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The Professionalization of Engineering and the Construction of Modern Peru (1850-1930)

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Abstract. The expansion of public works projects beginning in the second half of the 19th century led to important economic, political, and cultural transformations of Peruvian society. One of these was the creation of a professional class of experts specialized in the planning, execution, and administration of infrastructure and natural exploitation projects. This study analyzes the professionalization of engineering in Peru as part of a larger process during which the Peruvian state, in collaboration with certain sectors of civil society, initiated an effort to modernize productive structures and form a ruling class capable of administrating national modernization projects. This article also explores the agency of this professional sector in developing its own strategies of professionalization beyond just the state sector. Finally, the article explores how both these processes played a role in instilling social concerns among engineers and led to the development of technical proposals for modernization which had a nationalist and pro-industrial character.

Keywords: engineers, state, professionalization, mining, public works, professional associations, nationalization, industry.

Introduction

Between 1850 and 1930, Latin American modernization projects reflected the need for a close relationship between the so-called liberal professions and public administration. Research on the construction of professional knowledge during this period demonstrates that the influence of liberalism, positivist thought, and the consolidation of capitalism all contributed to generating a current of thought among the governing elites to the effect that the modernization of public agencies was linked to scientific, technical, and professional development.[1] In this sense, the slow changes in economic, political, and cultural paradigms reordered the roles of the state and allowed for the inclusion of doctors, engineers, architects, and city planners in public administration. As noted by Mariano Plotkin and Eduardo Zimmermann, states needed the knowledge generated by the nascent social sciences as well as technical know-how just as the latter fields needed the state for their consolidation and institutionalization (Plotkin & Zimmermann, 2012, p. 10). Therefore, it comes as no surprise that, in addition to medicine and its specializations, this period saw the professionalization and institutionalization of engineering disciplines in Chile, Colombia, Argentina, and Peru (López Soria, 2012; Gutiérrez & Reynolds, 2014; Valderrama et al., 2009).

The establishment of engineering as "professional knowledge" entailed the creation of specialized institutions to educate professionals, as well as roles in which they could perform and implement their specialized knowledge. Nevertheless, both processes did not necessarily take place simultaneously. Between 1840 and 1870, it was common in most of the aforementioned countries to hire foreign engineers and scientists, who were initially charged with geographical exploration and the construction of public works via the technical advisement entities of their respective countries. Later, these same individuals founded schools or faculties to train new specialists that would later work for government institutions. In this sense, the professionalization of engineering generated significant changes in the structure of the state and in the cultural norms of society at the time (Lucena, 2007, pp. 275-276). In general terms, the process questioned the educational patterns and Western values that traditionally related to "doing and constructing" ("haber y construir") with ignoble work reserved for the popular sectors Torrejano & Bocanegra, 2018, p. 17; Gutiérrez & Reynolds, 2014, p. 64; Serrano, 1994, pp. 204-205).

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1 See Gonzales (1999) and Cueto (1989).

In Peru, the Polish engineer Eduardo de Habich imported the French model for training engineers: the state organized the first professional bodies and promoted the creation of a school for local engineers geared toward training specialists for public administration. Although these developments are relevant, the creation of professional "knowledge," in addition to its technical component, required the construction of legitimacies beyond just academic spaces. Sergio Morresi and Gabriel Vammaro suggest that in the process of consolidating professional *expertise* it is also necessary to create a discourse and legitimize it, along with the people who employ it and the mechanisms used to mobilize it. This process entails the existence or, in its absence, the formation of dynamic spaces that allow these professionals to move between different social settings in order to form their own voice in society (Morresi & Vammaro, 2011, pp. 14-15).

Keeping in mind Elena Salerno's (2015) observation that modern engineering in Latin America developed in close connection with the development of the state through the dissemination of technical information, specialized consulting, and the planning of public works,[2] it is necessary to note that, in some cases such as Peru, state spaces were not the only settings where these professionals could mobilize and develop their own discourse. The creation of associations and media outlets, primarily written, allowed engineers to generate environments of professional legitimacy, sometimes with a certain independence from state influence.

Unlike other experiences in Latin America, in the case of Peru up to the 1930s, the training of engineers took place outside universities and had a certain autonomy from state intervention even though the public sector was the principal source of financing and employment for the profession. On the other hand, this situation allowed engineers to develop professionalization strategies through the creation of associations that were free from government intervention. Their independence allowed them to consolidate a new form of "thinking and doing" in Peru. Engineers created a discourse that advocated the elevation of moral values and social welfare through territorial integration and the physical transformation of the natural world, took advantage of the economic benefits generated by the exploitation and commercialization of natural resources (López Soria, 2007, pp. 33-39), and provided the tools necessary to construct a "scientific republic" and, through their proposals, to dispute the oligarchy's political hegemony.

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2 For a study on the role of engineers in the public apparatus, see Salerno (2015) and Guajordo (2015).

This article focuses on the analysis of professionalization strategies in the field of engineering and how these were related to the Peruvian state between 1850 and 1930. The first section explores the initial efforts by the state to create specialized institutions for the training of engineers. The establishment of the Lima School of Engineers (Escuela de Ingenieros de Lima) is seen as the end product of a series of state and civil society initiatives to modernize higher education and train specialists (*técnicos*) for the administration and promotion of production. The second section deals with the creation and workings of professional corporations that allowed the engineering community to legitimate their professional identity. The final section explores the participation of these engineers in debates about the most important problems that affected economic developments in Peru during the first decades of the 20th century.

Based on an analysis of documentary sources from the archives of the Engineering School at the Universidad Nacional de Ingeniería, we review the way that the characteristics of the processes of formalizing education and creating associations allowed engineers to play an active role in planning government policies in addition to becoming key actors in the economic, political, and social modernization of Peru. These same characteristics imprinted distinguishing features on the professionalization of Peruvian engineering, which at that time—as a community—sought the support and recognition of the state but without thereby losing its spaces of autonomy.

1. Rehearsals for modernization: the formation of engineers in Peru

In the 1870s, the electoral triumph of the Civilista Party, led by politician and intellectual Manuel Prado, brought to power a new generation of liberals from the banking and mercantile bourgeoisie who had benefited from the guano boom (Mücke, 2008, pp. 78-79). The economic ideas of this elite were amply publicized through the pages of the *Revista de Lima*. The Civilista leader's thesis on the railway revolution had, in addition to its economic basis, political and cultural components.[3] While it is true that the railroads were themselves considered symbols of modernity and tools that were useful for civilizing peoples, the Civilista project also represented a form of state-led fiscal reorganization and regional development (Gootenberg, 1998, p. 154). These liberals took on the task of constructing a narrative in which progress and economic and social development depended—to a great degree—on science and its technological applications to improve commerce and produc-

3 See Pardo (2004). The book brings together 31 texts, among them an essay about Jauja which Manuel Prado published in various issues of the *Revista de Lima* in 1860.

tion. In this sense, the expansion of the roles of public entities, the growth of commerce, and the need to modernize public infrastructure demanded a public administration with improved technical and bureaucratic capacities.

