timișoara.

One last aspect addressed is the growing number of young people who pursued higher education. This phenomenon which may be interpreted as a democratisation of education, which might suggest that education was a tool of social change in interwar Romania. Even if we did not find any study in the field of historical sociology to confirm or refute this thesis, the main consequence of this diversification of the Romanian educational system was the convergence between education and profession. Since the state was the main employer for higher education graduates (including engineers), the educational system proved to be a mechanism geared towards state purposes and not necessarily towards the economy, despite making the system look meritocratic and democratic. Pierre Bourdieu called this system social reproduction through education.

Undoubtedly, the professionalisation of engineers in Romania was a success. In 1938, they secured the training of engineers only in polytechnic schools, with the help of the two important professional organisations *Asociația Generală a Inginerilor din România* and *Societatea Politehnică*. In a capitalist system, however, professionalisation contrasts with proletarianisation. This is why any profession tends to raise the minimum criteria for access to its field. In this respect, the role of the state is decisive. This issue was at the centre of political and ideological debates and developments after the Great Depression of 1929-1933. A.M. Carr-Saunders and Paul Alexander Wilson, in their book called *The Professions* published in 1933, noted that establishing a fair relationship between "knowledge and power" would become "the central problem of modern democracies"[106].

[106] Dubar, Tripier Boussard, *Sociologie des professions*, 83.

The proletarianisation of intellectual professionals was addressed in the Weimar Republic by a Marxist analyst, Siegfried Kracauer, who noticed a growing gap between the horizon of expectations and the increasingly precarious and proletarian daily existence of the German bureaucracy. Although (higher) education had become, at the end of the nineteenth century, the entrance permit to a truly bourgeois life, the growing number of higher education graduates threatened certain notions cherished by bourgeois identity, such as personality, education, culture, profession, or community. In reality, in terms of their economic role, professionals became nothing more than a "salaried mass" focused on intellectual work. However, with regard to capital, the position of the intellectual worker was by no means superior to that of the manual worker: "Today the social space in which we find modern slavery is no longer the plant in which the great mass of workers works; that social space is instead the office"[107].

This might explain the support of the engineers' professional associations for the dictatorial turn in the late 1930s. Since 1935, the president of AGIR was Mihail Manoilescu, an engineer who had graduated first in his class from NSBR in Bucharest in 1915. Manoilescu is well known for supporting protectionism in international trade. According to this doctrine, agrarian economies, including Romania, were disadvantaged in their commercial relations with the industrialised societies. Therefore, Manoilescu urged increased state intervention in the economy, which he viewed as the main incentive for economic development, aiming to industrialise the country through a planned-economy system. "In a society where peasants constituted the vast majority of the population, such a program was incompatible with representative democracy, and thus Manoilescu quite naturally shifted his position from a rather conservative liberalism to authoritarianism during the thirties"[108]. As a consequence, Manoilescu became a supporter and ideologist of the corporatist state. He perceived the intellectual professions – engineers among them – as the top corporation of society. Since democracy had purportedly failed to deliver prosperity, Manoilescu argued that only an authoritarian system could solve the underlying problems of Romanian society, such as poverty and social inequality. The *laissez-faire* attitude had to be left behind, while a new state – the corporatist state – was to coordinate and apply the 'real' program of national development and social solidarity[109]. His

[107] Siegfried Kracauer, *The Salaried Masses. Duty and Distraction in Weimar Germany*, ed. Inka Mülder-Bach (London – New York: Verso, 1998), 30.

[108] Dylan Riley, *The Civic Foundations of Fascism in Europe. Italy, Spain, and Romania 1870-1945* (Baltimore: The Johns Hopkins University Press, 2010), 131.

