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Mémoire de Master

Buts industriels de l'École Pratique des Hautes Études et leur comparaison avec l'École des Hautes Études Mexicain.

Industrial purposes of the École Practique des Hautes Études and its comparison with the Mexican School of Higher Education.

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Chapitre I

Introduction

Each country and each village have its own history and similar events can reach different terms due to the political and social context in which they developed, currently in Mexico and with a declining education, which has come down due to the poor management of the unions of professors, to the low investment of the governments and mainly to the economic inequality of the population. I believe it is essential to carry out an in-depth analysis of the way in which our institutions have carried out their activities, as this will allow us to understand the current state of education and will help us to make the necessary changes to improve its functioning, always seeking welfare and development of the population, since this cannot have more than beneficial consequences for our country.

This work began several years ago, when I was doing research in the Historical Archives of the School of Medicine, where looking for the origins of the Faculty of Sciences and the first Mexican biologists, I found several documents sent from France by medical professors who sought to imitate the systems of European studies and implement them in Mexico. At that time, around the 1900s, the country was for the first time in its history as a free nation in a time of peace, which allowed for the first time to think about making improvements in the educational field.

At that time the Secretary of Public Instruction Justo Sierra took to Congress its first proposals for the realization of a University, which were rejected on several occasions. Finally, after an arduous struggle, it was agreed by the Congress and he managed to carry out his institution, which he could not see flourish due to his early death.

One of the main novelties that Justo Sierra had included in his project was the annexation of a School of Higher Studies, which sought to imitate the same French institution that had been founded decades before by Victor Duruy in Paris. And just as the French school did at the time, it represented an innovation for its time and it was the first time that a new teaching system broke with all the schemes of the traditional university.

Both institutions were created by similar needs:

- Educational crises, generated by the lack of innovation in the curricula and backwardness in teaching methods.

- Social pressures caused by neighboring countries, from their part Prussia in France and Mexico with the United States.

- The quest to excel in the new commercial and economic career that the development of the industry had unleashed.

In the end, each institution had a different outcome due to the political and social contexts in which they were developed. They followed different histories, but without a doubt they were pioneers and the mothers of great current scientific research institutions. They served to introduce educational models that broke paradigms and opened the doors to the foundation of new systems.

Importance of the realization of this project

Currently in Mexico and after 100 years of those initiatives carried out by Justo Sierra, it has been decided to carry out educational reforms that seek to strengthen the depleted level of knowledge in all sectors of society. According to the government report, the constitutional reform will provide the National Education System with the elements that promote its improvement and strengthen its equity[1].

The will of the State to improve access to education and provide quality education to citizens is a good start to progress, but certainly it is necessary first of all to carry out analyzes that help us understand the current situation, so we can have a better panorama of how the reforms carried out in the past have been directed the country.

The field of study in the area of education is very broad and a single work will not be sufficient to understand the totality of the current situation, since it covers basic, middle and higher education, as well as other institutions in charge of popular science and culture must be analyzed in depth.

I studied a degree in biology and as a historian of science, I am worried about the situation that exists today in the field of scientific education in my country, I have worked in research laboratories and I had to face the questions and incomprehension that society has regarding a sector of workers, researchers and scientists who in my country have been hidden, that no one knows their work and that by the same situation they are seen as an unnecessary expense for the public treasury.

It is very easy to see the backwardness in scientific education in Mexico when analyzing the data that the OECD and PISA surveys show a situation that is worrisome due to the importance that understanding and assimilation of science has for development and technology.

[1] Mexico Gobierno de la Republica . (2013). *Reforma Educativa.* Ciudad de México.

According to the data of the OECD and the Program for the International Evaluation of Students (PISA), the performance of Mexico is below the average of the countries that make up the organization, in subjects such as science, reading and mathematics, where only 1% of students achieve levels of excellence. In addition, the results of the test conducted in 2015 remain the same from the study conducted in 2006[2].

The worst results obtained in the test were within the area of science, where 48% of Mexican students fail to reach level 2 to make use of basic knowledge and scientific procedures to find an appropriate response, interpret data and identify the questions that emerge from a simple experiment. This figure is the highest in the OECD, on the other hand, around 8% of the students of the member countries reach a level 6 of maximum competence. At this level they must be able to apply their knowledge and scientific skills in a creative and autonomous way in a variety of situations, including unfamiliar ones, the proportion of Mexican students achieving that level is only 0.1% and this figure has not changed since 2006[3].

Another interesting fact of this same study tells us that the disposition of Mexican students towards scientific research methods is less positive than for the average of countries, mentioning that 75% of scientists change their opinion about what is true science and only 80% consider that it is good to conduct experiments more than once, to verify their own findings[4]. This tells us about the disorientation and ignorance that exists in the area of science and about scientific work and its applications.

These results at the same time are contradictory, because when asking students about their future expectations, 41% of them stated that they would like to work in an occupation that requires more advanced scientific training, while the OECD average is 24 % and the percentage remained high even in the students who did not manage to obtain the basic level of knowledge in sciences, of which 36% declared having such expectations against an average of 13% of the member countries[5].

[2] OCDE. (2016). Programa para la evaluación internacional de alumnos (PISA) Resultados. OCDE. p 1.
[3] *Ibid* p 2
[4] *Ibid* p 4
[5] *Ibid* p 4

On the other hand, most of the students who participated in PISA 2015 declared having enjoyed and being interested in learning science, and a point in favor for Mexico is that on average in OECD countries, boys tend to report this more than girls. In contrast, in Mexico there are no significant gender differences in the level of enjoyment of science, which is the highest among the OECD countries. Similarly, there is no difference between boys and girls in their levels of instrumental motivation to learn science, which is also the highest among the OECD countries[6].

Reading these results can be both disturbing and very encouraging, on the one hand, we have students who have not been able to access the sciences due to lack of materials to work, lack of laboratories, lack of training in teachers and the enormous economic differences that occur in all regions of the country that result in very low levels of learning. But those same students show great enthusiasm about learning in this area. This means that the interest and willingness of the students to be close to the sciences exists, however, there is a lot of work and deep analysis that we must carry out in order to establish short, medium and long term measures.

Why study educational problems in the context of an international master's degree in industrial heritage? What is the importance of having educational systems that bring students closer to sciences? Why should it be seen as a concern of relevant importance to carry this type of discussions at a political level?

These questions may seem easy to answer for those of us who are closely related to the scientific world, but many times in my personal experience and mainly in my country as we have seen in the PISA surveys, there is a lack of understanding of what is the role and the importance of scientific education.

Analyzing the data more closely we can realize that the correlation is not so direct or so obvious when is viewed from the outside, that is why for someone who is not an expert in the field, it can be difficult to understand the working between this league. Public policies that promote investment in education are usually very long-term and people who manage government budgets are often not experts in science and technology, which may prevent them

[6] *Ibid* p 5

from seeing the intimate relationship that exists between science education and its development with leads to generation of technology and economic growth and welfare of society.

That's why it is important to have analyzes and studies and promotes the understanding of these relationships and that give us the capacity to respond to current needs. With the writing of this project, you may end up with more questions than answered answers, but to understand a problem it is necessary to start a broad questioning, because only in this way will you be able to obtain clear solutions to our current needs.

Societies evolve, change, do not remain static and 200 years ago the thinkers began to question about how the new society should be organized that starts to being agglomerated in industrial cities, with very different and new needs, some were visionaries, while others waited a bit more to make judgments or demand some changes. As I mentioned before, each nation and each town has its history and it develops according to its political, social and geographical context.

The transition from agricultural society to industrial society in the second half of the nineteenth century brought a tremendous economic and demographic growth and the people of that time had to find solutions for the new organization of society and had to develop strategic plans for social protection, territorial planning and infrastructure development.

Currently in the same way that in the past we are in a society that has changed by leaps and bounds, where new technologies are invading all sectors of our lives and the way of life. Now we are in an interconnected world where the decisions that are made today in one country have the capacity to affect another, where ideas arrive in just seconds to the other side of the world, where knowledge can be stored within the network and be accessible 24 hours of the day with just one click.

We are also suffering the consequences of a world that has been overexploited and plundered in its natural resources, where the race for trade and industry are exhausting the plantet and it is precisely for these reasons that for society it seems that the problem lies precisely in the industry and so often talking about this issue is very difficult without fighting against many preconceptions that have been dragging from the past.

Throughout my experience in this master, I had the opportunity to meet many people from different nationalities and when talking about my studies in history and industrial heritage, it was always very difficult to make people understand the importance that it has had for society and the reasons why we should value and protect it, however, the majority answered that it was not worth protecting or saving the memory of something that had been bad, that is a symbol of labor exploitation, pollution and waste of resources. But these daily problems for talk about my project out of university made me believe more in the need to explain the reasons why industrial development has not been only negative for society, since we are a consequence of this historical process.

The Industrial Revolution was a new starting point in the history of humanity, it can be compared to the appearance of monotheism or the development of language, and despite all the stigmas that revolve around it, the reality is that in Perkin's words it was a revolution that gave men access to livelihoods, in control of their ecological environment, in their ability to escape tyranny and the pettiness of nature, opened the way for complete the domain of their physical environment without the inescapable need to exploit one another [7].

The way in which goods and services were produced changed the nature of family, the status of women and children, the role of the church, how people maintained their rulers and maintained to the poor, what they knew about the world and what they wanted to know[8].

The new industrial life introduced changes in many aspects of daily life and one of those that has most influenced the constitution of our new societies have undoubtedly been the changes in education systems and mass education, which initially amounted to literacy of all. But this process is closely related to the Industrial Revolution because mass education was introduced in societies by a need of shaping the new workforce according to the new requirements of the economy and the city[9], they looked for to continue improving the production systems for which the creation of new technologies was transcendental.

[7] Mokyr, J. (1987). La revolucion industrial y la nueva historia económica. Journal of Iberian and Latin American Economic. p. 203-204
[8] *Ibid* 204
[9] Brunner, J. (2002). Globalización, educación, revolución tecnológica. . Educación Superior, p 114-115

It is thus and under this political and social context of new needs generated by an industrial society that in 1810 Wilhelm von Humboldt decides to create the University of Berlin, introducing transcendental changes that broke many paradigms of what was considered traditional university education at that time but this topic will be more widely discussed in the next chapters[10].

The objective of this work is to understand which were the practical, educational, scientific and technological objectives for which the University of Mexico and its School of Higher Studies were created. And what were its impact on the country's scientific and technological education. But for this it is necessary to go to the origins of this institution and go back in time to the Ecole Practique des Hautes Etudes (EPHE) in Paris since it was the institutional model chosen by Justo Sierra for the creation of the Mexican school.

[10] Mitchell, A. (2006). Bachelor of what, master of whom? The Humboldt myt and historical transformations of higuer education in German-Speaking Europ and the US. European Journal of Education, p 246.

Organization of work

In order to achieve the objective of this work, research was carried out in both primary and secondary sources and because of its binational collaboration, part of the research was carried out in the Mexican archives, specifically in the Archives of the National School of Medicine, where the main documents and letters of the directors of the Escuela Nacional de Altos Estudios (ENAE) are located. On the other hand, in the French sources, I had access to the Archives of the National Library of France, especially to the reports that Victor Duruy published while he was Minister of Public Instruction.

Electronic resources and scientific journals were also used. The consultation of books was done in both electronic and physical media, the main institutions visited in France were the libraries of the Center Pompidou, Bibliothèque Nationale de France, Bibliothèque Interuniversitaire de la Sorbonne and local libraries belonging to the network of public libraries in Paris. Electronic consultation was also carried out in CAIRN and GALLICA.

In Mexico City, the main resources were obtained from the Archives of the School of Medicine and the library of University Studies, where the letters of the directors of the ENAE and Justo Sierra were consulted. Electronic resources were also used, such as the National Newspaper Library of Mexico online and scientific journals indexed to databases such as SCIELO

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Chapter II

Résumen

Il n'est pas possible de parler de l'enseignement supérieur ou de la création d'universités sans comprendre ce qu'est une université. Afin de nous présenter au sujet, le chapitre commence par une brève explication de l'histoire des universités. Après avoir compris l'importance de ce type d'institutions éducatives, on analyse les conséquences technologiques de la stabilité de l'association et de l'institutionnalisation de l'éducation.

Ces avancées scientifiques ont eu pour conséquence l'introduction de nouvelles technologies dans les zones de travail, augmentant et facilitant la production, la transformation et l'extraction des matières premières, ce qui a entraîné de nombreux changements sociaux et culturels. Ces changements ont à leur tour généré de nouveaux besoins qui ont permis de répondre à la nécessité de générer des connaissances qui apporteraient une solution aux nouveaux modes de vie.

C'est ainsi que commence une dispute pour la production de technologie. Cela a été introduit non seulement dans les sphères universitaires, mais a également rempli l'imaginaire culturel, l'art et l'architecture, un exemple de sa grande portée sont les expositions universelles qui ont fait de nombreux pays industrialisés.

La nécessité de continuer à produire des technologies de pointe a obligé a les gouvernements à introduire des changements structurels dans l'enseignement supérieur, certains hommes visionnaires comme Humboldt et Victor Duruy ont été les pionniers dans l'établissement des premiers liens entre l'université et l'industrie. Dans ce chapitre, nous parlerons de ce processus de changement dans l'éducation nationale et les idées de Victor Duruy à ce sujet.

The invention and evolution of university

The university is an institution, according to Walter Rüegg "European par excellence" and emphasizes in its assertion that it is the only institution that has preserved its basic patterns throughout history. But, what are those patterns that characterize a university?

To carry out an analysis the creation and historical course of a university, it is necessary to throw ourselves into the roots that gave rise to the creation of this type of institutions as we know them, the thoughts of those who created them and the philosophical and scientific base that gave rise to these ideas.

To begin this first chapter, we will start from the idea that, when speaking of an educational institution like the Universities and their origin, the information or the debate cannot be simplified to a need of knowledge production or the emergence of an educational conscience. This is rather a process that occurred slowly, and these institutions are heirs of a long history[11].

We know in advance that different kind of schools existed since antiquity, so giving the exact date of the creation of the first university seems an impossible task for historians, and with each investigation new information changes the perspective on its creation. Since from ancient Greece there were already schools of higher education. These schools gradually matured to give rise to universities as we know them today, integrating more and more innovative elements that allowed perfecting the teaching and research methods.

The current university has its origins in the Middle Ages, around the twelfth century being the product of various political and social issues of the time, so we can say that in its entire structure it is a product of its time and as such in its origins It has great influences of the Islamic tradition that during its expansion through Europe were widely introduced by the

[11] Charle, C., & Verger, J. (2012). Histoire des Universités XIIe XIIe siècle. Presses Universitaires de France: Paris.

territory, but acquired its own European and medieval personality to receive the protection of kings and popes who promoted the study of scholastic[12].

Currently within the universities we can see day by day the development of activities that are part of the daily life of those who make up the institution, such as the free association of students, scientific research, the exchange of ideas between teachers and students in a free way, and the autonomy to manage and make decisions.

As we have mentioned, the maturation process of the universities was gradual and, in order not to venture to give the prize of their invention to any city or country, demeriting the others, the only thing we can assure is that the Universities of Paris, Bologna and Cambridge compete for that place since the three are contemporary[13].

One of the main characteristics that defined the universities and separated them from the old schools of higher education was the formation of conglomerates of teachers and students, which gave some autonomy for the transmission and discussion of knowledge. In addition, they sought to obtain rights and in the case of Bologna, the most important step was the implementation of salaries, which allowed teachers to remain fixed in one place.

These educational institutions did not remain isolated from society, they interacted and fed back to each other, which is why some cities were more prone to its creation and although we can not say exactly what were the external factors that facilitated its formation we know that the social conditions, the economy, the politics, the bureaucracy and the papal power had a great influence[14].

But what was the different agents, popes, emperors, princes, bishops, municipal authorities, aristocracy, bourgeoisie, peasants, students and teachers expected to obtain from the university? Without doubt everyone wanted education and scientific support in their struggle to survive, the church and politicians wanted sustenance to strengthen their domain, students and teachers sought knowledge and acquire a social advantage, the residents of

[12]Makdisi, G. (1981). Rise of colleges. Edinburgh: Edinburgh University Press. pp 286-289.
[13] Charle & Verger. *Op Cit;* p. 7.
[14]Rüegg, W. (1992). Volume 1 Universities in the middle ages. Cambridge: Cambridge University Press; p. 11.

university cities wanted to improve their future, but these purposes do not sustain by themselves the need for a university and especially its survival over the years to the present.

Before continuing and immersing ourselves in our study subjects, we must take into account that each case is different, each region and each population responds to specific needs and in this chapter we will dedicate specifically in the analysis of the creation and evolution of the university of Paris, this is because the evolutionary process of this school that gave rise to its structural and bureaucratic model served as a model for the creation of the National University of Mexico and its School of Higher Studies.

When we talk about the history of universities and their invention, one of the main characteristics that mark the before and after in the evolution of these educational institutions is the formation of associations either of students or teachers who sought through the formation of unions, independence and defend some rights.

In Paris it is important to mention that, unlike the Mediterranean universities associations of teachers and students were formed, On the other hand in the mainly Italian case, the associations were students who sought to protect their rights. The dominant disciplines were the liberal arts and theology, while the ecclesiastical footprint remained strong. In the Mediterranean universities, the associations left the professors more or less out and the subjects were medicine and law, that implied students of higher socioeconomic level and the ecclesiastical power was preserved outside the institution[15].

What is now known as the Parisian university model corresponds in fact to the way in which the University of Paris was born, favoring a process of institutionalization that was completed from the 12th to the 13th century. While, in the north of Italy, around Bologna and Padua a completely different process was carried out[16].

This university was constituted in l'île de la Cité, Teachers and students met every day around the first church of Notre-Dame, in the Rive Gauche, where they enjoy an enormous independence. Around Sanint-Julien-le-Pauvre, between Boucherie and Garlande streets. There were the regular professors of Notre-Dame and the clerics of Saint-Victor and Saint-

[15] Charle & Verger. *Op. Cit* ; p. 14.
[16] Renaut, A. (1995). Les Révolution de l'Université: Essai sur la modernisation de la culture. Paris: Calmann-Lévy ; p. 50.