The public works construction boom that began during the first government of Ramón Castilla (1845 –1851) attracted a significant number of professionals to Peru, including European engineers, architects, scientists, and naturalists. These professionals provided the technical skills that the public and private sectors required and which elites adopted relatively easily (Gootenberg, 1998, p. 155). These ardent foreign scientists and technical experts—most notably engineers Ernesto Malinowski and Eduardo de Habich and naturalist Antonio Raimondi—played important roles in Civilista modernization. It is worth noting that these figures were not necessarily members or sympathizers of the Civilista Party but, because of their reformist ideas and their proximity to President Pardo, they provided the necessary tools for the application of the ideals of the "Practical Republic" ("República Práctica"). The fledgling public apparatus lacked institutions for gathering statistics and for planning, and thus the technical and scientific character of the studies prepared by these professionals provided the state with better criteria for the organization of public works.[4] In reports published in the *Anales del Cuerpo de Ingenieros del Perú* (The Annals of the Peruvian Corps of Engineers) (ACIP), engineers stressed the enormous economic possibilities offered by Peruvian territory, as well as the considerable difficulties resulting from not only the difficult geographic characteristics of the country but also the conflictive administrative organization of the state apparatus and the constant rivalries between regional powers and the central government for control over the benefits derived from public works. As eyewitnesses to this situation, they argued that the intervention of scientific professionals versed in the complex knowledge of the natural and pure sciences was indispensable since they were able to effectively employ the necessary technological tools to circumvent the aforementioned challenges and transform them into concrete possibilities. The Polish engineer Eduardo de Habich, who was hired by the government of José Balta in 1869, worked together with engineers Felipe Arancivia, Alfredo Weiler, and Mariano Echegaray on a reform of the statutes of the state's Corps of Engineers in 1872, establishing rigorous requirements for the admission of engineers, architects, and

4 Ernesto Malinowski and Manuel Pardo arranged for the publication of the works of Antonio Raimondi during the 1870s, including his study entitled *El departamento de Áncash y sus riquezas minerales* and the first volume of *El Perú.* Raimondi's studies in the north of the country and the Amazon basin were very useful for the commercialization of guano and for planning the railway projects carried out by Malinowski and the US entrepreneur Enrique Meiggs.

assistants to this technical corps (ACIP, 1874, pp. 16-39). The objective of these well-known individuals was to make the Corps of Engineers a highly specialized advisement center for the public apparatus as well as a center for professional training.

> The Central Board, when proposing this measure to the Supreme Government, has as its goal, in addition to [providing] good service, to provide the country with youth who are sufficiently educated to carry out ordinary work as defined by the profession of engineering. In this sense, the service will be a theoretical and practical school to train youth who choose the career of engineering and, at the same time, stimulate their zeal to finish their training as soon as possible, satisfying with exactitude all the demands of the Corps' examinations.[5] (ACIP, 1874, p. 16)

We can therefore infer that this Reform Commission thought of engineering as a profession, primarily "at the service of the state." This should come as no surprise since both Habich and Malinowski as well as many other French and Polish engineers hired between 1850 and 1870 had studied at the National School of Bridges and Roadways (École Nationale des Ponts et Chaussées) in Paris. This is important because of the enormous influence that these two individuals had on the professionalization of engineering in Peru. At the time that Habich studied there (1859–1863), French technical education had a centralist orientation that allowed for the reestablishment of a constant equilibrium between the economy and society (Wickenden, 1929, pp. 127-129). According to this educational model, the public sector monopolized the task of "educating highly qualified professionals" so that they would later become part of the technical corps of the state and industrial enterprises. In Latin American countries, the adoption of the French model was accomplished through the circulation of officials and professionals who, after finishing their education in France, traveled to the countries of this region. This was the case of the Polish scientist Ignacio Domeyko, who played a role in the creation of the engineering major at the Faculty of Sciences of the Universidad de Chile. In other cases, sectors of liberal elites, influenced by French intellectuals, promoted the consolidation of this model to strengthen the authority of the state in developing improved local technological capacity, as was the case of the Military School that later became the Faculty of Mathematics and Engineering of Colombia

5 All translations from Spanish are by *Apuntes*.

(Gutiérrez & Reynolds, 2014, pp. 74-80; Valderrama et al., 2009, p. 15). Whatever form of academic training was implemented, the establishment of academic studies in engineering became an important factor for the various regimes of the time. According to Sol Serrano, in the case of Chile (which was similar to other countries such as Mexico, Colombia, Chile, and Peru), training in scientific and professional engineering did not stem from the development of a traditional trade but instead developed as part of a government project intended to revitalize local production. Thus, the influence and protection of the state was very important in laying the cognitive foundations for the profession and safeguarding its labor market (Serrano, 1994, p. 205).

Universities played an important role in the formation and legitimization of the liberal professions since, as Marcos Cueto, notes, these spaces served for "standardizing training, socializing future professionals in the norms of the profession, and obtaining a degree that opened the door to working in their profession" (Cueto, 1989, p. 82).

Starting in the second half of the 19th century, Peruvian education underwent important reforms that were aimed at systematizing learning and putting education under the jurisdiction of the state. These liberal reforms promoted the secularization of education and the development of scientific knowledge as a useful instrument for the modernization of production and the state apparatus (Garfias, 2010, p. 55). The 1855 *Regulations for Instruction* (*Reglamento de Instrucción*) decreed that higher education, except for some "scientific activities," were the exclusive domain of the university and created the faculties of Theology, Medicine, Jurisprudence, Philosophy and Letters, and Mathematics and Natural Sciences. Although various regulations issued between 1850 and 1876 created courses for the study of mining applications, agricultural and public works, and other construction and industrial applications in the Faculty of Mathematics and Natural Sciences, these initiatives did not lead to the establishment of programs of study for the training of engineers.

Until 1876, in addition to Universidad Nacional Mayor de San Marcos, there were universities outside Lima that had chairs in Medicine and the Sciences, but the largest number of economic and professional resources were based in Lima. The centralist character of the educational reform implemented the same year by the Civilista government eliminated the Secondary School of Medicine in Trujillo (Ministerio de Justicia, Culto, Instrucción Pública y Beneficencia, 1876a, pp. 90-91). In Arequipa and Cusco, lesser universities continued to operate, which, in addition to their chairs in Law, Philosophy, and Literature, offered courses in general physics, general and

analytical chemistry, basic mathematical theories, mineralogy, zoology, and botany (Ministerio de Justicia, Culto, Instrucción Pública y Beneficencia, 1876b, pp. 55-56). While these subjects could inculcate students with approaches to the practical sciences, they were not designed to provide a complete education in engineering. Perhaps the high standards set from Lima by the government's Corps of Engineers restricted the educational capacities of these institutions.