[109] In 1942, Mihail Manoilescu gave an extent account of his vision regarding the necessity to reorganise Romanian society. He emphasised that the time of liberal bourgeoisie was over

shift towards authoritarisanism reflected in his adhesion to the Fascist *Legionary Movement* and the dictatorial regime of King Carol II. The same shift could be observed in the growing influence of the professional associations in the late 1930s. It was quite obvious that the professional associations played a major role in discrediting democratic practices and were among the first entities to support the new regime installed by Carol II.

While promoting this new vision, the heads of the engineers' professional associations played a key role in changing the economic paradigm of the Romanian state. In 1931, Romania was a country deeply affected by the Great Depression. In a public speech held that year, engineer Constantin Buşilă argued that Romania's economic policy should be controlled by engineers, since their industrial, technological, and economic expertise entitled them to this leading position. In exchange for this privileged role, engineers were supposed to develop a policy that would draw its roots from "the true general interests of our national economy"[110]. In the late 1930s, Buşilă became a supporter of the authoritarian turn in Romanian politics. During World War II, he was appointed Minister of Public Works and Communications in the government led by the dictator Ion Antonescu.

Romanian engineers like Manoilescu or Buşilă were promoters of and active participants in a pan-European trend that had a general impact on their profession. Through the development of the polytechnic educational system, engineers "were broadening their perspective and increasingly shifting their attention from the factory workshop to the economy as a whole"[111]. This change in the evolution of the engineering profession must be linked to the development of a specific system of knowledge networks. This allowed Romanian engineers to join the international community of experts, which anticipated and predicted that scientific progress would solve the basic social questions. The transfers of scientific and technical knowledge engendered, slowly but surely, a state of mind that purported to understand reality and envisaged solutions for a "better society" – from the point of view of the engineers. In a century marked

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and a new form of economic and political organisation was required. He concluded that "the Romanian bourgeoisie is overwhelmingly on the State's payroll" [Burghezia românească stă în mod precumpănitor în solda Statului]. Mihail Manoilescu, *Rostul şi destinul burgheziei româneşti* (Bucharest: Cugetarea – Georgescu Delafras, 1942), 110.

[110] Constantin Buşilă, "Industria românească în decurs de 50 de ani (1881-1931)," *Istoricul dezvoltării tehnice în România. Buletinul Societăţii Politehnice*, year XLV, no. 12 (December 1931): 2351.

[111] Jackie Clarke, "Engineering a New Order in the 1930s: The Case of Jean Coutrot," *French Historical Studies*, Volume 24, no. 1 (Winter 2001): 68.

by the temptation of breathing life into utopias, engineers tried to implement their holistic vision of society. In other words, engineers laid claim to building and mastering the future.

Rezumat

Studiul relevă evoluția numerică a inginerilor din România până în anul 1939, analizând prerechizitele socio-economice care ar fi putut contribui la alegerea studiilor inginerești. În acest sens, utilizez conceptele teoriei profesionalizării, premisa de bază fiind că profesia este o identitate socială construită ce implică promisiunea mobilității sociale ascendente. Conform acestei teorii, dezvoltarea unui sistem specific de formare educațională este o condiție esențială în acest proces. Studiul analizează principalele trăsături ale învățământului politehnic din România, cu un accent special pe Școala Politehnică din București, de-a lungul a mai bine de 60 de ani. În ultima parte, studiul analizează situația corpului inginerilor din România în anul 1938, folosind date extrase din anuarul Asociației Generale a Inginerilor din România (AGIR), cu scopul de a evidenția contribuția învățământului politehnic din România la dezvoltarea numerică a profesiei de inginer. Concluzia preliminară a acestui studiu este că, la sfârșitul perioadei interbelice, inginerii au devenit promotori ai unei noi abordări economice, sociale și politice în România, care promova creșterea rolului jucat de stat în toate palierele societății.

Cuvinte-cheie: învățământ superior, ingineri, Școala Politehnică din București, AGIR, studenți politehnici.

Dragoș Sdrobiș, Independent researcher.
Email: dragosconstantinsdrobis@gmail.com