Geneviève, also the added professors who had received from the monk in charge and in the name of the bishop the permission to teach "licentia docendi".[17]

This panorama attracted numerous students to private houses or cloisters that opened in Geneviève. Paris takes fame first from theological teaching, which is at the top of school disciplines, however the use of Aristotelian philosophy and reasoning made the dialectic triumph. So for some people, Paris becomes a light city and source of all intellectual satisfaction, while for others it becomes a den of the devil where the perversity of spirits conquered by philosophical depravity and the awkwardness of a life turned to wine, game and women[18].

What is certain is that, of the schools destined to train clerics under the authority of the bishopric of Paris, human wisdom was taught, the sacred and profane, which included the seven liberal arts (grammar, dialectics or art of reasoning, rhetoric, geometry and music) after the arts, the theology as specific knowledge for clerics, canon law and medicine[19].

The students, despite being future church people, always showed signs of freedom, which led to a marked propensity to create fights of great violence that sometimes left dead. These disputes could be given to the population or to the municipal authorities. This situation led to the creation of a unity among the schools, that ended up designating all of them as "universitas"[20].

The 13th century is the century of the universities because it is the century of the corporations. In each city there is an office that groups a considerable number of members, who in turn organize themselves to defend their interests, establish monopolies from which they will benefit. It is the institutional phase of the urban impulse that materialized in communes the political freedoms conquered and in corporations the positions acquired in the economic domain[21].

Two facts marked the formation of the university. The first of them in 1200, when during a fight with the inhabitants of the neighborhood, several students were killed by municipal

[17] Le Goff, J. (2006). Os Intelectuais na Idade Média. Rio de Janeiro: José Olympio ; p. 44.
[18] *Ibid* ; p. 44.
[19] Renaut, A. Op. Cit ; p. 50.
[20] *Ibid* ; p. 52.
[21] Le Goff. Op Cit; p. 93.

police next to the Abbey of Saint Germain des Prés. The masters threatened the king to leave Paris. Philip Augustus fearing that the glory of the schools of Paris would be displaced towards other cities, made the decision to eliminate the provost and the guilty were sentenced to life imprisonment. Later, they got a letter from the king where he assured security devices and resolved that if a student was arrested for having committed a crime, it would be remitted to secular justice in criminal matters and only in the case of a serious crime should be given notice and keep abreast of the real justice of the resolution of the case. This act is called by historians "privilege of Philippe Auguste" and according to professors and students of Parisian schools, constituted the first step for the creation of the university institution as L. Liard calls it a "State within the State"[22].

The next step to obtain total university autonomy was given by a conflict between the professors and officials of the bishopric, since it was usual a financial traffic whereby the candidates bought their diplomas. This situation diminished the credibility of the teachers in the schools and left them with less weight.

Finally, in 1212-1213 the teachers decided to make a call to the Pope and from 1219 to 1225 began a severe struggle of excommunication and strikes where the Pope served as arbitrator, notably in 1215 when he sent a bull that constituted expressly the schools as a university giving right to teachers and students to confederate and close schools if any member of the community was in serious danger. This power gave them all sovereignty over exams and programs[23].

By 1250 in Paris they already had organized faculties: the preparatory faculty of arts, the superior faculty of medicine, the canon law and the theology faculty. All of them were directed by a dean. In the arts students and teachers grouped according to their origin of birth in four nations (France, Normandy, Picardy and England) at his head appeared in 1245 an elected Chancellor, he will be imposed as director of the entire university, but his power it is reduced due to the presence of the general assemblies of nations and faculties. Subsequently the creation of schools in 1257, designed to receive poor students will begin[24].

[22] Cité dans *ibid* ; p. 53.
[23] Cité dans *ibid* ; p. 54.
[24] Charle & Verger. *Op. Cit*; p. 16.

The first schools were founded around the thirteenth century, they assured the student food and house to continue their studies, but later the donations of princes, men of the church or great royal officials began to favor them by donating libraries or giving specific courses inside the institution, displacing the power of the faculties that would have only the function of exam certification and graduations. To mention an example, Robert de Sorbon donated for a score of students a library of 1800 volumes and courses inside the school[25].

As we have discussed in the previous paragraphs, the process of autonomy of the Parisian University was gradually given through different events that promoted the separation of the church and the acquisition of certain real concessions that allowed them to self-manage. But why did the authorities, both ecclesiastical and real, allow those favors to an institution that previously lacked power?

To answer this type of questions it is necessary to understand the social and political context of the time, a very complex situation that has already been studied by many historians, but summarizing in a concrete way the reasons of the state, we can say that the power that the university took is simply an answer to the need of the state that expected the formation of competent lawyers and jurists whose administrations were in need of development, also expected to contribute to the elaboration of the national and monarchical ideology that accompanies the birth of the modern State[26].

In addition, the cohesion and determination of the guild, got them an all-powerful ally, the papacy. In Paris it was Celestino III in 1194 who granted his first privileges and Innocent III and Gregory IX secured their autonomy through the famous bull *Parens scientiarum*. And also since the year 1229 the Pope had written to the bishop:

While a wise man in theology is similar to the morning star that shines in the midst of the fog and should illuminate his homeland by the splendor of the saints and appease the discord, you were not content to violate that duty more, according to statements of people worthy of faith, it was because of your conspiracies, the river of teaching of the high letters, which, after the grace of the holy spirit, irrigates and fecundates the paradise of the universal church, left its bed, that is , the city of Paris, where it was exhibited until then. Consequently, divided

[25] Cité dans *ibid* ; p. 21.
[26] Cité dans *ibid* ; p. 22-23.

by many places, it was reduced to nothing, in the same way that a river dries from its bed and transformed into several small currents[27].

In different ways, political control will be felt on the universities by means of restrictions on the exercise of freedoms and privileges, interventions in the nominations of professors and the recruitment of students. In exchange for staying under the common order of the reign, the university graduates obtained certain financial rewards such as teacher salaries, as well as the promise of successful careers. The University of Paris tried to resist giving up its autonomy, but finally cedes, and at the end of the 15th century the universities are a well-established institution but very different from those that gave them origin, always linked to a principality or a city, what cannot be left in doubt is that they will always retain that status of monopoly that grants them institutional power, which they will fight to defend until the French Revolution that completely changes their fortune.

One of the greatest threats was the schools founded by the Jesuits that in 1618 were authorized by the king to give courses, to which the already established Sorbonna was opposed of live hand, reason why it was ordered that they were put under all the regulations of the university, it also decree that academic degrees could only be conferred by their schools. Finally, these decrees were broken by royal power, which meant a triumph for the Jesuits until their expulsion in 1762[28].

No doubt the support conferred on the Jesuits was nothing more than an effort to dismantle that State within the State that the academic corporations had tried to build, and although its expulsion would seem to be a triumph for the university, 30 years later the Revolution will dissolve the corporation creating the great schools to replace it. Although the University will be restored once again, it will never be a true monopoly like before.[29].

In 1793 the Convention of September 15 approved the abolition of the university leaving only some large establishments such as the College of France, the King's Garden that was transformed into the Museum of Natural History, the Paris Observatory and specialized schools such as the School of Mines and that of Roads and Bridges (Ponts-et-chaussées,

[27] Le Goff. *Op. Cit;* p. 98.
[28] Renaut. *Op. Cit;* p. 68.
[29] Cité dans *ibid* ; p. 69.

Mines). In addition, medical schools were restored, replacing the faculties of Paris, Strasbourg and Montpellier[30].

The reconstruction of higher education was made continuously with certain innovations of the eighteenth century but in opposition to the opening of the radical phase of the Revolution and the decadent treaties of the eighteenth century. Three points dominated the reorganization of the education sector: 1) give the state and the postrevolutionary society the necessary guidelines for the stabilization of a convulsed country; 2) closely control their training in accordance with the new social order and 3) avoid the reactivation of new professional corporations[31].

This despotism explains the predominance of the school system and not the reorganization of universities; the tyranny of the state diplomacy, which gave the right to work or the exercise of a specific profession; the importance of classifications and competences, even in the sectors that do not need precise regulations or uniform programs and finally the monopoly of the accumulation of degrees by the state. A recreation of a corporation was attempted at the University, which included the secondary and superior teaching staff, but it is a supervised corporation integrated into the hierarchy of the bodies that make up the new state[32].

This system implied a narrow division of work, a specialization of formations, and therefore a divergence with the new university ideas that Wilhelm von Humboldt had begun to introduce in Germany of which we will speak later. The faculties of letters that in the German model are the natural place of tendency and innovation, in France they were vegetative or they never fulfilled that role. The little and essential innovation or research is done in large establishments such as the Sorbonne or the College of France[33].

[30] Charle, C. (2007). Que sais -je? Histoire des universités. Paris: Presses Universitaires de France.
[31] *Ibid;* p. 71.
[32] *Ibid;* p. 71
[33] *Ibid*; p. 71

Universal exhibitions

While all these processes of institutionalization were carried out, in parallel a new phenomenon began to transform societies and it is around that time when the modern experimental sciences that had being developed thanks to the Universities start to generat a technically usable knowledge, despite that these opportunities of application only occurred with posterity until arrived the centuries XVIII and XIX, until that moment the modern science had not contributed too much to the technical development[34].

In the words of Jürgen Habermas "The progressive rationalization of society depends on the institutionalization of scientific and technical progress. To the extent that science and technology penetrate the institutional spheres of society, they transform the institutions themselves"[35]. What we can understand, is that this process of institutionalization of the universities reached even the scientific field, which allowed to integrate the use of new knowledge into daily and economic life, this is through a process of social transformation that gradually began to enter at the time of industrialization, commonly called by historians "industrial revolution".

But what is the industrial revolution? We will take the definition of David Landes who tells us that "The term industrial revolution usually refers to the complex of technological innovations that by substituting human skill for machinery and human and animal strength for mechanical energy, causes the shift from artisanal production to factory, thus giving rise to the birth of the modern economy"[36] According to this definition, an industrial society is one that knows how to take advantage of technological development to replace the energy provided by humans and animals, and also maximizes the use of mechanical energy to increase production.

[34] Chavez Palacios, J. (2004). Desarrollo técnologico en la primera revolución industrial. Revista de Historia ; p.96
[35] Habermas, J. (1986). Ciencia y técnica como ideología. Madrid: Tecnos ; p 53
[36] Landes, D. (1974). Progreso tecnológico y revolución industrial. Madrid: Tecnos ; p. 15

But these technological advances and their business applications continued in a convergent direction, so that one change generated another change, and in that sense, another characteristic of the industrial revolution can be established, based on the principle that, once the process has begun, this process prolongs indefinitely. The takeoff leads to the development that sustains itself. And it is that a new product produces the demand of others. One invention gives rise to the next and the same invention becomes a habit. This dynamic is clearly seen in the technological improvements and its dependence on the progress of other related activities. It was entered into a dynamic that required invention, diffusion of machinery and production that is the key to industrial development[37].

With the Industrial Revolution began a cumulative process of self-powered technological advances, which gave a never-before-seen importance to scientific advances. Financing scientific research stopped being a patronage activity, it sought to find real applications to the discoveries made by the wise, the invention was promoted, and ideas always shared in search of generating new advances that could be translated into improvements to the production systems.

An example of the importance that the spread of scientific advances had at that time is the creation of universal exhibitions. The first of these meetings took place in 1796 when the magistrate François de Neufchâteau had the idea of entrusting a special commission to inspect the manufactures of Sevres, Gobelins and Savonnerie, realizing that many of the products did not find a buyer , decided to make a fair to expose the production to the public and meet with manufacturers and merchants[38].

Thanks to the success of these fairs, which attracted large audiences, Neufchâteu decided to organize the first national exhibition of products of the industry in Champ-de-Mars from September 18 to 21, for which 110 exhibitors showed up. These developed so well and between 1801 and 1849 there were 11 of these national exhibitions in France[39].

[37] Chavez Palacios. *Op. Cit* ; p 5
[38] Ageorges, S. (18 de juin de 2018). Sur les traces des expositions universelles, Paris,1855 - 1937. Obtenido de expositions-universelles: http://www.expositions-universelles.fr/1855-exposition-universelle-paris.html
[39] *Ibid*

Later and due to the political turmoil that existed in France, the first true Universal Exposition, with the presence of different countries takes place in England when in the 1850s Prince Albert organizes "The Great Exhibition of The Works of Industry of All Nations" . In order to welcome all the people that this event gathered, it was necessary to make an international architecture competition that sought to choose an original, modern and innovative design. The chosen project was a glass-like building that was named Crystal Palace and built by architect Owen Jones[40].

In order to understand the dimension and importance that this event had taken, it is enough to see the incredible investment that was made in the construction of this building, for which 5000 workers were used, the central gallery with a height of 30 meters, to preserve a forest of old trees in its interior and average 560 meters long with an area of 8 hectares, the exhibition tables were 13 kilometers long. The exhibition was divided into four large sections: raw materials, machines, manufacturing products and art objects. The main exhibitor next to England and in the center of the gallery was France[41].

Fig 1. Crystal Palace built specially for the exhibition "The Great Exhibition of The Works of Industry of the Nations"[42]

[40] Ageorges, S. (15 de Juin de 2018). 1779, première exposition nationale dans la ville de Saint-Cloud. Obtenido de expositions universelles: http://www.expositions-universelles.fr/1851-exhibition-londres.html
[41] *Ibid*
[42] Recoopered on http://www.expositions-universelles.fr/1851-exhibition-londres.html

Subsequent to the British exhibition, Napoleon III decided by imperial decree on March 8, 1853 to organize the first Universal Exposition in France similar to that of London. According to Article 1. A universal exhibition of agricultural and industrial products will be inaugurated in Paris at the "Palais de l'Industrie", on May 1, 1855 and will be closed on September 30 of the same year. A second decree proclaimed months later will link this exhibition to one of fine arts located in a different building[43].

For the realization of this project, in the same way that it was made in London the construction of a permanent palace of the industry was ordered to Champs-Élysées, which had to rival the Crystal Palace, reason why the architecture in glass remained, although French architectural conservatism decided to install stone walls. Contrary to the old Parisian exhibitions, this had a cost of one franc for the entrance, but free tickets were distributed for the workers[44].

Fig. 2 Interior of the palace during the universal exhibition of 1855 lithography recovered from http://www.expositions-universelles.fr/1855-exposition-universelle-paris.html

This innovation event had 23,954 exhibitors, all for commercial purposes, that's where the general public discovered the lawn mower, the washing machine, the 6-shot revolver of M.

[43] Ageorges *Op. Cit.*
[44] *Ibid*

Colt and the locomotive, the first vehicle that moved thanks to oil, Singer's sewing machines and a talking doll. Also, another type of demonstrations were exposed like the one of Foucault where the same one demonstrated to the visitors that the Earth turns thanks to its pendulum that still is conserved at the museum of Arts et Metieres[45].

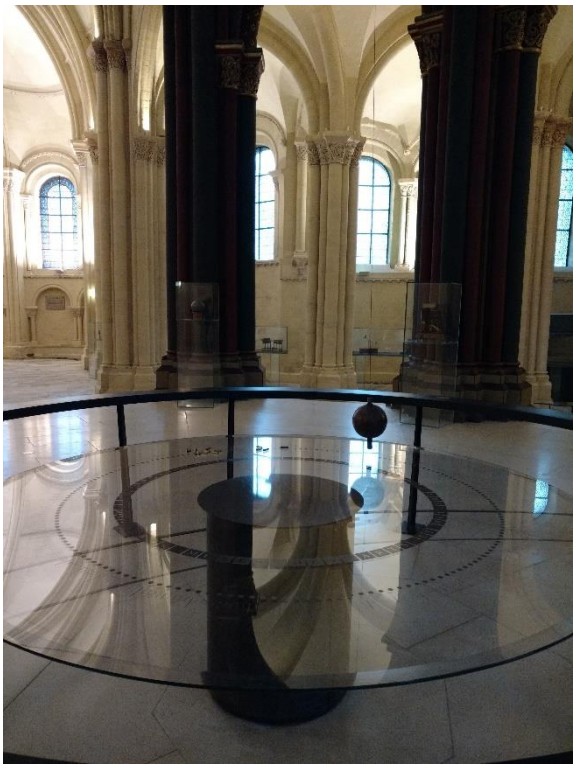

Fig. 3 Pendulum with which Foucault demonstrated in the universal exhibition of 1855 that the earth turns. Photo taken inside the Musee des Arts et Metieres in Paris, January 2017.

The prize-giving ceremony was attended by 40,000 people on November 15, 1855 and by the closing date of the exhibition in mid-November, around 5 162 330 people had visited the palace of the industry. The cost of the exhibition was 11,340,000 francs and the recovery of 3,200,000, so the deficit is around 8 million francs, however, we can consider this a real operation of prestige that served to show the other nations the greatness of France, which at the same time will allow Napoleon III to consolidate his position[46].

[45] *Ibid*
[46] *Ibid*

From this first large exhibition many more happened, that each time required large investments of money not only by the recipient country, but also by the countries that presented themselves and had to cover the costs of sending their delegates at the time when transportation was not so simple. Later these exhibitions took a lot of prestige and for the one of 1867 began what would be called architectures of exhibition, ephemeral buildings constructed only with the purpose of showing temporarily the cultural essence of the country or of a civilization, example of it, is the pavilion that Mexico intended to build in the Universal Exhibition of Paris in 1867 for which it was decided to make a replica of Xochicalco pyramid[47].

Fig. Pavilion of Mexico in the universal exhibition of 1867 Temple of Xochicalco photograph by Pierre Petit, National Archives of France F/12/11872/2

For this project, it had been planned 25 m long and 18 m wide, it would be made up of two levels joined by a stairway and in the exterior part would be applied some molds of the monument, as well as paintings and objects. On the ground floor would be placed in the 200 m^2 showcases with specimens of the fauna and flora of the country, as well as prints, plans and photographs[48].