Despite these timid efforts, education in the field of engineering went through different phases. While it is true that the *Reglamento* of 1855 for the first time included, in the regime of Special Education, schools or institutes that provided scientific education in various professions—a category that included the Institute of Engineers and a future School of Mines—these latter institutions did not actually exist as such (*Reglamento general de instrucción pública*, 1855). The closest case was the Institute of Civil Engineers, created in 1853, which was charged with providing courses on communication routes, irrigation, regulation, the distribution of water flows, and permanent fortifications. The government of Rufino Echenique appointed French engineer Carlos Faraguet (and later Emilio Chevalier) as its director and assigned it a premises, a budget, and statutes. Interest in the project led to an extension in the deadline for student admission, and an effort was made to foster interest among high school students and directors in studying engineering (*Reglamento de la Escuela de Ingenieros Civiles*, 1853); unfortunately, we do not know the reasons why this institute did not ultimately come into existence.

By the 1870s, education had become a tool for achieving progress and creating citizenship. This led to a change in elites' views of the characteristics of a "citizen producer" versus the "armed citizen" of the first decades of the 19th century. As noted earlier, states had already started to play a central role in national education policy, but the civil societies that began to emerge in this period also played an important part in that they created alternative systems that helped the less privileged classes and complemented some of the inadequacies of higher education. With the support of government engineers Joaquín Capelo and Teodoro Elmore, the Society of Artisans (Sociedad de Artesanos) created the School of Sciences and Engineering in 1872. The school taught complementary courses for students in the Faculty of Sciences of San Marcos University, which they needed to pass the entrance exam and, if they desired, a career as engineers in the State Corps of Engineers (Sociedad Amantes del Saber, 1875, p. 38). It should be noted that this institution was not part of the state system as such, since it was not authorized to award degrees; therefore, its students did not graduate as engineers.

The School of Arts and Crafts (Escuela de Artes y Oficios), founded in 1864, also tried to establish a link between popular classes and higher education. According to its first statutes, students in their fifth year of studies could obtain a degree in engineering (*Reglamento de Artes y Oficios*, 1865, art. 2). However, this was never implemented; in 1871, Manuel de Mendiburu modified the statutes and reoriented the school toward preparing honest and educated craftsmen ("artesanos honrados e instruidos"). The curriculum prioritized the training of mechanics, model makers, and foundry workers as well as boiler operators, blacksmiths, carpenters, carriage builders, and saddlers (*Nuevo reglamento de la Escuela de Artes y Oficios*, 1871).

These initiatives for training local technical professionals and increasing the numbers of Peruvians in the State Corps of Engineers fit in with the first *Civilismo*, which saw the development of technical and professional capacities as a way of generating economic wealth and strengthening the state, without abandoning the civilizing mission of popular education. Marking a departure from previous decades, the decline of the guano economy and the fiscal crisis resulting from the increasing external debt forced elites to look for new sources of wealth in agriculture, mining, and saltpeter in the interior of the country. To promote export agriculture and exploit the resources to be found deep in Peruvian territory, technology had to be employed to improve production and construct sophisticated infrastructure that would facilitate transport and commerce. Aware that Peru lacked the necessary experts to carry out these projects, Manuel Prado supported the creation of the School of Mines, the reform of the Faculty of Sciences at San Marcos University, and the creation of a new Faculty of Political and Administrative Sciences there in order to train bureaucrats with the technical rationality required by the state (*Creando una "Escuela de Minas*," 1875; *Disponiendo la creación de la Facultad de Ciencias Políticas y Administrativas en la Universidad Mayor de San Marcos*, 1875).

Pardo wanted San Marcos University to take charge of training new engineers, and so the commission on Educational Reform of 1876, made up of doctors, lawyers, and intellectuals, also included Eduardo de Habich as well as Ladislao Folkierski, another Polish engineer. The two submitted a proposal to reform of the Faculty of Sciences and to include engineering courses in order ameliorate the shortcomings of the public education system of the time (Fuentes, 1876). This project received the support of José Granda, Pedro A. del Solar, and José A. Barrenechea, while José Casimiro Ulloa and Manuel Atanasio Fuentes said the proposal was inadmissible since Peru did not have the conditions to establish a "polytechnic" and, as the proposal stood, it exceeded the possibilities of a university faculty (Fuentes, 1876, pp. 216-217).

Despite this initial rejection, the project for formal schooling of engineers was in keeping with the modernization plans of the state and while it could not be implemented at San Marcos University, the new Regulations for Public Instruction authorized—along with the reform of the Faculty of Sciences—the creation of a School for Engineers that was to be independent of the university structure (*Reglamento de instrucción pública*, 1876). It should be noted that these regulations did not provide guidelines for the design of the organic regulations of the school. This independence afforded the engineers greater autonomy in the preparation of their regulations and study plans and, later, it provided them with income from mining activity.[6] De Habich, who was highly regarded by his peers because of his leading role in the reorganization of the Corps of Engineers in 1872 and his work as a government engineer, was appointed the first director of the new school and was charged with preparing its draft regulations. Though his first draft was rejected, the Polish engineer created the foundations of the institution as an entity specialized in the education of technical professionals in exploring natural resources and directing public works (*Reglamentando la Escuela Especial de Ingenieros Civiles y de Minas*, 1876).

Unlike Chile, Argentina, Mexico, and Colombia, the education of engineers in Peru remained independent of the university system. This lack of a connection between universities and the education of technical professionals was the target of constant criticism from intellectuals such as Manuel Vicente Villarán, who maintained that "we are a people infiltrated by the mania of the old and decadent nations, the malady of speaking and writing and not of doing, of wielding words and not things" (Villarán, 1900, p. 9). The engineer Pedro Paulet pointed to the enormous difficulties caused by the lack of an organic policy to systematize technical education in Peru (Paulet, 1907, pp. 6-11), while Javier Prado, while serving as rector of San Marcos, suggested a solution to this problem: bringing the School of Engineers, the School of Agriculture, and the School of Arts and Crafts into his university (Prado, 1913, pp. 3-5).

Villarán, Paulet, and Prado were part of a generation of thinkers that viewed education as of great importance for progress and the creation of a national identity. The influence of positivism, which established itself in Peru a few years after the end of the War of the Pacific (1879–1883), spread the idea among political and intellectual elites that science and technology

6 In January 1877, it was decreed that part of the 15 soles tax on mining properties was be allocated to the budget of the School of Engineers. See *Dictando disposiciones aplicables a la industria minera* (1877).

could solve the problems of the country through the establishment of the order and progress it posited. Technical and scientific education became a tool for economic development and civilization for popular classes, while among elites it allowed the education of professional experts to run the government and plan and execute public policies.

The School of Engineers ultimately filled the vacuum noted by Villarán, becoming the central space par excellence where the social base of educated experts was trained to respond to the productive needs of the nation. This school, which had managed to stay open thanks to the efforts of its director, Eduardo de Habich, made it possible to hire a larger number of foreign specialists and to train local professionals who would contribute to revitalizing mining production, constructing public works, and promoting industry. Those graduates who went to work in the public sector fulfilled an important role in the reorganization of its administrative and productive apparatus through legislative proposals related to mining, commerce, and public works. They also became part of the Ministry of Development's workforce and of technical teams working on mining and transportation, as well as joining mixed associations that promoted research and the development of mining, agriculture, and industries.

With the participation of these elites, it was possible to restart some of the projects that had come to a standstill due to the War of the Pacific. Thus, the modernization of the state took place through a process of feedback of historical experiences: on the one hand, it was institutionalized and professionalized, while on the other, it still preserved some traditional structures inherited from the colonial system (Ruiz, 1994, p. 25). Despite such a particular form of modernization, the creation of a scientific–technical culture resulted in scientific knowledge being translated into concrete results, such as the construction of railroads, the organization of mining legislation, the opening of roads, clearing of land, irrigation projects, and improvements in urban and sanitary conditions. In this regard, the professionalization of engineering was part of a process of constructing the first framework of a modern state that sought to rationalize the mechanisms for planning and resource administration. In great part, these were the changes and continuities that molded the professional profile of Peruvian engineers.

As part of this modernization process, the historical development of the professional practice of engineering was linked to a tradition that can be divided into two trends: first, the administration of public works, which contributed to economic development based on the exploitation and technification of the productive apparatus and, later, the promotion

of industrialization that utilized the natural potential of Peruvian territory. Employing their technical skills, engineers discovered a gamut of possibilities in Peru´s geographic and demographic diversity that contributed to the construction of an economically modern and articulated country (Sala, 2006, p. 446). On the other hand, many other engineers entered teaching and the administration of public institutions, taking charge of bodies such as the Ministry of Development and Public Works, the Technical Corps for Valuations (Cuerpo Técnico de Tasaciones), and the Technical-Industrial Institute, in addition to occupying legislative posts. It should be noted that these professionals could enter both the public and the private sectors with ease.[7] It is evident that the establishment of engineering education as well as the professional development of the profession were both strongly linked to the public sector. The creation of the Ministry of Development formalized the pre-existing link between engineering and the state, contributing to extending the state apparatus to different regions of the country and increasing the role of the public sector in areas that had previously been under the control of local powers, as was the case of public health.

State support was fundamental for the professionalization of engineering, although this support had certain limitations that Peruvian engineers were able to negotiate, as we will see below. The creation of associations afforded engineers spaces of professional legitimacy, which, as Claudia Araya argues, is important because it contributes, among other things, to "reinforcing professional sectors as communities capable of interpreting and responding to the needs of society and those of the group itself, thereby achieving the sanction of the state" (Araya, 2018, p. 151).

2. Autonomy and discourse: associations of engineers

During the 19th century, the state was able to monopolize the training of engineers and sought to bring together in public administration all the "vital forces that contributed to the enhancement of the nation" (Sociedad Nacional de Ingenieros, 1899a, p. 4). With this goal in mind, the government created the Technical and Industrial Institute of Peru with the goal of centralizing the various institutions and professional organizations related to engineering. The Institute was to be composed of the Ministry of Development, the School of Engineers, and the Technical Corps for Valuations, in addition to the national associations of agriculture, industries,

7 Biographies of engineers attest to the constant movement of these professionals between the public and private spheres; between 1876 and 1919, mining was the sector with the largest number of engineers.

and mining, and a future association of engineers (Ministerio de Fomento, 1898, pp. 129-132).

The professional societies of engineers created in the 19th century functioned as consultative bodies for the state and, above all, sought to legitimize the professional activity of these experts in the public space. The objective of these bodies was "to project the figure of the engineer as an erudite specialized worker, conscious that his functional validity was founded on the ability to be up-to-date and to apply new developments in the exact sciences and breakthroughs in technology" (Torrejano & Bocanegra, 2018, p. 18).

In Peru, during the 1870s, the first corporatist experience of these professionals was the creation of the Association of Engineers and Architects of Peru (AIAP). This association aspired to put science and work at the center of economic processes, and to this end it proposed the creation of a national industry through the production of local technological resources (Gootenberg, 1998, pp. 158-159). To achieve this goal, it established close ties with the Ministry of Public Works. According to Carlos Forment, the economic benefits that these engineers received should have served as a stimuli for other professionals to join this organization. However, allegations of corruption during the project evaluation and recruitment stages created doubts about the morality and credibility of the association's members. In order to eliminate these bad practices, some of the AIAP members began to work for the public administration and to be evaluated according to the norms established by the statutes of the Corps of Engineers and Architects of the State of 1872 (Forment, 2012, pp. 175-176).

By the 1890s, Peruvian engineers constituted a considerable group of professionals who had started to compete with and displace their foreign peers. In the private sector, a sizeable percentage of graduates from the School of Engineers worked in mining, while the public sector began to be the main provider of jobs for engineers. Through the Ministry of Development, municipal councils and, later, the Technical Corps of Mines and Transportation, some engineers began to occupy high-level posts in public administration, while others led different technical commissions outside Lima. It is worth noting that unlike the medical sector, engineering professionals did not receive sufficient support to be able to monopolize their professional work because there were no consistent laws punishing those who sought to work in the field of engineering without having professional credentials. To overcome this apparent lack of state support, engineers deployed various strategies to publicize the progress of their profession and to construct a distinct identity in the public space. Perhaps to prevent a repetition of what happened in the AIAP, in October 1898 Felipe Arancivia, José Balta, José

Castañón, Michel Fort, Juan C. Grieve, Alejandro Guevara, Juan A. Loredo, and Enrique Silgado created the Society of Engineers of Peru (SIP) as a private association but with a primarily public and nationalist orientation.

Meanwhile, the state had not given up its goal of setting up an association of engineers that would complete the list of institutions within the Technical and Industrial Institute. At first, it proposed that the SIP be part of the Institute but this request was refused by SIP's board due to the private character of the new organization. In response, in February 1899, the Director of Development of the Corps of Engineers, engineer Joaquín Capelo, led the meeting that created the National Society of Engineers (SNI).[8] Unlike the SIP, this society was conceived as an official consultative body for the state, and for this reason it was to receive economic support from the public sector (Sociedad Nacional de Ingenieros, 1899b, p. 8).

Thus, by 1900, there were two associations that practically shared the same membership and also had similar functions; that is, to be a center of scientific and professional enlightenment for engineers, to disseminate technical knowledge, and to create an archive of reports, documents, and publications (Sociedad Nacional de Ingenieros, 1899b, p. 8; SIP, 1899). Despite these similarities, each institution had its own board of directors and claimed for itself the "representation of engineers on the national level." This situation did not stop the organizations from working in parallel to one another. In 1899, SIP published the first edition of its official bulletin—*Informaciones y Memorias*—in which it described its goals and objectives, in addition to some monographies on technical studies; the SIN did the same in its *Anales del Instituto Técnico e Industrial del Perú.* Since it had more resources, the SNI organized its first conference on minerals from Cerro de Pasco as well as a display of minerals prepared by engineer Fernando Fuchs and, with the support of engineer Carlos Lisson, it was able to acquire a collection of 1,514 fossils for a paleontological museum (Sociedad Nacional de Ingenieros, 1902, p. 5).