[47] Barbosa, R. (10 de junio de 2018). O desenho e a arte industrial. Obtenido de casaruibarbosa.gov.br: http://www.casaruibarbosa.gov.br/dados/DOC/artigos/rui_barbosa/FCRB_RuiBarbosa_ODesenho_e_a_ArteIndustrial.pdf p 3

[48] *Ibid;* p 3

Due to the political turmoil in Mexico, this project could not be carried out and instead only a replica of the pyramid was created, financed by its designer Léon Méhédin. Medéhédin sought to recover part of its investment by charging entry to the site in addition to having received authorization from the general curator of the exhibition to make a profit from the sale of coffee and ice cream. This presentation generated much commotion among the attendees and journalists, it was a success that fed the curiosity and later for the Universal Exposition of 1889 Mexico would be present again, this time with a much more elaborate project in which it pretended to show the wealth and country advances[49].

This exhibition was the precedent of these new demonstrations that wrapped the cultural with the scientific and are the tangible representation of the importance that at a social level technological advances were having not only in the academic life within the closed university circles. The Universal Exhibitions were also popular manifestations destined to an extensive public of unequal cultural level, they tried to impress the imagination and the sensitivity[50]

The world was changing, from its economic structure to the social one. These fairs were not limited to a context of sales or production, but became true centers of social encounter, cultural exchange and development of the arts. Industrial life was changing the way we see the world, international relations at the commercial level became essential, the exchange of technologies and knowledge became a necessity, so that countries and kingdoms were no longer closed to public demonstrations of the scientific advances achieved, which integrated all aspects of daily life, including artistic expressions, architecture, literature.

This new society was delighted with the progress, science began to be part of the cultural imaginary, in the words of Rui Barbosa the exhibition of London in 1851 was the beginning of a new era, it did for art what Socrates for philosophy, even well-established structures saw their might wobble like the church. To be able to place at the head of this new battle, it was necessary to establish new strategies. The exhibition of 1862 in Paris was essential to show France that its industrial strength was declining, with the exposure of 1867 the seriousness of the situation was completely clear and forced Napoleon II to take action[51].

[49] *Ibid* ; p. 3
[50] **Fuente especificada no válida.** p 13
[51] Barbosa. Op. Cit ; p. 5

On January 25, 1863, he gave a speech where he mentioned:

"The Universal Exhibitions, are not simple bazaars but brilliant manifestations of the force and the genius of the people. The state of a society is revealed by the more or less advanced degree of various elements that make it up and as all the progresses go forward and the examination of only one of the multiple products of intelligence is enough to appreciate the civilization of the country to which they belong. So much so that to this day we discover a single object of art of ancient times and judge more or less by its perfection to which period of history belongs. If it deserves our admiration it will surely come from a date where the settled society was very well developed for war, for letters, for sciences and for the arts. It is not then indifferent to the role reserved for France, to have placed under the eyes of Europe the products of our industry: they themselves are the testimony of our moral and political state "[52].

As can be seen in the speech of Napoleon III, by the mid-nineteenth century it was obvious the importance that the sector of scientific research had taken and for the Universal Exhibition of 1867 Victor Duruy demands the integration of a pavilion dedicated to the Instruction Public and mentions that these events are the complete representation of modern society in all its modes of activity, demand to put science at the same level as its applications, from their point of view these last ones are not more than their external manifestation. In his petition to appear at the Universal exhibition, he states that he intends to create three sections organized as follows[53]:

[52] Les expositions universelles, ne sont pas de simples bazars mais d'éclatantes manifestations de la force et génie des peuples. L'état d'une société se révèle par le.degré plus ou moins avancé des divers éléments qui la composent et comme tous les progrès marchent de front, l'examen d'un seul des produits multiples de l'intelligence suffit pour apprécier la civilisation du pays auquel il appartient. Ainsi, lorsque aujourd'hui nous découvrons un seul objet d'art des temps anciens, nous jugeons par sa perfection plus ou moins grande à quelle période de l'histoire il se rapporte. S'il mérite notre admiration, soyez sûr qu'il date d'une époque où la société bien assise était grande par les armes, par la parole, par les sciences comme par les arts. Il n'est donc pas indifférent pour le rôle réservé à la France, d'avoir été placer, sous l'es regards de l'Europe, les produits de notre industrie : à eux seuls, ils témoignent de notre, état moral et politique. Démy, A. (1907). Essai Historique sur les Expositions Universelles de París . Paris: Alphonse Picard et Fils, Éditeurs ; p 109

[53] Duruy, V. (1869). L'administration de l'instruction publique de 1863 à 1869. Paris: Typographie de Jules Delalin; p 260

1) Los progresos realizados en Francia respecto a las ciencias físicas, matemáticas y naturales de los últimos 20 años, es decir desde que las grandes exposiciones existen[54].

2) Los progresos logrados por las ciencias morales y políticas y sus aplicaciones sociales[55].

3) El rol de las letras francesas, esto con la intención de mostrar que los bienes materiales han dado la libertad de poder desarrollar las artes libres lo cual desde su punto de vista ofrece una noble distracción y da fuerza y dignidad moral a la nación[56].

His request was accepted and as the man of science that he was, he delivered a report specifying how he had done his job. That they had granted him a space in the Universal Exhibition, lets us see that the advances made in economic matters thanks to technological advances were already perceived as common and social wellbeing, besides being considered the most feasible possibility of developing the arts, literature and the social sciences. In his report, he recorded the topics exposed, which included the theoretical discoveries of the sciences "where all the improvements to the industry come from" even the moral improvements and the administrative or economic reforms given thanks to the influence of the industry, mentioning that these are ideas that literature propagates, in addition to their applications in political and social sciences[57].

The exhibition was integrated as follows:

1) Progress achieved by the mathematical, physical and natural sciences.

-Mathematical Sciences Geometry, analytics, mechanics, astronomy and geodesy.

-Physical sciences. Physics and chemistry.

-Natural Sciences. Geology and paleontology, botany, zoology, anthropology, general physiology, medicine and surgery, hygiene, rural economy and veterinary art [58].

[54] *Ibid* p. 260
[55] *Ibid* p. 261
[56] *Ibid* p. 261
[57] *Ibid;* p. 263
[58] *Ibid;* p. 264

2) Progress achieved by the moral and political sciences with respect to the needs of which society needs.

-Public Law.

-Administrative law.

-Legislation civil and criminal.

-Political economy.

-Right of the people [59]

3) Role and trends of French letters

-Literature, poetry and theater.

- Philosophical dialogues.

- Historical work.

-Archaeological discoveries [60].

So far we have seen since the late eighteenth century and during the nineteenth century society had truly changed, the main actors, politicians and governments could not continue to manage their institutions in the same way as they had done until then, they had to adapt to the new changes or resigning to stay behind in the race for development. The markets were no longer limited to certain regions, trade was international, the exchange of goods crossed borders and production and quality had to be maintained at the necessary pace, the first marketing campaigns began, which developed the art, inspired literature and the great industrial centers were created and the cities grew to magnitudes never seen. No doubt the world would not be the same again, a profound change had occurred and would remain permanently.

It was then that, in the context of new business needs, we sought to integrate knowledge, educate new workers, who now required certain more advanced technical capabilities and promoted the institutionalization of scientific research. These ideas were not easily accepted and required time to be processed and analyzed by the leaders of the time. In the next chapters

[59] *Ibid;* p. 264
[60] *Ibid;* p. 265

of this project we will seek to analyze the important role of the University in these social changes and how its evolution to new pedagogical and research models helped to develop and sustain this new form of social organization.

With this analysis we intend to demonstrate the importance that educational and research organizations had and still have, we also intend not to forget or lose sight of the fact that humanity keeps changing and acquiring new needs, educational systems must continue in the same way evolving and changing to adapt and continue accompanying these processes always for the benefit of society.

Educational model of Humboldt

In order to resume the course of this research and focus once again on our subject of study in France, it is necessary to go back in time and reflect on the changes that were introduced in the German educational systems as this strongly influenced future reforms in French schools, which introduced many of the innovations that had been integrated several years earlier in German universities.

According to some historians, this new university model was applied for the first time at the University of Berlin, founded in 1810 and although it is disputed whether its invention was only a product of Humboldt's ideal or of several thinkers who formed the idea of a new higher education[61], In this work and for practical purposes we will leave that discussion aside and we will call it as in a classical way it has been treated by historians German model or Humboldt model:

-Teaching freedom. Humboldt was liberal in the traditional sense, believed in individual freedom. He argued that students have as much right to decide who their teachers are and what subjects to choose as teachers to decide what and how to teach [62].

-The unit of teaching and research. For Humboldt teaching is a collaborative enterprise where the teacher is not there for the students, but both are there for science [63].

-The unity of science and scholarship. For him there was no fundamental differentiation between the natural sciences and the humanities, because the concept of erudition applies to both equally. The concrete institutional expression of this ideal was to increase the status of the so-called Philosophical Faculty, to provide theology, law and medicine with an egalitarian status [64].

[61] Mitchell, A. (2008). From Humboldt to Bologna History as discourse in higher education reforme debates in german-speaking Europe. En B. Jessop, N. Fairclough, & R. Wodak, Education and the knowledge-based economy in Europe (págs. 41-61). Rotterdam: Sense Publishers; p. 42
[62] *Ibid* p. 42
[63] *Ibid* p. 42
[64] *Ibid* p. 43

-To give priority to pure sciences over specialized professional training. Humboldt and those he cited said to understand science and erudition in the modern sense of a research process[65].

Humboldt's importance as a reformer of education is that despite having seen only the beginning of these social changes, he had the vision to realize that the direction of humanity had changed and that institutions should adapt to the needs that were generated in a world that was beginning a new era. Its ability to take precedence over the challenges that would arise from the new economic models and city management and work organization were key to the future success of Prussia as an economic and industrial power. That is why later in France it is resorted in several occasions as we will see more ahead to make analysis of the German educational systems, then, for half of century XIX the capacity of this country for innovation and adaptation was obvious.

The history of the German university of the first half of the 19th century is characterized by certain phenomena. In the first place, a vigorous growth of the students that happened of 4900 in the year 1815 to 9876 in the year 1825 to culminate in 15838 in the year 1830 and stagnant around 11000 in 1860. This growth allowed the salaries of the faculty improved, giving freedom for teachers to devote themselves to other things such as research[66].

The numbers of students by subject changed of balance, they stopped being majority law or theology and they overturned by the medicine and philosophy (letters and sciences) that by 1830 had 21.5 and 40.3% of the total of students. The ways of teaching evolved as well, the courses multiplied and seminars appeared in the new disciplines such as philology, history and later mathematics and physics. Laboratories or clinics were also opened in order to train specialists or future teachers and sages[67].

Meanwhile in France for 1833 Victor Cousin the future minister of public instruction, makes a report on German universities. Undoubtedly he was the first to call attention to a system that was particularly attractive to the French vision of the time, because after the suppression of universities because of the Revolution, France had not been restored in the

[65] *Ibid* p. 34
[66] Charle, C. (2007). Que sais -je? Histoire des universités. Paris: Presses Universitaires de France. p 65.
[67] *Ibid ;* p. 66

field of higher education and only some faculties isolated from each other had been restored and none specialized on a specific branch of knowledge, this is what enhances Cousin's analysis and what gives rise to that violent vision in contrast to Germany.

The organization of the French universities appears globally more fragile than in the other countries of Europe, in short, they had an inability to adapt to the social and intellectual mutations that had appeared during the last centuries. Some reforms ended up remedying the most obvious faults, but it was always painful processes and traumatic shocks that ended up strongly modifying the rules of the game. In fact, in each critical period a new university was formed, this reorganization allowed to subsist fragments of the old regime, encompassed in new structures[68].

Victor Cousin writes it in one of his reports sent from Prussia.

"It is unusual to see, in France, the various faculties of which a University is composed separated from one another and as lost in isolation. Indeed, if one tried to give the spirit an exclusive and false culture, if one wanted to make frivolous literates, scholars without general lights, prosecutors or lawyers instead of jurists, I could not indicate a better way to achieve this result than the diffusion of faculties. We have about twenty miserable faculties scattered across the surface of France, without any real focus of light. Let us move forward to replace these poor provincial faculties, everywhere languishing and dying, great scientific centers rare and well situated by some universities as in Germany, with full faculties, supporting each other. Mutual lights, mutual movement.[69]

The originality of Cousin's report was to connect two realities: the lack of the university institution in France and the propensity of French education to train professionals more than

[68] Charle, C. (1994). *La Republique des universitaires 1870-1940.* Paris: Éditions du seuil.

[69]Charle, C. (2007). Que sais -je? Histoire des universités. Paris: Presses Universitaires de France « Il est inouï de voir, en France, les diverses Facultés dont se compose une Université allemande séparées les unes des autres, et comme perdues dans l'isolement. En vérité, si l'on se proposait de donner à l'esprit une culture exclusive et fausse, si l'on voulait faire des lettrés frivoles, des savants sans lumières générales, des procureurs ou des avocats au lieu de jurisconsultes, je ne pourrais indiquer un meilleur moyen, pour arriver à ce résultat, que la dissémination des Facultés. Hélas ! nous avons une vingtaine de misérables Facultés éparpillées sur la surface de la France, sans aucun vrai foyer de lumière. Hâtons-nous de substituer à ces pauvres Facultés de province, partout languissantes et mourantes, de grands centres scientifiques rares et bien placés, quelques Universités, comme en Allemagne, avec des Facultés complètes, se prêtant l'une à l'autre un mutuel appui, de mutuelles lumières, un mutuel mouvement » *apport sur l'instruction publique dans quelques pays de l'Allemagne et particulièrement en Prusse,* 1833, t. I, p. 179.

people of knowledge, so the boldest suggestion was to recreate the universities to the German and not exactly revive the organization of medieval inspiration[70].

In his report, he also stressed the importance of the existence of a ministry of public instruction, which had been placed at the same height and in the same rank as all the other ministries in the country and had everything related to the institutions of public health and medicine, so that ministry was called "Ministry of public instruction, of cults and medical affairs"[71].

Another of the educational issues in Germany that caught his attention was that science and academies, libraries and all the analogous institutions such as botanical gardens, museums, clinics, schools of surgery and medicine, music institutions were encompassed in ministries and mentions that "it is quite natural that the minister who directs the faculties of medicine direct the lower schools of medicine, as well as the minister who has in his hands the faculties of letters and sciences have control of the scientific and literary academies[72].

Although in the same report he writes:

"Undoubtedly there are always some things that are a bit arbitrary in all the classifications, and in Berlin there are some establishments that are fought by the ministers of interior and public education, but in general there is a line of separation that clearly divides its attributions, since the interior minister understands in principle the institutions that have relation with the application to the industry, to the commerce and to the public works, even though there are some chairs taught in these. I know that in France it is not like that, because most of the establishments of sciences, arts and literature, are not under your attributions, that is something with which I do not agree and I reproach it vividly, and it is not under the interest of increase your power, but under the obvious interest of the arts, letters and sciences, in addition to public instruction that is practically without bases and deprived of the instruments it needs[73]".

[70] Cité dans *ibid* ; p. 96.
[71] Cousin, V. (1833). Rapport sur l'état de l'instruction publique dans quelqyes pays de l'allemagne et particulièrement en la Prusse. Paris: F.G. Levrault. p. 149
[72] *Ibid;* p. 149
[73] *Ibid;* p. 149

In Europe there is no country that does not have universities, in Germany there is a fortnight, in France there were several in the middle ages and Paris was considered the first and the most famous of all in Europe. But to call any institution of public instruction University is to impose a strange meaning on a word that already had a perfectly defined and very different meaning. It is to corrupt to the pleasure the use and the habits of the language and its use is disastrous to refer to the whole assembly of the public instruction. In France now there are only universities on the constitution of faculties, separated from each other and scattered as special schools without any relationship, without any spirit in common and without any life[74].

This report on public instruction was undoubtedly what opened the way to the new Humbold model in France, the harsh criticism against the implemented educational system starts and discussions began, but despite this it had to be a long time before It was formally decided to open a school that would operate based on German universities.

This is how at the beginning of the 19th century we had two totally clear university models, which opened the way to a fundamental reform on the traditional university, on the one hand the French model, based on schools with severe discipline and sometimes military, strictly organized and controlled, directed by the enlightened despotism that sent until the last detail of the curriculum, the granting of degrees, the conformity of points of view related to doctrines and even personal habits such as the prohibition of the use of beards in 1852[75].

And on the other hand, we had the German model of Humboldt, based on the idea that the function of the university was not only to transmit recognized and useful knowledge, as schools and colleges had done up to then, but also to stimulate the idea of science in the minds of students, to encourage them to take into account fundamental scientific laws in all their thinking[76] on the other hand, the state only had two functions with respect to the university: to protect its freedom and to designate the professors, but this model was not so easy to be implemented as the interventionist model of Napoleon, the plan of Humboldt that anticipated the donation of great extensions of land in order to ensure financial freedom, was

[74] *Ibid*; p. 150-151
[75] **Fuente especificada no válida.**p.5
[76] **Fuente especificada no válida.**5p

abandoned by his successor and freedom of opinion was limited in 1819 through measures of control and censorship that followed the students[77].

Similarly, the introduction of students to scientific and research thinking through seminars and laboratories came slowly, but in any case, in the end, the liberal reform in Germany paid off, since until then Paris had been the Mecca of students and scientists around the world, but in the early twentieth century was the German model that dominated universities not only European, but also in America and Japan[78].

During the nineteenth century throughout the continent, ministries like the Germans were established to deal with the growing importance that public education had assumed on all scales, in general policy and in the budgets of the States. The ministerial administration decided the type and composition of all higher education in the country, as was the case in Spain or Italy, who governed access to universities and controlled their curricula and exams, in addition to universities provided modern buildings and laboratories[79] . The commitment to a new policy on education was ambitious, since it should be created in favor of the modernization of the university, a new organization of knowledge, required for the logic of its development and for the demands of its transmission[80].

Until now, universities had been training places for lawyers, clerics and other professionals, but these changes revolutionized the entire system, promoting research as a vital complement to teaching, emphasizing science, allowing information traffic between different disciplines and making universities contribute more directly to the economy and society[81].