Since the SNI depended on the state, it was subject to political and administrative vagaries while the SIP, as an independent body, did not suffer from the same problems. In 1902, the government of Eduardo López de Romaña revived the State Corps of Engineers, which had been defunct since 1884. The reestablished entity, which brought together engineers from

8 The following engineers took part in this meeting: F. Arancibia, B. Aspíllaga, A. Bentzon, F. Blume, S. Basurco, F. Barreto y Helguero, M. Elguera, M. Fort, F. C. Fuchs, F. Gamarra, A. Hayne, N. Levy, J. A. Loredo, J. F. Maticorena, P. Marzo, G. Porras, J. M. Recabarren, S. G. del Solar, and P. C. Venturo.

different sectors, had among its functions collecting materials for scientific purposes and serving as a technical council (*Organizando el Cuerpo de Ingenieros y Arquitectos del Estado*, 1902). As was to be expected, some of these functions coincided with those assigned to the SNI, which put this organization in a vulnerable position vis à vis higher level institutions such as the Ministry of Development. This is evident in the name change that the institution was forced to implement, which favored the SIP; the good relations between the Minister of Development, Enrique Coronel Zegarra, President López de Romaña, and the board of the Society of Engineers of Peru (SNI) allowed this association to keep its name and its independence. Meanwhile, the SNI was forced—very much against the wishes of Joaquín Capelo of the Corps of Engineers—to change its name to the National Society of *Engineering* in order to avoid confusion (Sociedad Nacional de Ingenieros, 1902, p. 4). A few years later, when the National Society of Engineering was dissolved, the SIP continued to operate and became the most representative organization of engineers in Peru until the College of Engineers was created in 1960.

The SIP's growing membership illustrates the status it had gained within its professional milieu. When the society was founded in 1898 it had close to 98 members; the next year, the number was 101; in 1923, 690; in 1928, 722; and in 1930, it had 908 members, divided into the following categories: honorary members; members in Peru; members abroad; and correspondents.[9] The SIP understood engineering as professional activity, preferably in service of the state, which served the common good and the progress of Peru; consequently, the organization was prohibited from engaging in any type of political activity (SIP, 1899). Nevertheless, as time went by and its members began to enter spaces of political representation and public administration, concerns related to "social welfare" were incorporated into its initial mission of being a "social, professional, and scientific club." It slowly took on the role of a consultative body but without losing the autonomy it desired from the beginning. This progressive change was nothing particularly new to its members who had been instilled with concerns for economic and social problems during their studies at the School of Engineers. This aspect became more evident in their writings and publications.

The journal *Informaciones y Memorias* provided a means for collecting and disseminating the results of the engineers' travels and scientific research, which were useful for the material and scientific progress of the country

9 For a breakdown of members and the clauses of the SIP statutes regarding members see López Soria (2009, pp. 73-78).

(SIP, 1899). In addition, it promoted the habit of writing by its members as well as debates on national issues. The goal of *Informaciones y Memorias* was to set a national agenda that included precise data about the resources, customs, and the "ways of being Peruvian" ("los modos de ser peruano"), and to contribute to improving the criteria of the men that took part in the exploitation of the resources of the earth and of labor power (SIP, 1907, p. 2).

One of the main problems faced by the journal's promoters was that initially, and unlike other politicians and intellectuals, scientific engineers had little practice in writing for the public outside their profession. Consequently, creating content other than technical reports was a challenge that required hard work to overcome. Despite the initial invitation and the 341 members who received the journal, until 1907 only eight issues contained original papers—written by engineers Ernesto de la Combe, Fernando Fuchs, Fermín Málaga, Roberto Letts, Nathan Levy, and H. Tweddle (SIP, 1907, p. 209). The small number of submissions prompted the editorial board to deploy various strategies to bolster the journal's content. First, they adopted a system of questionnaires (*enquêtes*) on various subjects. These involved providing a theme for debate along with a matching questionnaire, previously approved by the board. Once approved it was distributed among the membership, who could answer as many questions as they wished. One of the first such questionnaires, and the most successful, was on mining legislation. The topic was proposed by a group of members from Morococha and the answers were published between 1908 and 1909. Among the other approved themes were the reforms of railway policy and the School of Engineers.

The journal also included a system of "questions and answers," which, in contrast to the *enquêtes*, dealt with a variety of issues. The stated goal was to communicate with everyone in society in order to dialogue and share information (Alayza, 1908, p. 249). The questions had to be specific and the answers were not to include a detailed study of the issue under discussion but rather were intended to encourage members to use the data they possessed. The speed and ease of this mechanism was intended to allow members living in the provinces to receive as much information as would aid them in their work, including numerical data, facts, prices, bibliographies, and so on (Alayza, 1908, p. 250). In general terms, the idea was to demonstrate the SIP's usefulness to its members, who could benefit from it no matter where they were. Finally, like other institutions such as the School of Arts and Crafts, the School of Agriculture, and the Technical Corps for Valuations, the SIP created a network of dialogue that promoted the dissemination of its theoretical and practical knowledge regarding matters related to the

"professional experience" of engineers and to how they could be useful to society (Tizón, 1908, p. 122). The target audience for the panel discussions and conferences on these issues was diverse: workers, industrialists, politicians, and other professionals (López Soria, 2009). Around 1908, the then director of the Technical and Industrial Institute expressed interest in bringing together these types of activities by preparing a plan and a single statute to which all the abovementioned institutions should adhere. To this end, it was suggested that SIP preside over the organization of these types of events, with financing from the Ministry of Development. The way this proposal was presented indicated that the participation of all these institutions would create the foundation for a true "popular university" (Tizón, 1908, p. 122).[10]

By the end of the 1910s, the SIP had become a consolidated organization that aspired to be an independent consultative body and whose criteria demanded respect from the relevant public institutions (Fuchs, 1908, p. 372). These objectives were achieved by encouraging members to study and deliberate on public issues, developing learned judgement about matters of national interest (Alayza, 1908, p. 251). The SIP held panels and talks that demonstrated the wide sphere of action that engineers had at their disposal. The SIP stressed the idea of progress linked to the full development of the economic opportunities available to Peru. These strategies were effective and facilitated the inclusion of content generated by SIP in its journal, in addition to providing the basis for the organization of campaigns aimed at the "public good." Some of the representative campaigns were related to the reform of the Ministry of Development and the State Corps of Engineers, mining legislation, and promotion of irrigation works and urban construction. In addition, it offered professional specialization courses in the form of public conferences (SIP, 1918, p. 373). During the celebration of its 23rd anniversary, the SIP's *Información y Memorias* published an article describing the organization's numerous accomplishments, including monographs, conferences, and other activities.