The two additional roles that the university acquired "convert basic research into advanced research and the assimilation of knowledge and technology" were acquired partially and unequally in different countries and only by some university elites. Normally, the search for science has always opened the doors to commercial applications, since many researches have

[77] **Fuente especificada no válida.**p5
[78] **Fuente especificada no válida.**p6
[79] Rüegg, W. (2004). A history of the university in Europe (Vols. III Universities in the nineteenth and early twenty century (1800-1945)). New York: Cambridge University Press; p. 7
[80] Charle, C. *Op Cit.* p. 96.
[81] Yusuf, S., & Nabeshima, K. (2007). How Universities Promote Economic Growth. Washington: The World Bank ; p. 2

achieved industrial applications or in agriculture, others have served to increase knowledge and improve techniques in many ways[82].

Before establishing these changes, most of the advances were made by those who were trained in universities and then developed a business independently. Until the nineteenth century, very little research was done by universities, for example, most of the applied research in the railways was carried out by companies' research, but in recent years with the impetus of the industry the universities were more involved in directly or indirectly with the development of technology for industrial purposes. The German universities were a valued scientific and experimental resource for the nascent chemical and pharmaceutical industry at the end of the 19th century, the same happened with biological and biomedical research[83].

This model represented one of the greatest transformations of the medieval university, rejecting the opposition between academics and university students, the Prussian university and its research seminars and its doctorate diploma, destined to unite in the same person and on the same roof the practices, until then carried out by different individuals and in different institutions (the university for teaching and the academia or the personal research laboratory for research)[84]

Humboldt launched a process of transformation of the professorial body that gave birth to a new social class, the professor-researcher. However, the German model was not taken into account in France until 1868 that under the social pressure and the harsh criticism that the French educational system had been receiving since the reports of Victor Cousin, the Emperor Napoleon III decided to give Victor Duruy the green light to make certain transcendental changes which included the creation of the Practical School of Higher Studies[85].

[82] *Ibid ;* p. 2.
[83] *Ibid;* p. 3.
[84] Gingras, Y. (2003). Idées d'universités, enseignement, recherche et innovation. Actes de la recherche en sciences sociales, p 3

[85] *Idid ;* p. 5

École Pratique des Hautes Etudes.

From the 1860s, the faults of the Napoleonic system of faculties appear increasingly clear and are publicly criticized by both universities and authorities. The double problem of developing the function of research within the faculties as in the German model now in full swing and of rebalancing a hypercentralized system, converges in the intense reflection on the defeat of 1871, to accelerate the reform movement[86].

When Emperor Napoleon III calls the Liberal and Democrat professor of history to direct the fate of the university in France, it was seen in that designation a hope of bringing life to the organization, visibly insufficient and fortunately that hope truly paid off[87].

The importance of a character like Victor Duruy, does not only reflect on the transcendental changes he introduced in the French educational system, but also in the way in which he conducted various analyzes that served to get an idea about the results that were being obtained in education. The formality with which he carried out his work and his reports, well detailed and with specific data was what allowed the opening to the criticism that later was translated in the reforms that gave life to educational institutions like the Practical School of High Studies.

In the year of 1864 Victor Duruy ordered a series of statistical studies that gave several interesting results that helped him reflect the reality that France was living and the importance of introducing a comprehensive educational reform. In these reports he writes that statistics gave for the first time to know the true state of primary, middle and higher education to the most minute detail and that the emperor has given the signal and proclaimed that in the country of universal suffrage, all citizen must know how to read and write. To these actions that he undertook he calls them a crusade against ignorance[88].

[86] Charles C. *Op. Cit;* p. 92

[87] Vernes, M. (1915). Les caractéristiques de l´École practique des Hautes Études-Science religeuses et sa place dans lénseignement supérieur français. Annuaires de l'École practique des hautes études., p. 19-22.

[88] Duruy. Op. Cit ; p. 5

What gives us to understand with these words is that from that moment there was already the will of authorities to find a solution to improve the state in which education was in France and that in the scientific world began to speak on the subject in a more serious and formal way. He proposes in an open manner, to perfect education for the masses, his first proposal is to strengthen the schools where teachers are trained, allowing to expand the plant and send to each commune an instructor whom he calls "agents of progress""[89].

But the idea of educating the population was not only to create a country of lawyers, his purposes were very clear, because what he wanted was to bring knowledge to all areas of work to improve the performance and effectiveness of workers through education and application of techniques developed in a scientific way, this can be seen when he talks about education in rural areas and he highlight that should be created a field of experimentation and horticultural studies in normal schools, so that this could works as a model for the small crop and he proposes to give agricultural courses and provide the workers with professional knowledge that industry needs[90].

These processes of transformation of educational ideas are totally a consequence to the needs of the time, as he himself makes it note mentioning that the government has already tried to make these changes, because it is a strictly necessary consequence of its political and social organization, also he mentions that having given the people the sovereignty and the right to vote, the free concurrence to the industries, the machines at work and the free discussion of the problems of the days of the workers, the government also imposed the duty of caring national work, order and freedom, expand by all ways the education and intelligence of the working classes[91].

In his report refers to the humanities and history, but also tells us that the society of the time was not the same as before and indeed, the industry had introduced unimaginable changes, forms of work and management of cities had changed daily life and political

[89] Duruy. Op. Cit ; p 5
[90] Duruy. Op. Cit ; p 5
[91] Duruy. *Op. Cit* ; VI-VII

relations, advocates to organize a new education appropriate to the needs of trade and industry [92].

His ideas that now may seem obvious to us, at the time implied a rupture with the old educational and university systems, because as we talked before, the priority of the universities had been that of institutionalization. At this time the priority was industry and commerce, so all efforts would be focused first hand on the improvement and sustenance of these activities that had become the main engine of the new nations, the modern, technological nation, industrialized and commercial.

Among his proposals, for example, he directly mentions the need of give students the industrial applications of commercial science, history and geography, civil law, economic notions and living languages and mentions it as a prevailing need for modern education. No longer think about keeping the knowledge only for the elites, change the language of Latin by living languages let see the importance of international business relations, this does not mean that completely abandon the classical courses, as he calls them, although his priority clearly is develop the schools in a more practical sense.

He mentions that it is essential for special education to study industrial and agricultural applications of sciences, more than theories. In languages, to study those that are alive and their literature more than those that are dead, in philosophy, to prioritize morality and not metaphysics, in history, contemporary society more than societies of another time and emphasizes saying "our laws, our institutions, our economic organizations and not those of Athens or Rome and to achieve it he fixes its ideas in a series of proposals[93]:

1) A reorganization of the alive oriental language schools, since the current ones do not respond more to commercial needs and diplomacy.

2) The creation of law faculties in all the big industrial cities, teaching of economic and administrative sciences that had been asked to create for 80 years, which Cuvier wanted to establish and which would be the natural development of higher education, at the same time a satisfaction given to the new necessities and that

[92] Duruy. *Op. Cit*; XIII
[93] Duruy. *Op. Cit* ; XIII

we can constitute immediately without charges to the treasure, imitating the case of Nancy and Douai when two of their new faculties were created.

3) The organization of the education of the agronomy that the study deepens in the laws of the vegetal and animal kingdoms to reproduce the safest processes to destroy the species that make us bad and multiply those that serve us.

4) For the physical and chemical sciences, should be established in all faculties teaching laboratories where practical exercises and manipulation are carried out [94].

Several of these projects had already been launched as the higher school of agronomy that had a direct relationship with the Museum of Natural History, because there were two years of courses followed by one more practices in regional schools or directly in the Work field. What he was looking for in his own words was to be able to "take knowledge to all the provinces where our big industry needs to take from the soil the treasures that routine leaves and science will emerge"[95].

As we have read before, for the first time it puts on the table the important discussion about the objective of the educational centers, which are no longer centers of diffusion of truths and discoveries of the wise only for the students' rejoicing. From his point of view the institutions must be transformed and have as purpose the development of the commercial activities of the time, the industry and the commerce, but it never loses of sight that to be able to realize this objective the scientific progress is the utmost importance, even if this means making some sacrifices. In the same way, it advocates that public authorities have confidence in the considerations of the wise and endow them with total freedom, arriving in a radical way to mention that it should not matter who they are or where they come from or where they are going, they should be given the resources they need to be able to carry out their large studies[96].

But as a man who has a blind will in science, he would not make any changes to the systems of study without having hard data in his hands, and that is where the greatness of his

[94] Duruy. *Op. Cit ;* XIII-XIV

[95] Répandre dans toutes nos provinces les connaissances dont notre grande industrie nationale a besoin pour tirer du sol les trésors que la routine y laisse et que la science en fera sortir. **Fuente especificada no válida.**p XIV

[96] Duruy. Op. Cit ; p XVII

work lies, since his philosophical and intellectual thought bases it not only in the new ideas of the thinkers of the time, it is not a new stream of philosophical thought that makes it to make its decisions, if not the series of statistical studies of primary, middle and higher education and is aware that it is the only way in which he can convince scholars and politicians to carry out the reforms necessary to achieve these objectives. His project was well planned, and he took order in his speech, because at the beginning of his reports and letters he was completely focused on achieving the improvement of the education systems of basic education and normal schools, but this discourse little by little turns to the importance of transforming the system also in the higher levels of education.

In his analysis Duruy knew well how to guide his learning and his speeches so that the wise, the historians, the philologists, the counselors, completed by a group of ardent young elite who had started in the great foreign universities obtained from him the first steps to the integration of a new educational model, which would consist, as we already mentioned, of a part in the creation of laboratories for mathematics, physics, chemistry, physiology and natural sciences, which were distributed among the higher Normal School, the Faculty of Sciences, the College of France and the Museum of Natural History, but undoubtedly the most important and ambitious of all the arrangements to be made was the creation of the Practical School of Higher Studies, where under the guidance of eminent teachers, assisted by young collaborators would prepare future teachers[97].

Why is it so important to carry out these reforms and carry out the project designed by V. Duruy?

At that time 25 million French were engaged in agriculture, ten million were engaged in industry and commerce. The introduction of new machinery in the factories, had increased production, the work had stopped being manual and artisanal, they required new technical knowledge that would allow the correct handling of these new production technologies, in

[97]Vernes, M. (1915). Les caractéristiques de l´École practique des Hautes Études-Science religeuses et sa place dans lénseignement supérieur français. Annuaires de l'École practique des hautes études., 19-44..

Duruy's words "the machine has replaced the man and the modern industry is spiritualized demanding without ceasing for his works more intelligence and more art"[98].

At that time, as we have mentioned before, the industry was the main driver of the European economy, so it play a fundamental role. The political and social efforts were focused on strengthening them and that meant being able to equip the workers with the necessary skills to carry out their work. From Duruy's point of view, it was the new peaceful struggles of the nations, in which they had to fight and win in the name of France[99].

Another of its objectives was undoubtedly balance economic inequality and expand access to education, because he firmly believed that an economic balance would be beneficial for society, also in his project was intended to accept any student who was trained to perform academic work, interested only for really attracting talent without caring much about nationality or social status. Duruy analyzed the socioeconomic status of university students, which clearly shows that around 75-80% of them came from a well-off social level, whereas, if we compared with the German universities of the time, this number was only around from 40%[100].

With the creation of this institution we wanted to create an independent study center of the Sorbonne where all its teachers and students will be totally devoted to scientific research, this I do just with the intention of creating a new school, that did not have the bureaucratic load of the old universities and that allowed to integrate the new ways of teaching, to break with the old ways. In his project, he is aware that to be able to carry out science and establish a school, it is not enough to have what he calls "the resources of the imagination" as it happened in the first schools created, which were dedicated to art. Their desire is to create an eminent scientific family, to establish centers of knowledge, of experimentation, where the genius itself is strengthened and dispersed, where the professor can follow his discoveries and teach how to make them[101].

[98] La machine-outul remplace l'homme-machine, et l'industrie moderne se spiritualise en exigeant sans cesse pour ses œuvres plus d'inteligence et plus d'art. **Fuente especificada no válida.**
[99] Duruy. *Op. Cit;* p IX
[100] Rüegg. *Op. Cit;* p. 263
[101] Duruy. *Op. Cit;* p XVII

Undoubtedly the creation of this school was the first step to realize his mission to introduce a new teaching model, as we have mentioned this was a very ambitious project, but despite this he considered and firmly believed that the wise would be the responsible for raising the level of civilization of the country. According to his ideas, the progress of science would eventually give glory and wealth, so it would be essential to support the improvement of scientific theories.

Decree of creation of the school

Finally, on July 31, 1868 and after all the analyzes, studies and efforts of Víctor Duruy, the Practical School of Higher Studies was created by means of a decree approved by Napoleon III and which can be read in an extract from the same[102]:

Under the proposal of the minister of public instruction, seen from the decree of July 31, 1868, concerning teaching laboratories and the creation of research laboratories.

The Imperial Council of Public Instruction has decreed the following:

Article 1. It is founded in Paris, attached to scientific establishments that are under the Ministry of Public Instruction, a Practical School of Higher Studies, which aims to place next to the theoretical teaching exercises that can help strengthen and understand it.

Article 2. This school will be divided into four sections: Mathematics; Physics and Chemistry; Natural History and Physiology; Historical and Philological Sciences. The professors or the wise persons in charge of directing the works of the students will take in the second section and the third the title of directors of laboratory, in the first and the fourth the title of director of studies.

[102] Section de sciences historiques et philologiques. (1894). *Annuaire de l'École Practique des Hautes Études.* Paris: Imprimerie Nationale.p. 16

The analogous advantages that are made to the directors of research laboratories by the decree of today on the laboratories can be attributed in the same way to the directors of studies.

Article 6. The students of the EPHE who deserve for their work, can by special decision take advantage of the Superior Council of the School and be exempt from the special tests of the degree to be presented directly to the doctorate.

Article 8. The scientific missions abroad are entrusted by the Minister of Public Instruction to the repeaters or to the students of the EPHE

Article 9. The students of each of the sections of the Practical School will be placed under the sponsorship of a permanent commission of five members, appointed for three years by the Minister of Public Instruction and elected by the directors of the study laboratories.

These commissions will take the necessary measures to obtain the entrance of the students to the research laboratories or in other places of studies where they consider convenient to place them.

They will also give their approval on the publication with the financing of the status of the work carried out by the students.

Article 13. Every year after the examination of the reports of the director of the laboratory of studies, with the notice of the permanent commission and of the superior council, the minister will give missions to the students, according to the medals, mentions and subsidies or special rewards.

Article 14. This is provided by the internal regulations prepared by the permanent commissions available to individuals and to each of the sections of the EPHE.

Signed and approved by the Emperor Napoleon and by the Minister of Public Instruction Victor Duruy.

In the decree creating the institution, the purpose for which it was designed is clear, since most of the articles that constitute its creation talk about maintaining the academic level through subsidies and incentives for students to develop, in addition to the integration of a body of commissioned synods to direct the students, those who will have the opportunity to

develop their capacities in laboratories and through learning trips promoted and subsidized by the government.

As Duruy mentions, science is in fact a body of doctrines that we can learn in classrooms, but it is at the same time an instrument that must be maintained and to know how to use it, it is not enough to hear about it, we must exercise it and make use of it. For medical schools and pharmacy schools it is strongly believed that practical exercises are an essential part of courses and school work, regardless of the number of students, the state should provide this training[103].

The teaching laboratories mentioned, will be the places where the directors of research laboratories find their assistants, because researchers do not need only work places and appliances, but also need auxiliary workers to help in the research. And he mentions, that a scientific laboratory must be composed of two main elements; laboratory instruments and the most intelligent collaborators. In his project he thought money could give him the first, but what would guarantee the second would be a good organization[104].

Research laboratories, well established, will not be useful only to the teacher, but will also be good for the students and consequently will ensure the progress of future sciences, since they will generate students with theoretical knowledge and at the same time initiated in the teaching laboratories, able to manipulate the necessary instruments and elements. In addition being around a teacher, they will be inspired by their example when exercising under their eyes the art of observing the methods of experimentation. And he closes by noting that it is in this way that Germany has found a way to reach the development of the experimental sciences that are studied in France with great sympathy.[105].

As we can see, the school plan was well organized, because it was not only to place laboratories where students learned the use of instruments. Duruy had planned all aspects of its operation as we will explained below.

The areas of physical and natural sciences should be closely linked, since mathematics could help astronomical studies, as well as calculations of rational or applied mechanics.

[103] Duruy *Op. Cit ;* p 648
[104] *Ibid ;* p. 650
[105] *Ibid ;* p. 650

Also, to make pure analyzes, it requires the realization of conferences, questions, advice and have the habit of being aware of the develop of sciences abroad. The students of mathematics would be admitted to the imperial conservatory and will follow an order of studies that will lead them successively to all the theoretical knowledge required by mathematical astronomy and the use of instruments used in observational astronomy. They will form a school of astronomers that until then was needed in France. The others can also find the Sorbonne or the College de France courses and talks to develop skills for applied mechanics, these will be their guides who can direct them to the renowned factories where they can learn how to start up the mechanical devices and how to improve their design[106].

For the philology section the works will be archeology, linguistics, epigraphy, paleography, comparative philology, general grammar and critical history held under the care of skillful teachers who can prepare their successors, so for this purpose the academy of fine arts, the directors of the archives of the empire, the imperial library, the school of maps, the conservatories of the archaeological collections of the Louvre and the rector of the faculty of letters will be a necessary part of the superior council[107].

But undoubtedly the main purpose of the whole school as a whole would be to train scholars and not be limited to the walls of an institution, but the students would be part of different courses in normal schools, hospital clinics, dissection cabinets, botanical studies in the garden or at the museum school and will also be part of the fine arts school[108].

By 1868 he made his first report of activities, which included very specific details about all the laboratories and their operation, the areas where science was being done and where changes were needed, included future plans and planned the opening of new laboratories and museums, proposes the formation of a central horticulture school, the creation of a meteorological center, introduce physiology in secondary schools of medicine, the teaching of paleontology and expand the chairs of natural sciences in the provinces. In his report,

[106] *Ibid ;* p. 655
[107] *Ibid ;* p. 656-657
[108] *Ibid ;* p. 657

regarding mathematics, he leaves them always linked to the natural sciences, because for him the technical application of the discoveries was fundamental.[109].

While for the section of historical and philological sciences it proposes to organize more trips to feed the creativity, in addition to giving aid for the publication of books by means of economic incentives since it mentions, many times the bookstores do not want to run the risks of publication. But the most important in this regard is the area of eastern and living languages, this institution would be organized in a way that could meet the linguistic needs that trade and the economy with other nations required. In this it proposes not only to study languages, but also culture always with the purpose of facilitating commercial relations between nations, so in this respect it also calls for the organization of annual scientific expeditions to other continents, which it affirms, will not only enrich philological studies and languages, but also bring enormous knowledge to the natural sciences and geography[110].

Finally, he proposes the creation in the EPHE of a section of economic sciences with the purpose of analyzing the way in which wealth is distributed among people and how it is destined to satisfy the needs of individuals, as well as the collective being that we call State. He also mentions that these studies are already common in Germany and that sometimes they even form an independent faculty, which will help to develop intelligence and the practice of sound economic doctrines. At that time only two chairs in this regard were held in Paris, one more in Nancy, Grenoble and Toulouse. The proposal to create this new area of economy is not only a response to the needs of the time, it also represents one of the innovations that Duruy introduced in the new French educational system and that show us the importance and the radical nature of its proposals, because he really was not shy in his requests, he knew that it was what was needed and he would not hesitate to put it into practice[111].

In two months and despite the summer in this school, 264 enrollments were received, a number that exceeded all the forecasts that had been made, which had to be necessarily reduced by a test that sought to stay with students with more real skills.[112].

[109] *Ibid ;* p. 682-699
[110] *Ibid ;* p. 701-709
[111] *Ibid ;* p. 682-699
[112] *Ibid ;* p. 679

The inscriptions were distributed as follows:

Mathematics	27
Physics and Chemistry	75
Natural History and Physiology	94
History and Philology	68

The type of students who entered were mostly graduates and some doctors, it is mentioned that some had left the places they had already earned elsewhere because they lacked resources and they believed could be provided by the institution, many others were foreigners[113].

The first section of the EPHE responded to the first need, creating laboratories linked to teaching and a place to transmit science in the form of specialized seminars that broke with the normal courses for the great publics that were taught in the faculties. The second objective was the most difficult to achieve because it was necessary to obtain local resources that allowed the school to free itself from the republic and local elected representatives to commit themselves more, but many more teachers were also needed, which required more preparation and investment and supports, the number of teachers went from 488 in 1865 to 1416 in 1919, after the introduction of reforms[114].

In order to receive these students, the opening of 17 research laboratories was planned, provisional or definitive, they were located in different places. In the Sorbonne were the laboratories of Vegetal Anatomy, Physics, Physiology, Mineralogy, Geology and Chemistry. At the Collége de France for mineral chemistry, the chemistry of organized bodies and animal physiology; to the Museum for Plant Physiology, Agricultural Chemistry, Botany and Zoology and Physiology; to the Normal School, Physiological Chemistry; to the Faculty of Medicine, for botany with a garden of experiments. This same school also offers its own students research laboratories for chemistry and anatomy, pathology, physiology and histology [115].

[113] *Ibid ;* p. 679
[114] Charle C. *Op. Cit;* p 92
[115] Duruy. *Op Cit ;* p. 680

In the provinces, many laboratories also applied to join the EPHE, such as the laboratory of the Faculty of Sciences of Caen for agricultural chemistry, and even some private establishments took on a scientific nature that would allow them to be annexed without deleting their autonomy. An example is the Aquarium of Arcachon that was no longer considered a curiosity, but rather a museum and a library to which a research laboratory would be attached. Also the aquariums of Le Havre or the one of Boulogne, would allow to study the marine world and it was thought that something similar could be constructed in Marseille for studies on the Mediterranean Sea[116].

The rhythm of the school continued in the same way during the following decades and despite the war against Prussia, the school survived and continued to be one of the most important educational bodies within the country, as evidenced by the regulations deliberated by the municipal council of Paris of November 23, 1882 and July 30, 1887, where the way to manage money is discussed[117].

ANNEX V TO THE REGULATION

Concerning the employment and distribution of money in the three sections of the school practice of high studies, of the subsidy of 36 thousand francs agreed to by the municipal council of Paris. (deliberation of the municipal council of Paris)

Article 1. A municipal subsidy of 36000 francs renewable each year, is agreed for the EPHE this subsidy is applicable for:

1. To the foundation of study scolarships.
2. To the foundation of travel scolarships abroad or in France.
3. To scholarship awarded to students, under a special request.

Article 2. Scholarships and municipal grants may be given only to students who have followed the courses of the School or who have taken part in the work for at least one year.

Article 3. Each year the sum of 12,000 francs will be attributed to each subsequent section.

1) Section of physicochemical and mathematical sciences.

[116] [116] Duruy. *Op Cit ;* p. 682

[117] Section de sciences historiques et philologiques. *Op. Cit* ; p 23

2) Section of natural sciences.
3) Section of philological and historical sciences.

Article 4. Minimum one third of the subsidies must be used in travel grants.

Article 5 Each year a list of reasons for candidates for scholarships for study and travel and special grants for the following year must be prepared by each section of the school and be addressed before July 1 to the minister of public instruction for be transmitted to his lordship and to the municipal council. Article 6. To the list of presentation should be attached the files of the candidates which must necessarily include:

1) The notes, reviews, indications of previous works executed by the students, etc. To clarify the council on the situation and merits of the student.

2) The precise and detailed indication of jobs that each candidate wishes to undertake and for which he requests a travel grant or a special grant.

If the municipal council commission has observations made by subject of the presentations of the delegates of the sections of the high schools, these will be called to give the necessary explanations.

Article 10. Travel scholarships must justify scientific or literary works and will be given mainly for trips outside of France. The travel scholarships from France will only be given on an exceptional basis and after a favorable opinion from the school's patronage committee.

Article 11. Their purpose is to facilitate the work of students in libraries, archives, museums or laboratories.

As we can see, the school followed its course and the budgets were awarded on a regular and constant basis even 20 years after its foundation, besides that the use of that money was perfectly controlled and well managed for the good maintenance of the EPHE.

This project was born of a real need to solve the new challenges to which France as one of the main industrialized countries was facing. But thanks to academic support and because the foundations on which it was founded were solid, this project could last and be preserved so that we still have many of the main ideas with which it was created. This is visible when reading the speech he gave for the 50th anniversary Louis Hevet, in which he remarked

remarkably how the teachers took their role as a guide alongside the students and in the teaching laboratories.

Speech Louis Hever for the 50th anniversary of the EPHE

It is a school without comparison, it is a different school in France and it may be that on all the planet earth, it is the only establishment of public instruction devoted to erudition, a little sister was born to us after blow, the historical and philological sciences, where the past of religions is studied, but my young colleagues can still be associated with our celebration.

That which defines science is logic, it is method, it is not the object. A science studies an object, studies data, studies nature, initiates a hypothesis and then confronts them with the real, verifies them, begins to predict and then verifies them. Astronomy predicts a planet and then sees it go. A page of history is an assemblage of implicit prophecies, where each one waits for an eventual confirmation of a new testimony or a new criterion ....

The old great minister and creator of this school tells us about his origins, the great experimenters were not missing, Claude Bernard was fifty years old, Pasteur forty-six, Berthelot younger had already unified the chemistry, what Duruy wanted, was that, inside From the laboratory, a great experimenter could associate with the students their research, participation, common overture. Before it was an instructor giving a monologue in a chair, that's why the idea of creating a Practical School, being the word practice in the title an essential element.

Both in philology and in physics, it is necessary for the student to see how to conjecture, the conjecture must be confirmed or disproved on some occasions, cheerfully denied on some occasions, we must tell the students to challenge us and dare to think for themselves , it is also necessary that the student, in the eyes of the teacher, learn to interrogate himself in reality, that he judges everything as a last resort.

We keep and commit ourselves to keeping the originality of our organization, where the chair is seen as something harmful to the teaching and the apprentice is sitting at the same table as the old driver who guides[118].

In the analysis of this discourse we can realize what life was really like inside the institution and the ideas that teachers shared about education and how they evolved in everyday life. The priority was to let the student think for himself and learn to question himself and his teachers, always in search of the truth. What was intended was to bring the teacher closer to the student, to end the distant relationship that the traditional chair promoted, since this type of teaching did not allow the feedback of ideas.

The great importance and impact of this model is that when exists an exchange of knowledge, the generation of new ideas was facilitated, the laboratory work was formalized, which helped to receive government budgets that increased productivity. The solitary researcher who works in his basement in search of answers like an alchemists of the middle age ceased to exist. The knowledge was released, through the creation of magazines and publications, where the main discoveries or analyzes were written monthly, being state budgets those that financed these investigations, the sample of results became a priority, that would give prestige to the institutions and countries and naturally, later this knowledge was transformed into technology, which reached the industry.

[118] Havet, L. (1922). Discours de Célébration du cinquantenaire de l'École Pratique des Hautes Études. Celebration du Cinquentenaire de l'Écoles Pratique des Hautes Études (págs. 3-12). Paris: Librarie Ancienne Honoré Champion Édouard Champion.

Chapter III

Résumen

Dans le prochain chapitre, nous parlerons de l'intervention française et de l'importance que cet événement a eu au Mexique, car les nouvelles idées sur l'éducation et les politiques publiques sont venues au pays grâce a l'arrivée d'un roi autrichien protégé par l'armée de Napoléon III. Bien que l'idée de créer un protectorat français a Mexique n'ait pas duré par un longe période, le pays a jamais retourne a être le même, car nombreuses institutions ayant déjà été influencées par Maximilien de Habsbourg et ses principaux généraux et ministres du gouvernement.

Avec la restauration de la république, le président Benito Juarez essaie de réorganiser le pays en commençant par l'éducation, mais ce projet prend de nombreuses années à se développer et après sa mort en 1890 une dictature de 30 ans est bien établie dans le pays. Porfirio Diaz a cherché un moyen de pacifier le pays c'est pour cela que le dictateur a confié au ministre de l'Instruction publique la réalisation d'une université, à laquelle sera annexée une école d'études supérieures chargée de préparer les connaissances scientifiques et sages de la république.

Malgré cela, l'intention de moderniser le Mexique ne peut pas encore être réalisée, car la révolution explose en 1910 et tous les programmes de l'ancien régime sont sabotés par les nouveaux dirigeants politiques, ce qui affecte fortement notre sujet d'étude, l'Ecole Nationale des Etudes Supérieures qui perd peu à peu sa forme originelle pour devenir une faculté de philosophie et de lettres, mais, malgré cela, c'est sans aucun doute l'institution par laquelle elle se pourrait formaliser les instituts de recherche scientifique et d'enseignement du pays.

French Intervention in Mexico

The history between France and Mexico has a special league that often is not spoken or given as much importance as it deserves, it seems that it has been erased from the historical memory of both countries, but undoubtedly to this day In Mexico there is a strong footprint due to the consequences that this relationship left and its influence on the current constitution of the country.

After Mexico gained its independence from Spain, it was invaded twice by France, first in the so-called "Pastry War" and then by a government imposed by Napoleón III, in which Maximiliano de Habsburgo and his wife Carlota were crowned kings of Mexico. These interventions created a close relationship between both nations, at a political and intellectual level.

In the same way that France felt admiration and at the same time suspicion for Germany, Mexico had the same resentment and admiration for France and it seemed normal at times to have these feelings for the opponents that give us a strong battle. Normally in the history of Mexico these episodes of French intervention are treated both in schools and in books as simple wars in which they had to fight to maintain the freedom of the country, sometimes they also speak with military pride, for having won the battles, but never mention is made of the consequences that from a cultural and intellectual point of view left in our territory, from Mexican cuisine that can not be enjoyed without a bit of creme fraiche until the constitution of its most important university and a of the best in Latin America and the world, which is what we are going to talk about in this chapter.

During the first years of the independent life of Mexico several internal struggles were fought to decide how to govern the country, a government plan had not been established in a serious way and there was still a debate about whether it would be better to establish a monarchy or a republic. After so many internal wars and against the United States, the

government of Mexico started having problems with the insufficiency of resources to establish order in a country exhausted by the constant confrontations, barracks and rebellions. This reason led to the Congress of the Republic decreed the suspension of payments of all public debts on July 17, 1861, which led to the reaction of England, Spain and France, who demanded the cancellation of that measure. However, the Mexican Government ignored the demand of those countries, and that's why English and French ended diplomatic relations with our country[119].

The conservatives in Mexico saw in these difficulties of the government of Benito Juárez the opportunity to realize their objectives, since the consummation of independence they sought to establish a monarchy in Mexico. In response to the temporary suspension of payments, England, France and Spain, signed in London, on October 31, 1861, an agreement by which it was established to send an expedition to occupy the main military fortresses of the Mexican coasts with the objective to capture the economic resources of the customs and collect the debt of the three countries. The Mexican government never refused to pay such debts, only requested an extension of time to overcome the anguished economic situation in which it was after the episode of the civil war of Reform[120].

After the three European powers signed the agreement in London, the Spanish squadron arrived in Veracruz on December 8, 1861; the English on January 6, 1862 and the French anchored the next day. The Mexican government appointed General Manuel Doblado to negotiate with the interventionists, requesting the intentions of their expedition, without which their advance could not be allowed. The European plenipotentiaries exchanged impressions with Minister Manuel Doblado in which the interest to avoid a confrontation was exposed and on February 19, the preliminaries were agreed in the town of La Soledad through which it was agreed that the allied powers would abstain from Interfere in any internal dispute of the Mexicans, restricting themselves to negotiation as a way to reach agreements on their claims, these negotiations were carried out by representatives of the allied powers and representatives of the Mexican government in Orizaba[121].

[119] Secretaria de la Defensa Nacional. (2018 de marzo de 18). La intervención francesa. Get in www.gob.mx: https://www.gob.mx/sedena/documentos/la-intervencion-francesa
[120] *Ibid*
[121] *Ibid*

The preliminaries of La Soledad were ratified by President Juarez and the English and Spanish representatives. On March 5, General Carlos Fernando de Latrille, Count of Lorencez arrived in Veracruz, who believed that because of the situation in Mexico that he was weakened for the bloody years of the War of Independence, the constant confrontations of the First Empire and the Reformation, would be a country without the courage to defend itself when they were attacked by the French army[122].

Napoleon III finds an opportunity to build a grandiose project: He wanted to make Mexico a Latin and Catholic monarchy, a client of France that would counterbalance the powerful and arrogant republic of the United States, Protestant and Anglo-Saxon that since 1819, was dangerously spread towards the south, but that at the moment was weakened by the war of secession. It is, then, time to take advantage of it[123].

The difference that exists in this project of Mexican colonization with the other successful French and Anglo-Saxon colonies is that it was an alliance to stop the liberal advance, it was intended to turn Mexico into a nation dominated by Catholicism and reactionary interests. This project included a whole scientific device to get the most out of the conquered territory. Likewise, the project involved the securing of a monarchical and Catholic enclave in the southern United States, a young republic, Anglo-Saxon and Protestant, as well as the conversion of Mexico into a client of France. However, unlike the colonial actions of France in other territories, in the case of Mexico it was a nation whose historical background made it extremely attractive, where "civilizing" means understanding to control[124].

That is why France decides to send the army to Mexico and place a king under his protection. On May 29, 1864, he arrived in Veracruz on the Austrian ship Novara, where Maximiliano of Habsburgo and his wife Carlota were traveling. They would be crowned kings of Mexico and would try to take control of the country. Maximiliano distinguished himself from all the previous rulers that Mexico had had because he was highly educated to

[122] *Ibid*
[123] Ramírez Sevilla, R., & Ledesma-Mateos, I. (2013). La Commision Scientifique du Mexique: una aventura colonialista trunca. Relaciones, p 305
[124] *Ibid* p 309

govern, he was trained by excellent teachers, who were mostly enlightened bourgeois and moderate liberals[125].

While under the French protection the new king arrived in Mexico, in Paris the scientific commission of Mexico was being created, which was entrusted to the minister of public instruction Victor Duruy who in 1864 sent a draft of the project:

Mexico certainly does not have the interest that offered us in a historical level Egypt, where Herodotus believes that the origin of religion, the arts and a part of the inhabitants of Greece were coming from, however, has a many secrets to reveal, a strange civilization that science must revive, races to which the origin has escaped, unknown languages, mysterious inscriptions and grandiose monuments [126].

But, if we see the expedition from the point of view of natural and physical sciences, what comparison can be established between the two countries! On the one side a long valley of 260 leagues, long in certain areas, where the sky, the earth and the waters are of an admirable desolate uniformity; on the other side, an immense region, bathed by two oceans, crossed by great rivers and high mountains that located near the equator has all the climates, because it has all the altitudes, where the abundant vegetation of the tropics shelters innumerable tribes of animated beings , where the end of the richness of the inner sun responds to that of the surface: because the millions that after three centuries has given to Europe, are not the premises of the treasures it reserves[127].

The Mexico of Moctezuma comprises around 6° latitude, from 15 ° to 21°. He leaves outside his borders, to the south, Yucatan and the whole itzmo, to the north, all of Sonora and the great valley of the river of the north. But the history of those regions, the races that populate it relate to the Mexican races, so a Mexican expedition cannot be denied[128].

The exploration field extends from the Rio del Norte and the Colorado River to the Gulf of Darien at about 32 ° latitude. No doubt it has already been collected by the wise men of the country, a large number of documents and by some ministers that France has sent and by

[125] Ratz, K. (2008). Tras las huellas de un desconocido. Ciudad de México: Siglo XXI Editores, p. 1-2
[126] Duruy, V. (1869). L'administration de l'instruction publique de 1863 à 1869. Paris: Typographie de Jules Delalin. p 71
[127] *Ibid* p 71
[128] *Ibid* p 71

travelers who have followed in the footsteps of the illustrious Alexander Humboldt. But these reviews taken in elongated points need to be co-ordinated and subject to scientific verification. Because of the details of the rigor of the method that today's science demands of us, Mexico offers a new field of exploration to several sciences[129].