Despite the achievements of the Peruvian Society of Engineers, its efforts to regulate the professional practice of engineering had not yet yielded the expected results. According to Marcos Cueto, the denationalization of mining made it impossible to create a monopoly in this area of technological activity and to expand scientific knowledge relating to mining engineering (Cueto, 1989, p. 89). In addition, in Lima and other regions, consulting

10 The term "popular university" that appeared in the engineering community would become a widely used concept in the 1920s among intellectuals and political activists.

firms staffed by foreign engineers as well as enterprises with a greater capacity for technological investment and their own experts were established (*Guía comercial e industrial del Perú hecha por la Oficina de Periodismo*, 1921). Peruvian engineers saw their labor market, which depended in large part on government resources, shrink. Faced with this situation, the strength of their association provided engineers with the means to defend their collective interests. In 1907, the SIP strongly supported a draft law, presented by congressional representative and engineer Fermín Málaga Santolalla, that sought to place limitations on foreign engineers' exercise of their profession. They were to be required to revalidate their qualifications in Peru and those who did not possess credentials considered acceptable by the SIP would not be allowed to work as engineers (Málaga, 1907, p. 252).

In the case of engineers with foreign degrees, the SIP argued that their supposed lack of knowledge of the geographic, economic, and social conditions of Peru often disqualified them from overseeing the construction of public works or providing optimal technical advisement. Such limitations, it was felt, would have serious consequences for the quality of the works constructed. It should be noted that the foreign engineers that founded the School of Engineers were exempted, as were other such engineers whose trajectories and achievements were recognized; this included Eduardo de Habich, Ernesto Malinowski, Charles Sutton, Arthur Wertheman, and others. Despite the SIP's efforts, Málaga's draft law was not approved. Still, the society continued to work on these issues over the following years. In 1918, the so-called Professional Law (Ley Profesional) was drafted as one of the conclusions of the First National Congress of the Mining Industry, and in the 1920s there was even more insistence on this issue due to the contract signed with The Foundation Company.[11]

Despite the failure of its efforts in favor of the Professional Law, the SIP was able to position itself as one of the publicly recognized technological institutions to the extent that the presence of its members was requested at international events. In 1915, General Commissioner Federico Elguera charged José Balta and Ricardo Deustua to prepare monographs about coal and petroleum on Peruvian territory, respectively, as part of SIP's contributions to the Panama–Pacific International Exposition in San Francisco. Two years earlier, in 1913, engineer Alejandra Guevara, SIP's representative at the Fifth Medical Congress in Lima, presented an outstanding study that later had an influence on the establishment of a Sanitary Engineering course

11 For information on the debates regarding professional regulation, see SIP (1907, 1927, 1929).

in the School of Engineers. The SIP's capacity for publicity also attracted national industrialists who perceived that this organization provided the necessary standing to propose reforms related to commercial matters to the ministries of Development and Finance. This was the case of protests against the increase in the costs of transportation and construction materials as well as proposals to amend the regulations governing industrial property. Through members linked to the congress,[12] the SIP achieved the capacity to arrange for congressional debates on issues such as the draft Road Conscription Law (Ley de Conscripción Vial), drafted by engineer Carlos Oyague y Calderón and sponsored by SIP member engineer Coronel Zegarra. This law played a memorable role as "a modernizing and civilizing element" of the second government of Augusto B. Leguía.

The success of the SIP symbolized the consolidation of a professional elite with liberal views, belonging to the middle class, that—through the development of their professional and intellectual activities—developed mechanisms to propose and implement modernization projects in various government bodies, as will be discussed below.

3. Agents of modernization: engineers in public debates

The active participation of engineers in decision-making spaces was supported by the association with a view to consolidating their position as indispensable agents of change. At the beginning of the 20th century, the scientific character of the profession served as a guarantee of objectivity, which the engineers claimed freed them from private interests. These professionals took an interest in a broad gamut of issues and made them their own through a discourse backed up by their "scientific and professional authority." During the 1920s, there were two important changes that favored the participation of engineers in the public sphere. First, the engineering community developed a conception of political action that was closely linked with the idea of the "public good." Second, science and technology were no longer seen as the magical formulas that positivism posited at the beginning of the century, and nor were they expected to solve national problems in and of themselves but rather required a professionally organized state and the development of scientifically planned policies oriented toward social welfare.

The economic effects of the end of the First World War led to the reorganization of the government apparatus and increased discussion about the

12 The number of engineers in the political sphere increased considerably starting in the 1920s. Many held important positions in the ministries of Finance and Development, in addition to serving in the congress.

roles of the state and professional sectors in society. The wartime export boom did not improve the population's quality of life, and nor did it set Peru on the road to progress. This context compounded negative views of the traditional oligarchic regimes that had held power until 1919 and had been unable to construct a modern nation. In the words of engineer Ricardo Tizón, "if in 1821 we were born to an independent life,[13] by 1921 we should have created a nation and we are still very far from this goal" (1919, p. 447).

The development of their professional activities and their direct link with the state allowed the engineering sector to conceptualize what Tizón called "a nationalist ideal," understood as an increase in public wealth, population homogenization, and the creation of an entrepreneurial mentality among political and economic elites. If in the 19th century railroads attracted hopes for progress, in the 20th century industry was the new force that was to boost economic and social development. The foundations of this change were the accumulation of capital, the expansion of markets, and the mechanization of production, all of which made it possible to transform territorial conditions to promote social welfare as well as an active role for civil society, also taking into consideration workers and indigenous people. On the other hand, although not stated openly, there was also an implicit questioning of the role of the state, professional sectors, and even foreign capital in the process of industrialization.

During the second government of Augusto B. Leguía (1919–1930), foreign investment, primarily from the United States, grew considerably, especially in the mining sector. At the beginning of the 1900, mining reclaimed the importance it had lost during the guano export boom in the 1850s and 1860s. However, this progress also implied the denationalization of mining, in which large commercial houses took control of the railways and established their hegemony in the most productive parts of the country (Thorp & Bertram, 2013, pp. 110-128). At the same time, the agricultural sector had begun a process of mechanization as a result of the modernization of haciendas in the north of the country (which were primarily in the hands of private capital) starting at the end of the 19th century. The state endeavored to increase its participation in agricultural production through the Corps of Mining and Irrigation Engineers and certain departments of the Ministry of Development, which studied and planned irrigation projects on the northern coast and some southern Andean valleys. The Society of Engineers became the venue for various discussions about how to take advantage of ground-

13 Translator's note: Peru became an independent nation in 1821.

water for energy generation and for public consumption. Starting in 1904, engineer Charles Sutton planned irrigation projects that were intended to boost agricultural development related to strengthening the internal market. However, the pro-export economic policies of Peruvian governments up to the 1930s did not provide the support necessary for these projects.[14]

Unlike sectors of the economy linked to agriculture and local manufacturing, the engineering community considered mining to be the sector with the greatest capacity for generating industry (Noriega, 1927, pp. 500-508), not only because of the earnings its sale could generate but also because it brought together the elements important for production: sources of energy such as coal (for combustion in smelting furnaces, powering machinery in sugar mills, as well as domestic use) and petroleum.