In this report, the Minister of Public Instruction of France continues to narrate the nation's natural resources for 4 more pages and mentions the possibility of opening a channel that connects the Pacific Ocean with the Atlantic Ocean. France had a great interest not only at the level of natural and scientific resources, but it was considered a key site for politics and trade[130], the expedition is designed similarly to the commission sent by Napoleon I to Egypt and is conceived as part of a broader project that includes the political, military and economic control of the Mexican territory, this project was integrated by scientists, naturalists, politicians and military, all of them French[131].

The ambition to establish a protectorate and to have access to the historical and natural resources of the country did not go very far and finally Maximilian was defeated and shot on June 19, 1867, thus terminating the second French intervention, however, the footprint that culturally and scientifically left in the country would last for many years.

The restoration of the republic and the educational reforms

As we spoke earlier in Europe after the French Revolution and with the arrival of the ideas of the Enlightenment, it was clear that political equality should begin by granting basic education to all citizens. The state took as one of its main goals the educational democracy reason why, it began to systematize the education that before was reserved only to the theoretical pedagogues, at the same time the industrial revolution generated the need to prepare educated men, but as already we also mentioned earlier, industrialization came unevenly to each nation and the context of Mexico, it took several years to establish the large

[129] *Ibid* p 71
[130] *Ibid ;* p 72
[131] Ramírez Sevilla, R., & Ledesma-Mateos Op. cit; p 316

European industrial systems, so the entry and establishment of new ideas of educational systems took more time to Integrate into national politics as we will see later.

In Mexico since 1861 the goal of Juarez was to restructure education in which the liberal government, editorialists and literati saw the salvation of the country. This idea was clearly expressed by Juarez in his report of May 9, 1961, but the French intervention and the entry of the government of Maximilian of Hapsburg prevented him from continuing the reforms and had to wait years later at the fall of the Empire in 1867 and once the Republic has been restored to begin a definitive consolidation of institutions and liberal thinking in the public life of the nation[132]. The deep imprint of the liberal ideas of the government of a Habsburg had already been marked in the political ideals of the nation for which the European educational ideas were taken as the basis of the new project, where the restructuring of the education system was perceived as a fundamental part of the restoration of peace and the unification of the population in a new nation, as the Minister of Justice and Public Instruction, the lawyer Joaquín Baranda, mentioned to the Congress in March 1887:

"Public education is called to ensure democratic institutions, to develop patriotic feelings and to realize the moral and material progress of our country" [133].

On September 15, 1867 to celebrate the anniversary of independence, in the city of Guanajuato the speaker Gabino Barreda was chosen to give a speech, in which Barreda said.

"Citizen, that in the future be our goal: Freedom, Order and Progress; freedom as a means, order as a basis and progress as an end ".

This speech impressed Juarez very much and says Leopoldo Zea "as a shrewd statesman he divined in positive doctrine the instrument he needed for the foundation of the reformist revolution" whose point of support would be the education of the people. Soon Benito Juárez appointed Minister of Justice and Instruction to Antonio Martínez de Castro[134].

[132] Stahl, C. (2013). Sintesis histórica de la Universidad de México (siglo XIX). Ciudad de México: Dirección general de orientación vocacional UNAM; p 117
[133] *Ibid;* p 125
[134] Ovando Diaz y de, C. (2011). La Escuela Nacional Preparatoria. La UNAM en la historia de México (págs. 65-80). Ciudad de México: UNAM. p 70

Minister Castro was undoubtedly one of the most prominent in the field of national education, he was given the task of projecting the law, but was supported by a commission, made up of men of recognized worth, as were the engineer Diaz Franz Coarrubias, Dr. Gabino Barreda, Dr. Pedro Contreras Elizalde, among others who as a whole were engaged in the development of the law, which has as its main characteristic, which was based, not on empty notions, but on severe doctrinal principles, what makes it different from all the previous ones[135].

Thus, on December 2, 1867, President Juárez created the Law of Public Instruction that was to begin to govern in the Federal District, the year of 1868. In the explanatory statement, the president affirmed that the illustration of the town is the most important safe and effective to moralize it and to establish in a solid way the freedom and the respect to the Constitution and the laws. Juarez should have remained calm with the enactment of this law, because as Zea "said he saw in it the necessary instrument to end the era of disorder and anarchy in which the Mexican nation had fallen and with this reform entered fully into the path of progress"[136].

In this the primary instruction was regulated, based on secularism and it was indicated as obligatory and free for the poor. Likewise, the secondary instruction was regulated in its contents and it was extended for women and the contents and directions of the Preparatory School and of the professional schools that would be the following were required: Jurisprudence, Medicine, Agriculture and Veterinary, Engineers, Naturalists, Fine Arts, Music and Declamation, Commerce, Arts and Crafts and Normal for teachers[137].

The National Preparatory School (ENP) was considered the main arch of the curriculum and with a small ceremony, on January 18, 1968, the appointment of Gabino Barreda as director of the high school was celebrated. Notices section of the newspaper "El Siglo XIX" gave news of the start of courses. "The courses of the Preparatory School will open on February 3 at the Old School of San Ildefonso, looking at the interior door of him the list of

[135] Villalpando Nava, J. (2014). Historia de la Educación en México. Ciudad de México: Porrúa. p 214
[136] Ovando Diaz *Op. Cit;* p. 73
[137] Villalpando Nava. *Op. Clt;* p 213

authors of the subject for this year. Mexico, January 29, 1868. Ignacio Chavero. Secretary"[138].

The subjects would be 34 and there were both scientific and humanistic and in the words of Gabino Barreda to the governor of the State of Mexico, Mariano Riva Palacio, should be:

"An education in which any important branch of the natural sciences is omitted; in which all the natural phenomena, from the simplest to the most complicated, are studied and analyzed both theoretically and practically in which is fundamental; an education in which the understanding and the senses are cultivated in this way, without the effort of maintaining by force an opinion, this or that dogma, political or religious, without the fear of seeing contradicted by the facts, this or that authority; an education, I repeat, undertaken on such bases and with the only desire to find the truth, that is, what really exists and not what our concept should have in natural phenomena. This should be, at the same time an inexhaustible source of satisfactions, the most sure preliminary of peace and social order, because he will put all citizens in a position to appreciate all the facts in a similar way and, for this reason, uniform opinions as much as possible . And the opinions of men are and always will be the motive of all their actions ... The intellectual order that this education tends to establish is the key to the social and moral order that we need so much ... "[139].

It is important to carry out a reflection on the foundation of the ENP of Gabino Barreda as background to the founding of the National University. Not only because it was a novelty in the traditional structure, but also because it adopted the philosophical principles of Auguste Comte, according to the interpretation that Dr. Barreda made of them in Mexico. The idea was to train the student in a horizon that was not a simple specialization, but a certain encyclopedism[140]. Showing that it was one of the most powerful scientific devices of the Restored Republic, because the system of higher education made science the instrument to channel the modernization of the country and even more so for Barreda positivist education was "the means of liberation, perfectibility and progress of its inhabitants "[141].

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[138] Ovando Diaz *Op. Cit;* p. 75
[139] Sthal *Op. Cit;* p. 123
[140] *Ibid;* p. 120
[141] Azuela, L. (2011). Los dispositivos cientificos para la restauración de la República. La UNAM en la historia de México. Tomo I. (págs. 81-94). Ciudad de México: UNAM. 90

In 1872 after the death of Benito Juarez, the country returned to enter a period of instability that prevented the continuity of the reforms and the country had to wait for the arrival of President Porfirio Diaz and the establishment of his dictatorship so that, through a peace imposed by military force, there would be time and tranquility to develop the country in its educational and industrial sector.

Porfiriato

One of the most curious characteristics of this general is that he was one of the main military leaders who had fought against the French in the wars of intervention and who by means of his ingenuity achieved most of his defeats, for which he had won the love and respect of many. Strangely, his regime was characterized by a Frenchness that would later cost him his exile precisely in Paris.

The main work of Porfirismo was the economic impulse based on liberal capitalism. Since his first presidential term, Díaz encouraged rail transport. Mexico was the first country in Latin America to have railway communications and under the slogan of "Peace, Order and Progress" it began a restructuring of the country creating economic, political, social and cultural reforms, which it helped with a group of intellectual men influenced by the positivist philosophical current[142].

Positivism was the banner of his government and in this respect, broadly speaking and in general terms without going into much detail, we will say that this type of thinking admits only the experimental scientific method and rejects all a priori notion and every absolute universal concept, has tendency to value perfectly the material aspects of reality and give great importance to science[143].

It is for all of the above that during the government of Porfirio Diaz the foundations were laid for the capitalist development of the country, achieving during this stage a great economic growth, stimulated and achieved thanks to the historical project, which was framed within the schemes and principles of economic liberalism and responding to two phenomena of great importance: On the one hand, the expansion of world capitalism, which incorporates Mexico, placing itself within the framework of the international division of labor. Incorporation that from within is to take advantage of as a dynamic element that serves as

[142]http://congresoweb.congresojal.gob.mx/bibliotecavirtual/legislacion/Benemeritos/Porfirio%20D%C3%ADaz%20Mori.pdf p 1

[143] Ocampo López , J. (2010). Justo Sierra "El maestro de America". Fundador de la Universidad Nacional de México. . Historia de la educación en Latinoamerica, 13-38.

the axis of attraction of all the other elements that make up the economy of the country, in such a way that the link with the exterior is not a factor outside the functioning of the economy, but that, on the contrary, it was an element that although by itself it makes its way, internally the conditions were prepared for its entry, convinced that it would be the source of capitalist development. The Porfirian development scheme was simple and optimistic. It was based on the conviction that linking the nation with the exterior would produce the basic impulses to put it on the road to progress[144].

On the other hand, the Porfirian project is the consummation of the internal struggle for political hegemony that responds to a widespread interest already: the establishment of the bases and norms for the full functioning of the capitalist mode of production, which, in a way it is the continuation of the general tendencies of Juarez and Lerdo liberalism. Thus, for all the above and given the conditions in which the country was, it was imposed that the main measures to carry out the porfirista project, should be based in internal administrative adaptation, including the reorganization of fiscal structures; to build a system of transport and communication that, in one fell swoop, was thought to place the nation at the center of modern civilization, to exploit the abundant natural resources available to the nation; also it was fundamental for the formation of a modern credit system[145].

The industry and science at the porfirian time

In the momentum of the modernization process, certain tasks that required knowledge and technical training had a huge importance and also they had a fundamental impact on productivity and not only on the exploration and recognition of natural resources, but also on the application and design of novelties technologies for its exploitation. Training was required for the implementation and extension of new means of communication such as the telegraph and the railway, whose lack was attributed to economic backwardness. Likewise, health personnel were needed for epidemiological control and medical attention to strengthen the population and strengthen agronomy and the incipient industry[146].

[144] Barceleta Chávez, H. (2012). Desarrollo industrial y dependencia económica en México. Berlín: Académica Española;.p 25
[145] *Ibid;* p 26
[146] Azuela. *Op. Cit;* p 90

According to the records of the scientific literature, academies and societies whose publications often did not cover a year even appeared and disappeared successively throughout the 19th century. The only two branches of science that had a representative boom during this era were medical sciences and Geography and Statistics[147].

On the one hand, Geography continued to develop thanks to the fact that from the colony one of the main economic activities of the country has been mining, and during the Porfiriato this joy of a great boom, on the other hand, because it is a basic need of man, since on the development of this matter depends on the survival of the same, it seems natural that despite wars and vicissitudes, medicine has always remained constant, so the National School of Medicine served as support for this new institution and it contributes giving professors and directors, in addition the majority of their scientific institutes were incorporated into the National School of Higher Studies, the first professors of the biological areas were the doctors who worked here, this section undoubtedly had had much more development than the areas of mathematics and physics.

However, during the government of Maximilian, the Mexican Society of Statistics and Geography founded in 1839 enjoyed great privilege, especially for the socio-economic value of this scientific practice and for the legitimacy it offered to associate its projects with the legendary Egypt Expedition, which, as already mentioned, would be repeated in Mexico. The main collaborators of Maximiliano were the geographer Manuel Orozco y Berra and the mathematical engineer Joaquín Velázquez de León. In addition, his participation was very important for the French expedition, as they served as translators and guides for French scientists[148].

As had happened in the past, many of the projects initiated during the Second Empire had no continuity and were suspended when the republic was restored (1867). This situation was not new, and provoked among the scientists a sense of loss and frustrated illusion that led them to take the liberal triumph as the precise moment to promote science, in 1872 according

[147] Saldaña, J., & Azuela, L. (1994). De amaterus a profesionales. Las sociedades científicas mexicanas en el siglo XIX. Quipu; p 141
[148] *Ibid*; p. 145

to a geologist of the time, José G. Aguilera relates that the activity of the Mexican explorers and sages awakens unexpectedly due to individual efforts and government commissions[149].

The governments of the restored republic and the Porfiriato seem to have had the clear certainty that the solution of practical problems of social and economic interest required highly trained individuals and regardless of their racial, economic and social origin. The insertion of Mexico into the world order required the State to adopt strategies and policies of industrialization and communications in line with its position as an exporter of precious metals and agricultural products, and importer in a large number of manufactured goods and industrial equipment. For that reason, from 1867 is perceived in the government of Juarez and those who followed him a scientific and educational and industrial policy that was lived in the nineteenth century[150].

The integration of science in the development of government projects occurred in the scientific field. This materialized in the creation of offices in research institutes, in which a scientific community applied to perform tasks of territorial recognition, exploration of natural resources and eventually for study their best exploitation. These establishments contributed significantly to the professionalization of science in Mexico, since while professional schools generated specialties such as mechanical or industrial engineering, at government establishments such as observatories and scouting commissions, techniques were required, specific skills and knowledge, those who finally restricted access to non-specialists[151].

By then the Mexican scientific associationism had left behind the painful history of failures and a fruitful stage of collaboration with the State was beginning, later, the scientific societies began an intense promotional work through journalistic articles, public sessions, contests and specialized meetings, all actions aimed at achieving the appreciation of science by society and the wide dissemination of its results. Given the evidence of the value of the results, the scientific community was able to successfully manage the creation of observatories and research institutes, some of which had their own buildings. We refer to the National Medical Institute and the Geological Institute[152].

[149] *Ibid*; p. 146
[150] *Ibid;* p. 146
[151] *Ibid;* p. 147-148
[152] *Ibid;* p. 150

The creation of the University

Under these political and social circumstances in 1880 Justo Sierra is elected Deputy in the National Congress, where he made his first intervention raising the need for a civic instruction "to awaken and consolidate the feeling of the holy love of the fatherland." He also spoke about the importance of providing the indigenous with a scientific education and not just a rudimentary instruction like the one he intended to give him[153]. With these ideas, he decided to publish on February 10, 1881, in the newspaper El Centinela Español, a proposal for the creation of a National University with the purpose of promoting a "reasoned discussion" as well as allowing him to weigh the feelings of public opinion and According to the arguments generated modify and enrich the original version. Finally he presented at the Chamber of Deputies on April 7, 1881 his "Draft Law establishing the establishment of the National University"[154].

Its University project proposed as the seat of the capital of the Republic, it should be an independent corporation, but subsidized by the Federal Executive Power with the amount of money agreed by the Chamber of Deputies in the annual budgets and be formed by the Preparatory, Secondary schools for women, Fine Arts, Commerce and Political Sciences, Jurisprudence, Engineers, Medicine, Normal and Higher Studies. It should be noted that since this first attempt to establish a university is mentioned in Article 7 the creation of the National School of Higher Studies, which would aim to train teachers, improve the studies done in professional schools and create specialists, providing pedagogical knowledge, literary and scientific of a higher order and according to essentially practical and experimental methods, also he thought that in the future and as the resources of the University allow it, they would be opened new courses corresponding to all branches of human knowledge beginning with studies in biological, sociological and historical sciences[155].

This Project, as Justo Sierra himself mentioned at the time, "belongs to the positivist liberal school", and he also affirmed that his initiative was inspired by the German educational systems but adapted to our democratic spirit. He proposed this institution as an

[153] Ocampo López *Op Cit*
[154] Alvarado y Martinez Escobar, M. (2014). El proceso de la creación de la Universidad Nacional de México a través de las fuentes
[155] Sthal *Op. Cit; p.* 134

independent corporation of the State, because he considered that it was time to create the autonomy of public education and that it should be encyclopedic and based on the scientific method. What he was looking for was to generate freedom for the development of knowledge, without political or religious interests that interfered in its expression.

His thought of free education explains it openly in an article published in the newspaper El Federalista in 1875, where he mentions his admiration for the German system, and also he explains that:

"Although there is no freedom on educational sector to open a university or other establishment of instruction, you have scientific freedom, and all opinions, ideas and even whims of men, can be taught in the chair and all the losses of teaching is judge only by the ones who learns, never the State, allowing spiritualism, materialism, atheism, pantheism, positivism, nihilism, all religions, all doctrines, all methods, all sciences, natural or supernatural to live together in those prodigious intellectual centers. "

And in his opinion Justo Sierra considered that by such conditions:

"This country owes to “free education” its intellectual force, because it is the one that even serves for the material triumphs".

He also retakes from the German system the independence in its internal regime, the freedom to direct his rectors, employees and Senate, trying to emulate what he himself mentions.

"So, the institution has become sacred in Germany and the iron hand that has fallen in the new empire on the Catholic Church, would never dare to touch the sacrosanct jurisdiction of that immortal church of thought called University"[156].

At that time, three objections were presented to this initiative.

1) In the first place, it was objected that the project of deputy Sierra came to revive the Royal and Pontifical University of Mexico. Why do you want to resuscitate a thing that is dead and that has died well?

[156] Alvarado y Martinez Escobar *Op. Cit.*

2) The project of the deputy Sierra conceives the University as an autonomous corporation against the State. How the government is going to create an independent institution, delivered to be governed by people outside of it? How will the government consent to divest itself of a sum of its faculties so that another can govern the cause that it pays?

3) How do you construct a high institution; a vast building of higher education and you do not give to it a sufficient base? This is equivalent to build an inverted pyramid, in an unstable equilibrium, which cannot be sustained. If there is no solid primary education, why do you want this crown, why go to higher education, which is used to create science, if the elements from which all of it will be nourished are not ready? [157]

This last objection, says Sierra, was the one which really made him decide to abandon this project. Agreeing to postpone it for when it was sufficiently developed and organized primary, secondary, professional and superior education. It is also important to mention how at that time, an offensive against positivism had begun as a doctrine that gives life to education because it is considered a corrupting system that denies the possibility of a life beyond the grave, because it was unconstitutional, since it implied an attack on freedom of conscience and because public opinion had condemned it. These ideas were expressed by the Minister Mariscal who intended to take the Krausist work of Tiberghien that was based on the free chair and the experimentation with which he thought to substitute the Positivist of Bain, even came to ask for the extinction of the ENP[158].

Meanwhile in other countries, as we have already mentioned, during the second half of the 19th century the University had acquired a new meaning. The German universities were centers of great scientific importance, the French were recovering from the vicissitudes experienced by the revolution and the university education in the United States acquired a great development, reason of why the idea follows inside the thought of Sierra as the highest step to which national education can aspire, considering it the crowning of a great educational work in the country and remaining insistent in its speeches as much as a politician and journalist.

[157] Hernandez Luna, J. (1948). La Universidad de Justo Sierra. CIudad de México: SEP.
[158] Jimenez Rueda, J. (1955). Historia Juridica de la Universidad de México. Ciudad de México: Facultad de FIlosofía y Letras.

However, it was not until 1902 when he again made official his desire to present a University project to the legislative power, which he mentioned in his speech "would not be the heir of the Pontifical Mexican University" because he considered it "petrified without object and in doctrines without life "which from his perspective prevented the passage to new intellectual currents (Hernández Luna, 1948). According to old ideas, he rejected the traditional concept of a university, but he also rejected the style of American university "born suddenly and at a simple moment from the ground". Within his speech he also clarifies that he will not stop before those who consider him blind imitator of the French, recognizing that several of his proposals were inspired by the model of institution of this country, and he justified by mentioning that he is perfectly aware and not blind, in fact, its purpose is not to fall back into the mistake of inventing what has already been invented by only putting on new labels or tags[159].

Later in 1905 during the inauguration of the Higher Council of Education he insisted again on the idea mentioning that "the completion of your school constitution will necessarily be the creation of the National University penetrated by the modern spirit". On March 30, 1907, as Secretary of Public Instruction and Fine Arts, he mentioned at the end of his speech that the Head of State could retire to finish his journey in peace with the awareness of having fulfilled his duty by crowning the work of education with the University[160].

Finally, on April 26, 1910, the bill was presented to the congressmen, to whom Sierra indicated:

"I will begin by confessing, deputies, that the project for the creation of the University is not preceded by a clear and strict demand from public opinion. This project is not popular, in the rigor of acceptance of this word; It is governmental. It could not be otherwise, because it is an act by which the government detaches itself, in a considerable portion, of faculties that until now it had exercised legally, and deposits them in a body that will be called National University ... The State has a high political, administrative and social mission; but in this mission there are limits, and if something cannot and should not be within reach, it is higher

[159] Hernandez Luna *Op. Cit;* p. 11-12
[160] *Ibid* p. 12

education, the highest education. Higher education cannot have, as science does not have, another law than the method; this will normally be beyond the reach of the government"[161].

He promoted the initiative and it was approved by the Congress and they promulgated the law on May 26, 1910. The new ordinance prescribed in its art. 1 "It is instituted with the name of Universidad Nacional de México a teaching body whose primary purpose will be to perform in its superior elements the work of national education." And add at the art. 2 "It will be constituted by the meeting of the National Preparatory School, Jurisprudence, Medicine, Engineers, Fine Arts and High Studies. The Federal Government may place under the dependence of the University other higher institutes and also the new that it will create with its own resources with prior approval of the Executive, or those whose incorporation accepts, through the requirements specified in the regulations. According to article 3 "The Minister of Public Instruction and Fine Arts will be the head of the University; the government of this one will be, in addition, in charge of a Rector and a University Congress "[162].

After three decades of constant struggle for his university ideal, on June 18, 1910, Porfirio Diaz, officially informed about the founding of the new institution and three months after the publication of the University's founding law, the secretariat of Public Instruction and Fine Arts organized in the Amphitheater of the National Preparatory School a ceremony to inaugurate that University that Justo Sierra had dreamed so much[163].

The Government of Mexico designated the universities of Salamanca, Paris and California as godmothers of the new institution. The ceremony was chaired by Porfirio Diaz, accompanied by members of his Cabinet, the foreign representatives who came to the centenary celebrations and the delegates appointed by the invited Universities to witness his birth. Justo Sierra said the official speech, Ezequiel A. Chavez proclaimed the names of the Doctors Honoris Causa of the new University and in the middle of the act, Porfirio Diaz pronounced the classic formula: "Today September 22, 1910, I declare solemnly and legally inaugurated the Universidad Nacional de México". Then followed by the "parade of

[161] Sthal *Op. Cit; p.* 138
[162] *Ibid;* p.137
[163] Hernandez Luna *Op. Cit;* p. 13

doctorates", which left the building of the High School to the main classroom of the ENAE consummating the erection of the National University[164].

That University that had just emerged with such solemnity was the crowning of the liberal education program that the Republic initiated under the presidency of Benito Juarez and contained in origin in the law of December 2, 1867 that Gabino Barreda devised. The founding of the University meant the culmination and crowning of the educational work of the men of the reform and the liberal politics in the educational sector.

[164] *Ibid;* p. 13-14

Escuela Nacional de Altos Estudios

We have seen before that since the time of President Juarez it was necessary to reorganize the educational work so that the Organic Law of Public Instruction was issued on December 2, 1867, removing all religious content; from that moment, education became secular, the subjects for each career were pointed out in the School of Jurisprudence, the School of Medicine, the School of Engineers and the School of Naturalists that never came to be established[165].

This last one, was decreed with the intention of forming botanists, zoologists and geologists, and although the reasons for which the project never saw light were unknown, but these had obstructed its opening immediately decreed its creation, since in the regulation of the same law it was left as a pending and it was postponed indefinitely in subsequent provisions. Probably, the funds of the Restored Republic were insufficient for the educational program that the government had proposed, and in the Reform to the Law of Instruction, it retracts about the establishment of some schools, such as the one of Naturalists.

Several decades later, Justo Sierra would see in the creation of the University the culmination of the educational project that had been undertaken in Mexico since then and one of the most ambitious proposals for the its development was the founding of a National School of Higher Studies (ENAE). He wanted an institution to train professors a professional level and also serve as a research institute "where science could be cultivated by science ... where the courses were done not for the purpose of preparing students for exams, but to reveal men of study ", to prepare" wise ". This school intended to offer postgraduate studies and provide everything necessary for teachers and students to carry out scientific research as well as to train teachers for secondary schools and professionals[166].

[165] Hoffmann, A., Cifuentes, J., & Llorente, J. (1993). Historia del departamento de biología de la Facultad de Ciencias, UNAM. Ciudad de México: Facultad de Ciencias UNAM. 17

[166] Bazant, M. (2006). Historia de la educación durante el porfiriato. Ciudad de México: Colegio de México. p. 224

Once the UNM was established in 1910, the National School of Higher Studies that had been created by the law on April 7, 1910 was formally inaugurated on September 18 of the same year, was formally assigned to the University. Its first director was Don Porfirio Parra, positivist doctor, student of Gabino Barreda, who died in 1912, staying under the direction of Don Alfonso Pruneda, a doctor who also held important positions such as the Rector of the UNM (1924- 1928) among others[167].

Purposes of the National School of Higher Studies

The purpose of the National School of Higher Studies was delivery courses on advanced subjects, in sciences and humanities. Its objectives are manifested in the speech that its Director Don Porfirio Parra addressed during the opening ceremony:

"Here the Mexican sages will find the indispensable elements that scientific research requires, because the National School of Higher Studies will open its doors to different researchers so that this art, as important as fruitful, is practiced by every Mexican who feels love for the science and desire to investigate the wise laws that govern the Universe. Not for being a school of scientific research it won't be a school of profesors, here all the branches of knowledge will be made known to a degree and an extension that could not be taught in other schools, because they are not enough specialized"[168].

The school was planned by Ezequiel Chavez and Justo Sierra, copying the structure of the Ecole Practique des Hautes Études and under the same educational principles of this institution, which can be clearly seen in its constitutive law:

CONSTITUTIVE LAW OF THE NATIONAL SCHOOL OF HIGH STUDIES

Art. 1 A National School of Higher Studies is established and will have its center in Mexico City.

Art. 2 The objects of the National School of Higher Studies will be:

[167] Hoffmann, Cifuentes, & Llorente. *Op. Cit;* p. 28
[168] *Ibid;* p. 29

1) Perfection, specializing and raising them to a higher level, studies that in lesser degrees are done in the National Preparatory Schools, of Jurisprudence, of Medicine, of Engineers and of Fine Arts, or that are in connection with them.

2) Provide students and teachers with the means to carry out methodically scientific research that will enrich human knowledge, and

3) Train teachers of secondary and professional schools.

Art. 3 The National School of Higher Studies will have three sections:

The first, of Humanities, will include: classical languages and living languages, literatures, philology, pedagogy, logic, psychology, ethics, aesthetics, philosophy and the history of philosophical doctrines.

The second section, of Exact, Physical and Natural Sciences, will embrace mathematics in its higher forms and the physical, chemical and biological sciences.

The third section will be that of Social, Political and Legal Sciences, and will include all those that have social phenomena as their basis or object.

Art. 4 The Secretariat of Public Instruction and Fine Arts may form subsections of studies, coordinating those that it believes have a special scientific or practical interest.

Art 5 The teachings that are being established will be classified in the Section or in the Subsection constituted by the knowledge with whose methods and programs have greater analogy.

Art. 6 The classes and work centers of the National School of Higher Studies can be in various parts of the country, and even outside of it, in relation to the maximum effectiveness of the elements that can be gathered, to determine the success of the instruction that is given or the studies that are undertaken. The institutes that depend on the Federal Government the laboratories and stations that are established in the District or other parts of the Mexican territory will be part of the National School of Higher Studies, insofar as it is indispensable to realize the purposes of the same and they will remain in the rest of their functions in the regulatory dependency of the ministries that organize and sustain them.

Art. 7 The government and administration of the School will oversee by a Director, a Deputy Director, a Secretary and a Secretariat and Administration service. The Secretary and his dependents will be appointed by the Director of the School in the terms that define regulatory prescriptions.

Art. 8 The professors of the National School of Higher Studies will be ordinary, extraordinary and free: ordinary, those who occupy the teaching positions of the plant; extraordinary, those who, through a contract are in charge of one or more special teachings that fit into the general program of the School; and free, those who through the requirements indicated by special provisions, establish a specific teaching in the dependencies of the same School.

Art. 9 Free professors may demand from their students the payments they deem appropriate. In order to obtain a school certificate of the success of their teaching and of the students' achievement, they will have to submit them the tests prescribed by the regulations.

Art. 10 Students of the National School of Higher Studies may present reliable certificates of having completed their education in the National Preparatory Schools, of Jurisprudence, of Medicine, of Engineers or of Fine Arts, provided that, in the courses of said schools that they have connection with the courses that they are going to undertake, have obtained the highest qualification, or that, by virtue of the tests that are carried out before juries appointed by the National School of High Studies, show their aptitude to attend the educations included in the section in which the supporter wishes to register. Only those who come from the schools listed above have the right to receive during the time of their studies a pension, which they will lose, as well as the condition of students, if in the final tests of each course they do not obtain the regulatory average.

Art 11. Students coming from the Schools of the States of the Federation that have institutes whose curricula and programs are equivalent to those of the national schools referred in the previous article, may register as students of the National School of High Studies, through certificates similar to those already mentioned, but will not be entitled to federal pensions. The exceptions to these rules may only be expressly decreed by the President of the Republic.

Art. 12. Students of private schools, as well as foreigners, will have to submit to the requirements of the regulations to belong to the National School of Higher Studies.

The School was originally formed with three sections: exact sciences (physics and biology), humanities, and political and social sciences. To give it a real structure, the Medical Institute, the Pathological Institute and the Bacteriological Institute, the museum of Natural History and Archeology and the museum of History and Ethnology, as well as the General Inspection of Archaeological Monuments were incorporated[169]. According to the statutes, the National School of Higher Studies could create research centers throughout the national territory, but, its activities were limited to Mexico City[170]. The intention was that this new university would reach a higher level of education than other schools, not only because of its quality, but also because of its nature, because it would not be limited to the transmission of knowledge, it will produce it[171].

As Sierra mentioned in his inaugural address:

"Our ambition would be that in that School, which is the highest rung of the university building, may like this to discover in the most open horizons, like those that only from the highest peaks of the planet can be contemplated; our ambition would be that in that school we should teach ourselves to investigate and think and the substance of research and thought should not be crystallized in ideas within souls, but rather that these ideas constitute dynamisms that can be perennially translated into teaching and in action, that only thus can ideas be called forces ... "[172].

To enter it was necessary to have completed the full cycle of studies in one of the higher institutions that were part of the University and a system had been established to grant equivalencies to provincial students[173].

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[169] Ciudad de México: Dirección General de Publicaciones y Fomento Editioral.
Pérez Tamayo, R. (2010). Historia general de la ciencia en México en el siglo XX. Ciudad de México: Fondo de Cultura Económica; p 34-35

[170] Fell, Claude. (1989). José Vasconcelos los años del águila (1920-1925). Ciudad de México: UNAM. P. 229

[171] Pérez Tamayo. *Op. Cit;* p. 34-35

[172] Pérez Tamayo, R. (2010). El estado de la ciencia en México: pasado, presente y futuro. En H. Fix-Zamudio, & D. Valdés , Formación y perspectivas del Estado en México; p. 329

[173] Fell, Claude. *Op. Cit;* p. 294

The National School of Higher Studies did not have a specific program and it didn't offer academic degrees of a specialty master or doctorate, but rather it would give courses of the highest level in different aspects of human knowledge, which could only be attended, after rigorous enrollment, the best students of relevant professional careers[174].

At the beginning it was almost impossible to recruit personnel prepared with such a high level within the country and to integrate the teaching staff, foreign professors were hired; Dr. J.M. Baldwin for psychology, Dr. F. Boas for anthropology and Dr. Carlos Reiche who gave a higher course in botany since July 1911, with an enrollment of 33 students; He also gave lectures on the theory of Organic Evolution and, later, he gave a course in General Biology and a practical course on Botanical Classification. He was likewise, Chief of the Section of Systematics and Botanical Geography in the National Medical Institute of Mexico. After returning to his homeland, Germany, the Graphic Workshops of the Nation published in 1926, his famous book Flora Excursoria in the Central Valley of Mexico[175].

In the last decades of the 19th century, Mexico experienced a boom in development of its scientific activity: specialized societies were formed; the publications multiplied; the first research institutions appeared and the men of science left their status as amateurs to become professionals. The impact these events had on social life can be calibrated in terms of the enthusiasm that science aroused at that time and that led intellectuals to place their hopes in it to lead the country in an inexorable movement towards perfection. Science appeared as the element that had sustained the successive strengthening of human reason and whose cultivation would achieve that goal[176].

During the regime of Porfirio Diaz, science experienced an intense process of institutionalization, was seen for the first time as a public issue of social interest that could put the country in conditions of competitiveness and should be incorporated into modernity,

[174] Pérez Tamayo. *Op. Cit;* p. 330
[175] Hoffmann, Cifuentes, & Llorente. *Op. Cit;* p. 29
[176] Azuela, L., & Guevara Fefer, R. (1998). La ciencia en México en el siglo XIX: una aproximación historiográfica. Asclepio Revista historiográfica de la medicina y de la ciencia, p 79

that is why that the end of the 19th century has been like a turning point in the development of our scientific history[177].

In Mexico the twentieth century begins with very good advice for science, because the country was still immersed in the porfiriato and this political structure presented a very favorable attitude towards its development[178]. However, the lack of job opportunities within the industrial fields due to the labor policy induced by foreign companies who only hired qualified personnel of the same nationality from their countries of origin, led to the disinterest of many young people to perform scientific-technological university studies, unleashing an academic crisis in some educational sectors, such as the National School of Engineers[179]. This situation favored the development of the social sciences and very soon this same century became the most negative for the relations between the State and the science that records the history of our country[180].

At the beginning of the 20th century there was a group of positivists from which Porfirio Diaz surrounded himself "the scientists", a political college restricted to state ministers, powerful businessmen and their lawyers, bank advisors, landowners who had friendship and the support of President Diaz and that those whom controlled almost the entire country, including higher education. This group had absolutely nothing more scientific than the name, which became popular because the media and the citizens identified it with the old positivists in whose ENP some of them had studied. However, the political discredit in which "the scientists" fell at the end of the regime and at the beginning of the Revolution was so resounding that undoubtedly influenced the reserve with which the first governments emerged from our maximum social movement of the 20th century took everything related to true science[181].

[177] Carrillo, A. (2011). La Escuela Nacional de Medicina durante el porfirismo: forjadora de la modernidad y pilar de la Universidad Nacional. La UNAM en la historia de México (págs. 145-173). Ciudad de México: UNAM; p. 146
[178] Pérez Tamayo. *Op. Cit;* p. 328
[179] Ramos Lara, M. (2013). Vicisitudes de la ingenieria en México (siglo XIX). Ciudad de México: UNAM. p. 199
[180] Pérez Tamayo. *Op. Cit;* p. 328
[181] Pérez Tamayo. *Op. Cit;* p. 29

Operation of the School and its decline

The National School of Higher Studies emerged under a context in which the country had never been taught basic science in a formal way, let alone in order to generate specialized men in specific branches of knowledge. For this reason, there were no teachers with the experience to teach in these areas of knowledge, there was a lack of adequate facilities, and even more important, of a curriculum. To start this institution, institutions were used that already had some prestige and teachers who had some kind of experience teaching in other faculties.