In the pages of *Informaciones y Memorias* as well as in discussions about irrigation of the coastal pampas, some engineers also questioned the lack of clear government policies regarding mining and petroleum. During the 1910s, the outbreak of the First World War created favorable conditions for exports of natural mineral resources. The shutdown of European markets reduced coal imports and opened up the possibility of generating investment to improve local production (Diez Canseco, 1916, p. 84). There were various proposals about how to take advantage of these resources to benefit the state. For example, the former Minister of Development and founder of the Corps of Mining Engineers, José Balta, suggested nationalizing the coal industry, while the president of the National Mining Society, Pedro de Osma, suggesting creating a national oil company.

The Society of Engineers, which by this time was already the recognized representative of Peruvian engineers, served as a forum for debates on the issues of agriculture and mining that had begun during the first decade of the 20th century but began to be reassessed starting in 1920. Debates on mining were initially promoted through *enquêtes* and questionnaires about the change to mining legislation that allowed for the creation of monopolies, with which national capital could not compete. In this context, initiatives emerged to advocate for greater state intervention in mining. Engineer Enrique Dueñas suggested extending the regulations regarding guano mineral reserves and normal salt to create a system of fiscal reserves in which the state would set aside for itself a portion of territories rich in rare and expensive minerals such as coal, petroleum, iron, tungsten, vanadium, molybdenum, mica, and fine graphite as well as gold panning sites, in addition to

14 For a summary of Sutton's projects, see Sutton (1929, 1905).

modifying the articles of the mining code that allowed for the creation of monopolies (Dueñas, 1908, p. 454). Dueñas made clear his disagreement with the government's mining policy and argued that a "nationalist credo" should be adopted that would make it possible to eliminate the economic dependence that resulted from implementing conceptions of national development based only on foreign capital (Dueñas, 1915, p. 423).

The modernizing logic imposed by the Peruvian oligarchy during the first decades of the 20th century was based on the idea that the income generated from the extraction and export of natural resources would promote the development of new sectors of the economy. In this conception of progress, the inflow of foreign capital increased the spectrum of technological and financial possibilities, and would lead to the diversification and mechanization of agricultural and mining production as well as the emergence of new economic sectors linked to industry. The tax revenues were used by the government to build roads, railways, public buildings, water lines, and sewage systems, as well as on improvements in the quality of life of the population. Thus, social and political stability would be the natural result of the exploitation of the country's natural resources. Mining statistics compiled by engineers working for the government illustrated the growth of income from mining between 1900 and 1918 in comparative terms (Jiménez, 1918, p. 396). However, for engineer Carlos Jiménez, head of the Statistics Section of the Corps of Mining Engineers, this illusion of progress was undone by several trends that represented risks for national capital investments. Increases in prices of production materials (wood, explosives, steel) as well as increases in shipping costs, foreign exchange rates, and smelting and refining tariffs directly affected the income of the small-scale mining sector and forced medium-sized enterprises to become subsidiaries of large capital in order to avoid economic loses (Jiménez, 1918, pp. 388-389).

Faced with this situation, a nationalist current of opinion developed among some in the engineering community, which involved calls for the nationalization of strategic sectors of the economy to foster development of the national mining industry. Such ideas were countered by a sector of liberal engineers who were convinced of the importance of promoting the private sector in the national economy. Although at first sight these positions appear to be diametrically opposed to each other, both sectors agreed that the role of the state as the overall "regulator of economic life" should be strengthened.

Dueñas proposed a comprehensive program to promote the mining industry, which consisted in converting research into a key aspect of mining

education as well as nationalizing railways and establishing coal and steel industries. According to this proposal, the state should be the principal promoter in the development of national industry, excluding all types of foreign investment. He argued that this would stimulate small-scale mining and favor the growth of national capital. It was the government's role to reform mining legislation and define in detail property rights, the tax regime, the size of mining claims, and the system of fiscal reserves for mineralized territories (Dueñas, 1921, p. 439). He based his arguments on the possible creation of heavy industry; his case was strengthened by the publication of his 1918 study about the iron field in Huacravilca.[15] According to Dueñas, the reserves of this mineral were sufficient to serve as a catalyst for a national steel industry if it were supported by the state, and this would make it possible to "nationally industrialize" the country (Dueñas, 1919, p. 439). A similar case was made for coal and petroleum but found little support in the congress. However, a former Minister of Development, engineer Héctor Escardó, began a campaign in the congress to gain support for a draft law to establish a fiscal mining reserve in the iron fields in Huacravilca, which also included water, coal, and fluxes (Dueñas, 1919, p. 440).

The opinions voiced by engineer Dueñas elicited various reactions among the members of the Society of Engineers. Ricardo Tizón, who had been a tenacious defender of commercial liberalism and foreign investment, felt that it was necessary to intensify mining production in order to generate other types of economic benefits beyond taxes and salaries, arguing that the solutions should not lie in expelling foreign capital but rather in having the state assume a regulatory role over the economy (Tizón, 1921, pp. 421-422). In Tizón's view, Peru was still a poor country with a governing class that lacked an entrepreneurial spirit. For this reason, the idea of creating national industry through state promotion could only be seen as "a utopia created by optimistic men" and was not a practicable possibility (Tizón, 1919, p. 449).

These concerns about mining led to the First National Congress of the Mining Industry, sponsored by the government and organized by its technical bodies, including the Corps of Mining Engineers, the School of Engineers, and other institutions such as the National Mining Society and the Society of Engineers. The subjects discussed during the congress included mining exploitation and technologies, transportation, mining education, and mining hygiene, as well as sociology and legislation (Cuerpo de

15 The report is available in Dueñas (1918).

Ingenieros de Minas, 1921, pp. 13-18). A review of the proceedings of the congress reveals that it was not just a technical event but also a space where ideas related to mining policy were debated. José Balta, in his capacity as president of the plenary sessions, summarized the lack of well-defined ideas about mining and also criticized the lack of effective actions to industrially exploit mineral resources (Balta, 1921, pp. 269-272).

During the eighth session of this congress, some proposals were presented to create a National Chamber of Mining that would be charged with the following tasks: determining the precise means by which railroads and basic mining industries could be nationalized; designing the necessary policies to protect national mining and to establish derivative industries for producing fertilizers, dies, explosives, cement, etc.; reviewing mining legislation; and arranging for the establishment of a national bank that would specialize in transactions related to the export and sale of petroleum and minerals (Delgado, 1921, pp. 28-33).

Unfortunately, the conclusions reached at the congress led to few concrete results, though they did have an influence on discussions about the state's role in the development of mining. The well-known engineer Alberto Noriega, who was a past president of the SIP and had ample experience in the mining sector, suggested what could be considered an alternative approach. While he defended "nationalism" as an ideology that should be used to promote the mining industry, he did not view this as excluding foreign investment, as Enrique Dueñas had suggested a few years earlier. Noriega noted that a lack of capital limited the ability to invest and expand industry. He argued that the state should create the necessary mechanisms so that foreign investment would maximize the productive capacity of the country without thereby renouncing or minimizing the benefits that came from the exploitation of natural resources (Noriega, 1927, p. 498). Consequently, it was role of the public apparatus and its local technical professionals to update registers of leases, provide better property guarantees, build transportation infrastructure, provide specialized training for engineers in metallurgical processes, and implement technology for processing minerals (Noriega, 1927, pp. 508-510).

Initially, the reforms proposed during the second government of Leguía (1919-1930) sparked optimism in the mining sector. The road-building policies started in this period opened up the possibility of revitalizing the national mining sector, since roads provided a reduced-cost alternative to railroads (*La Vida Minera*, 1928, pp. 125-126). In addition, the constitution of 1920 allotted mining property in all its amplitude to the state, whose possession or use it could confer on third parties in the form or under the

conditions specified by law.[16] Proposals to nationalize coal and establish a steel industry seemed to yield results, with the creation of a Coal and Steel Commission (Comisión Carbonera y Siderúrgica) in 1924, presided by José Balta. In addition, the idea of reserving mineralized zones to the state for future use came into its own, especially in the case of petroleum, a scarcer resource than coal (Alayza, 1927, p. 84).[17]

Despite the optimism of the 1920s resulting from high levels of petroleum and coal production, the mining sector continued to be financed primarily by foreign investment while public works—a symbol of modernity—required large bond issues, which greatly increased foreign debt problems.[18] In the case of the agricultural sector, access to credit was made possible by loans from local banks to agroexport hacienda owners (Manrique, 2015, p. 143). This was not the case of other sectors such as mining and industry. To help solve this problem, Alberto Noriega suggested that a mining bank be created to provide loans to national or "Peruvianized" mining entrepreneurs so that they could finance the implementation of production technologies and promote links between mining and the development of other production sectors (Noriega, 1930, p. 126).

Noriega's proposal was sponsored by the SIP and received support from mining entrepreneurs in Morococha, Yauli, and other regions in southern Peru.[19] The project was promoted in discussions within the SIP, which even appointed a commission to improve the presentation of the project, made up of the following engineers: Augusto Umlauff, Carlos Alayza, Alfredo Arguelles, José Balta, José J. Bravo, Guillermo Boza, Héctor Harvey Cisneros, Alberto Noriega, Humberto Solari, and Enrique Torres Belón (SIP, 1927a, p. 71). The final text presented to President Leguía proposed that the bank, in addition to providing loans, also had other prerogatives such as constructing public infrastructure, should this be necessary.

Efforts to nationalize mining and create a government credit institution were aimed at creating an industry with national capital and strengthening the role of the state in the national economy. This objective is evidenced in conversations in April 1927 in which almost unanimous references

16 Art. 42 of the Political Constitution of Peru of 1920. "Mining property in all its amplitude belongs to the state. Possession or usufruct can only be conferred in the form and under the conditions specified by law." http://www.leyes.congreso.gob.pe/Documentos/constituciones_ordenado/CONSTIT_1920/Cons1920_TEXTO.pdf

17 Law 4452, Declaring as Properties of the State Oil and Hydrocarbon Fields. http://www.leyes.congreso.gob.pe/Documentos/Leyes/04452.pdf

18 See Fuchs (1920).

19 The appearance of mining unions and intensified campaigns for the creation of the small mining sector also marked this process.

were made to "industrial protectionism" as a necessary way to strengthen production and create an internal market. In general terms, the proposal was for a model of top-down development in which popular classes would benefit through the expansion of commerce, technical education, housing, employment, social security and so forth. When the Society of Engineers was founded in 1898 its members expressly declared that the organization must steer clear of all political interests and activities, whereas between 1920 and 1930 "politics" was redefined as the study and the discussion of major national issues. Therefore, it became members' responsibility to be useful by educating the public—through the means afforded by their status—regarding those national problems related to various branches of engineering that had to be resolved in order to serve the permanent interests of the nation ("*la nacionalidad*") (SIP, 1930b, p. 28).

During his second government, Leguía supported the engineering community and used its proposals and work to provide technical criteria and legitimacy to his modernization projects. For example, he supported the First National Congress of Engineering (1923), the First Technical Conference on Roads (1929), and the Congress on Irrigation and Settlement of the North (1929). Nevertheless, professional and scientific criteria did not necessarily predominate during this period. Leguía tended to use and support projects that matched the objectives of his regime, as was the case of the draft law of road conscription prepared by engineer Carlos Oyague y Calderón.[20] The implementation of this law received criticism from various sectors, and in response the government used the publication *La Red Nacional de Carreteras* (1929) written by Ernesto Diez Canseco, engineer and Director of the Department of Communication Routes under the Ministry of Development, to show off its road building accomplishments. Nevertheless, this alliance had its limitations when it came to defending the interests of engineers versus those of the government: Leguía did not support the position of the Society of Engineers regarding the contract signed with the US enterprise The Foundation Company, which granted a monopoly in sanitation works to foreign technical professionals and capital. The projects proposed by Noriega, Balta, and Dueñas were not approved for political reasons but many of these proposals or discussions were later incorporated as part of political policies in the decades from the 1930s to the 1960s, first to overcome the economic crisis caused by the Great Depression and later as part of a model of state-sponsored development. For example, a Mining

20 For a study of the project see Oyague (1915).

Bank was created in 1935 through a law promulgated by the government of General Óscar R. Benavides and in 1940, Law 9157 was promulgated creating a banking institution to provide credit for mining, with Alberto Noriega as its first president. In the 1950s, the government promoted heavy industry through the creation of SiderPerú and made possible the construction of the hydroelectric complexes designed by engineer Santiago Antúnez de Mayolo.

Conclusions

The process of professionalization of engineering in Latin America had somewhat different characteristics from one country to the next due to the socio-historical conditions in each. In Peru, during the second half of the 19th century and most of the first half of the 20th, national progress was associated with population growth and the development of the means of production—and it was the latter that was particularly important for the professional field of engineering. As this article demonstrates, the professional practice of engineering was based on a vision of Peru as a country with specific characteristics. The merger of entrepreneurial vision with a nationalistic frame of mind resulted in engineers not only working in their technical capacity but also occupying important positions in public administration, technical schools and universities, as well as being elected to political office on the national level. Their interest in national issues led to the production of a considerable number of articles, pamphlets, and reports, which presented technical and scientific information about the population and the geography of the Peruvian interior, as well as proposals for modernizing production and the administration of various public sectors. In these modernization projects, the state was assigned a central role as the regulator of economic life. The proposals and discussions that emerged during this period continued into the following decades and constituted an important part of the construction of a welfare state from the 1930s to the 1960s. The conceptions of development as conceived from the field of engineering represented a vision of progress implemented from above and led by professional and business sectors.

We appreciate that this article describes only a few general aspects of the topic but it nevertheless helps demonstrate how the study of the engineering can contribute to an understanding of the characteristics of the agents and institutions that played a role in the construction of the Peruvian state during the 19th and 20th centuries.

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