The courses had a relative success the first year and very little enrollment the second. In addition, since the School lacked a building, conferences were held in different places, such as the High School or Jurisprudence, and a situation of greater importance was that it had no laboratories or library, as well as resources to build and equip them, so she was totally incapacitated to carry out original scientific research[182]. In addition, in a country of illiterates the existence of a "National School of Higher Studies" was not explained where pure science was going to be taught by foreign eminences and two months after its inauguration, the Mexican Revolution began, which triumphed in the month of May of 1911. The National School of Higher Studies in the middle of the revolution was just beginning and a commission formed then to establish what courses it was indispensable to institute had declared:

"The National School of Higher Studies is something new, unusual and unusual among us, about which there are no traditions to follow, nor precedents to take into consideration. In his program, the most abstract and general speculations fit, without dissonance, than the more concrete and detailed studies; the same methods and doctrines of mathematics, that the texture details of the nervous pulp, that the products of human understanding in the sphere of the beautiful letters"[183].

[182] *Ibid;* p. 29

[183] Cuevas Cardona, C., & Ledesma Mateos, I. (2006). Alfonso L. Herrera: controversia y debates durante el inicio de la biología en México. Historia Mexicana, 973-1013; p. 986

About the courses for the section of exact, physical and natural sciences they agreed that the following would be indispensable:

High mathematics	Organic chemistry
Rational mechanics	Biological chemistry
Astronomy	General embryology
Celestial mechanics	Experimental physiology
Experimental physics	Experimental psychology
Mathematical physics	Evolution of organized beings
Geology	Bacteriology
Physics-chemistry	Pathological anatomy
General chemistry	Mexican botany

And regarding the tools:

Thermodynamics	History of mathematics
Electrology	History of physics and chemistry
Mexican Meteorology	History of Medicine[184]

Being an institution created by the old regime, not only counted in its opposition to the enemies of positivism, but also to the new actors of national politics and it is not strange that, when discussing the budget of Expenses for the year 1913, In the last months of the previous

[184] Cuevas Cardona, C. (2010). Ciencias y revolución en la Escuela Nacional de Altos Estudios. En R. Ruiz, A. Argueta, & G. Zamudio, Otras armas para la independencia y la revolución (págs. 219-231). Ciudad de México: Fondo de Cultura Económica; p. 222

year, a violent opposition to the parties guaranteeing the support of the University and, in particular, those related to the National School of Higher Studies and its suppression was proposed. Ezequiel A. Chávez, deputy at that time, made the defense of the institution and helped by other representatives, managed to save the corresponding budgets[185].

The year of 1914 began with a fundamental reform in the High School Plan of Studies. The old Barrediano plan was incorporated into a series of chairs brought from the field of the humanities. The announced incorporation of the philosophy to the University, was not only in the curriculum of the National School of Higher Studies. There were now conferences at the Preparatory School that included Mexican history, Mexican and Ibero-American literature[186]. However, for the year 1915, on May 15, Jesús Díaz de León, then its director, announced that the National School of Higher Studies would be closed, which did not happen, but Carlos Reiche was dismissed[187].

When retiring Dr. Reiche, his position was occupied by Guillermo Gándara (1879-1940), master teacher who achieved great recognition for his work in botany. He was the first naturalist who obtained the degree of Doctor in Biological Sciences in the Faculty of Philosophy and Letters of the University (1929). He was also the Head of the Department of Biology of the Ministry of Development and professor of the Normal School as well as the author of many articles on botany. Prof. Gándara then offered four courses: General and Systematic Morphology, Physiology and Phytogenesis, Geographical Botany and Paleobotany and Industrial, Medical and Pharmaceutical Botany. As a professor of zoology, the doctor Agustín Reza was appointed in 1916 with a program of three courses: General Zoology, General Biology and Embryology and Comparative Anatomy.

On February 15, 1916 the "General Plan of the National School of Higher Studies " was approved, in which four lines of action were established; higher research and experimentation studies would be carried out, although the National School of Higher Studies would only provide the means for paperwork and management, free courses and specialized courses would be opened to complement the studies already acquired in the faculties or in the high

[185] Jimenez Rueda. *Op. Cit*; p. 189
[186] *Ibid*; p. 190
[187] Cuevas Cardona. *Op. Cit;* p. 226

school, serial lectures would be given merely informative and Specialization courses would be awarded for the training of normal teachers, with which they could become professors at the middle and higher levels[188]. The institution gradually acquired the status of a higher normal school where educators of high schools, faculties and colleges were trained. Specialization courses of two, three and five or six years were organized, which were aimed at obtaining a university degree in the areas of medicine, law, anthropology and national history. For this year, the school had 596 registered students and in 1917, 681[189].

In that same year, with the drafting of the new Constitution, the Secretaries of Justice and Public Instruction and Fine Arts were abolished. The new law of Secretaries of State issued on December 25, 1917, established a University and Fine Arts Department that would depend directly on the Executive. This organism was integrated with the different schools of the University: Jurisprudence, Medicine and Engineering. The Faculty of Chemical Sciences is founded. The High School is called the National School of Higher Studies. The University Department would also be in charge of literary, dramatic and artistic property, the organization of scientific and artistic congresses, university extension and the promotion of arts and sciences[190].

On September 29, 1921, Congress approved a constitutional reform that will make possible the existence of a Secretariat that would be called Education. The University would be incorporated into the Ministry of Education. The Faculty of Higher Studies received an impulse with the creation of new chairs[191]. By 1922 there were 14 professors in Mexican, French, English, German and Italian language and literature, two in philosophy and three in psychology; four professors in natural sciences who taught botany, zoology and biology and evolution; three in the physical and mathematical sciences; two in chemistry; four in geography, geology and climatology; three in anthropology and archeology; one in history; four in pedagogy and 10 in medical specialties. Alfonso L. Herrera, was appointed professor

[188] *Ibid*; p. 227
[189] Fell, Claude. *Op. Cit*. p. 294
[190] Jimenez Rueda. *Op. Cit;* 294
[191] *Ibid; 195-196*

of zoology and Carlos Reiche returned to give the class of biology and theory of evolution. A year later Carlos Hoffman would offer an entomology course[192].

By then, the problem of defining the functions of the now-named Faculty of Higher Studies continued and pedagogical matters were added to its plan that must be the seed of the future Higher Normal. From the rectorships of Ezequiel A. Chávez the mission of preparing teachers for the Second Teaching had been pointed out to the Faculty[193]. Chávez pointed out that the absurd assumption that it was only a pure and unbearable science center, in a country that needed primary schools, but that it would just be in charge of perfecting the knowledge of the teachers of these schools, should not be continued[194]. I made these kinds of statements in order to save the institution, since the country was not in a position to finance basic scientific research and the attempt to generate technology through science was incomprehensible.

From 1916 to 1921 one could choose to obtain the degrees of academic professor in botany, if three subjects were studied on plants, Latin language, logic and methodology, physiogeography and organic chemistry; or of zoology if three subjects were studied on animals and all the others, except the Latin language that was replaced by the German language. If the two areas were studied, the degree of university professor in natural sciences was obtained[195].

In 1921, the Director of the School of Higher Studies was Dr. Antonio Caso y Andrade, with José Vasconcelos Calderón as Rector of the University. When Lic. Vasconcelos became Secretary of Public Education, Dr. Caso occupied the Rectory and Lic. Ezequiel Chávez the school management; this last one also occupied the position of Rector and then, Dr. Daniel M. Vélez was appointed Director of the School[196].

According to the Record of Exams of the National School of Higher Studies, it was in 1922, when the School awarded the first diplomas of "Academic Professor" to Jovita Elguero, Elias Allande and Horcasitas and Alfonso Carrillo y Perea, the three "with specialty in

[192] Cuevas Cardona. *Op. Cit.* p. 229
[193] Jimenez Rueda. *Op. Cit;* 196
[194] Cuevas Cardona. *Op. Cit.* p 230
[195] Cuevas Cardona & Ledesma Mateos. *Op. Cit;* p. 1000-1001
[196] Hoffmann, Cifuentes, & Llorente. *Op. Cit;* p. 31

Zoology. " Later in 1924, the same Jovita Elguero, obtains another diploma "with specialization in Zoology". The way of writing these diplomas was not always the same, because the one of Enrique Beltrán in 1926 says to the letter: "Academic Professor with specialization courses in Natural Sciences (Botany and Zoology)" and the last one issued in 1927 to Irene Elena Motts : "Diploma of University Professor Specialization in Biological Sciences"[197].

In February of 1924 the rector of the university received a plan signed by Jose Vasconcelos, then secretary of Public Education, by which it was proposed to divide the Faculty of High Studies in three: Faculty of Philosophy and Letters, Normal School Superior and Specialties in Sciences Applied (then Faculty of Graduates), and was accepted in September of that year. But Álvaro Obregón ended his term on December 1 and by day 31 teachers received the communiqué of its closure, this did not last long thanks to the organization of the students and the school was reopened on January 1 of the following year[198].

Finally, in February 1927, it was divided into three sections: philosophy, science, and history and letters, and in the science section of these new programs, studies in mathematics, mechanics, astronomy, physics, chemistry, biology, and psychology were given. Three degrees could be obtained: added, teacher and doctor. On February 1, 1929, President Emilio Portes Gil issued a decree by which they were separated in the Faculty of Philosophy and Letters and the Normal Superior School. On July 24 of that year, the University obtained its autonomy and was granted the Government Institutes that had research functions and in chapter three subsection c, three were identified that would become part of its infrastructure: the Institute of Biology , the Geology and the Astronomical Observatory, which would start a new stage in the scientific organization of the country[199].

In 1930, the Faculty of Philosophy and Letters created a Department called Section of Sciences, where higher studies of biology, physics and mathematics were planned, being able to obtain the academic degrees of Master and Doctor in Exact Sciences, in Physical Sciences

[197] *Ibid;* p. 32
[198] Cuevas Cardona. *Op. Cit;* p. 230
[199] *Ibid;* p. 231

and Biological Sciences[200]. The University awarded doctorates and master's degrees to a group of distinguished professionals who taught chairs in this House of Studies and who had a seniority of over five years[201].

The situation of the masters in physics and mathematics was very irregular and nobody obtained that degree. In biology, on the other hand, the students were better organized and progressed a lot; so that in 1931 graduated the first two Masters in Biological Sciences who, for the first time also, had acquired a true and adequate instruction on this discipline. The first to graduate was Helia Bravo Hollis who presented the thesis "Contribution to knowledge of cacti"; his examination was carried out on December 21, 1931 at 7:30 p.m. in the then National School of Philosophy and Letters. The synodalists were Antonio Caso, Isaac Ochoterena, Federico Muelleried, Joaquín Gallo and Guillermo Gándara. The same day, in the same place and with the same jury, but a little later, at 9:00 pm, Leopoldo Ancona Hernández also obtained his degree with the thesis: "The chilacuiles or worms of the salt of Oaxaca" (Hoffmann, Cifuentes, & Llorente, 1993, page 36). In this way, the formalization of the degree at the Bachelor and Postgraduate level began, which opened the way for the formation of the Department of Biology within the Faculty of Sciences.

The establishment of science

Alfonso L. Herrera (1858-1942), son of the naturalist of the same name and who, like his father, became interested in the natural sciences in 1900, founded the Commission of Agricultural Parasitology and initiated research for the biological control of pests; likewise, he promoted the publication of the "Bulletin of Agricultural Parasitology". In 1902-1903 he wrote the work "The Plagues of Agriculture" and in 1902, a century after Lamarck and Treviranus incorporated the name of biology into scientific terminology, Herrera created the first Chair of Biology in the Normal School of Teachers. General imparted in Mexico. In 1904 he published his book Notions of Biology, which was widely known abroad. He was

[200] Hoffmann, Cifuentes, & Llorente. *Op. Cit;* p. 36
[201] *Ibid;* p. 35

also a professor at the Normal School, the High School and the Military College and Director of the National Museum of Natural History and the Directorate of Biological Studies. At his initiative the Botanical Garden was founded in 1922 and the Zoo in 1923[202].

In October 1915, Prof. Herrera founded one of the most far-sighted scientific research centers: the Directorate of Biological Studies under the Ministry of Agriculture and Development. This new center brought together the National Medical Institute, the Biological Exploration Commission and the National Museum of Natural History, as mentioned above. Shortly after the Bulletin of the Directorate of Biological Studies began to be published, where articles of the scientists of the time appeared, such as Herrera himself, Juan Manuel Noriega, Maximino Martínez, Moisés Herrera, Fernando Ocaranza, Isaac Ochoterena, Moisés Ramos and others[203].

On October 2, 1915, an evening was held to inaugurate the Directorate of Biological Studies, where he announced the creation of a Botanical Garden and a Zoo (Beltrán, 1969, pp. 109-110). To create the Directorate, it was necessary to suppress the National Medical Institute as an autonomous entity, profoundly modifying its programs, which was considered by many as an attack, having greater resonance because the last director was Dr. José Terrés, who enjoyed great prestige In the medical guild, which should have caused resentment in the medical class, this did not prevent doctors like Leopoldo Flores, Joaquín and Emiliano Torres, Fernando Ocaranza, Manuel Pérez Amador and Eliseo Ramírez among others, decided to collaborate with the nascent Institution[204].

After the time this Directorate of Biological Studies had to reorganize being integrated by the Institute of General and Medical Biology that had replaced the National Medical Institute and that absorbed the National Herbarium; also by the National Museum of Natural History, the Department of Exploration of Flora and Fauna, by the Botanical Garden and the Zoological Park of Chapultepec and the Station of Marine Biology of the Gulf, which was established in 1926 in the port of Veracruz. The amplitude of the project and the lack of an

[202] *Ibid; p.* 20
[203] *Ibid;* p. 30
[204] Beltran, E. (1969). La dirección de estudios biológicos de la Secretaria de Fomento y el Instituto de Biología de la Universidad Nacional. Anales de la Sociedad Mexicana de Historia de la Ciencia y de la Tecnología; p. 116

adequate budget resulted in the gradual deterioration of the Institution, which began to decline rapidly in its functions[205].

Meanwhile in 1924 Prof. Isaac Ochoterena founded, within the UNAM, the Institute of Biology, which was incorporated all the work that had been done since 1888; Thus, a large part of the personnel, equipment and facilities of the now very deteriorated Directorate of Biological Studies, which included the Institute of General and Medical Biology and the National Museum of Natural History, were annexed. The Botanical Garden and the Zoological Park were separated, while the Marine Biology Station of the Gulf disappeared[206].

With the creation of the Institute of Biology it is finally possible to consolidate this science, providing it with official representation. The creation 10 years later of the Department of Biology, within the Faculty of Sciences, is nothing more than a logical and necessary consequence of this transcendent first step[207].

In 1937 the Science section is completely separated to become the Faculty of Sciences and, remain the National School of Higher Studies alone as Faculty of Philosophy and Letters. In 1935, Lázaro Cárdenas created the National Council of Higher Education and Scientific Research (CONESIC), as a consulting body for the creation and organization of institutes that aimed to practice scientific research and regulate the work of higher education establishments . During the Cardenista regime, the Institutes of Physics, Mathematics and Biology were created at UNAM. In addition, the Institute of Agriculture and Health and Tropical Diseases were created; in the area of social sciences, the Institute of Anthropology and the House of Spain, which later became the College of Mexico[208].

The existence of the CONESIC was limited to two years, due to the lack of educational infrastructure and scientific research, as well as internal conflicts in the country. It wanted to promote technological development with the creation of the National Polytechnic Institute in

[205] Hoffmann, Cifuentes, & Llorente. Op.Cit. p. 30
[206] *Ibid;* p. 33
[207] *Ibid;* p. 34
[208] Arredondo Galván , V., Pérez Rivera, G., & Morán Oviedo, P. (2006). Politicas del Posgrado en México. Reencuentro; p. 4

1936 as an expression of the policy of industrialization adopted by the regime[209]. And this is how the institutionalization of scientific activity in Mexico was carried out[210].

[209] *Ibid;* p 5
[210] *Ibid;* p 5

Chapter IV

Analysis of results

This work is basically done by the analysis of ideas that can be made a little bit abstract. From the beginning try to understand what it is a university? required a huge amount of documentation. But you cannot understand and study the history of a high study institution without understanding what it is a university.

Without a doubt, these educational centres changed the historical course of societies and the current world cannot be understood without them. The institutionalization of education allowed a huge amount of changes in the way we relate and live together. In the first part we talked about this process that gave political power for the first time in history to a sector that had not previously been important and how the student and teacher unions allowed the development of knowledge.

The organization of this sector allowed teachers to receive a salary and to stay in fixed places, where they could without worry, devote themselves only to the development of sciences. No doubt this gave us the knowledge that later gave rise to the necessary technological advances that allowed the beginning of the machine age and the industrial revolution.

Already fully in this stage of production and development of machinery began a new way of relating between nations. Trade at industrial scales began to feed directly back the educational sector in a process that Humboldt had the capacity to understand.

The pursuit of science has often opened doors to technology with commercial applications. Many scientific results have helped spark innovations of industrial or agricultural value. Others have served to enlarge the stock of usable knowledge and to improve techniques in many different fields[211].

In many countries, it took time for this type of ideas to be understood by the governmental authorities, because as I mentioned earlier, these arguments are based on abstract ideas that may not be perceived in a simple way by those who have not devoted much time to reflect on the education sector and its importance. It is here where the Universal Exhibitions took on a very important role, since through creativity and art they allowed showing the world all the advances that were being made in the area of science.

[211] **Fuente especificada no válida.** p 2

The impact generated by these events was huge and thanks to them finally Napoleon III made the decision to reform education and allows the creation of a school created with the aim of conducting scientific research and prepare scientists who could bring new technological discoveries.

It is in this way that finally taking up the visionary ideas of Humboldt, the historian and minister of public education Victor Duruy initiates the project of the creation of the EPHE with which France opens the door to the institutionalization of scientific development, in addition to accepting knowledge and science as a way to bring economic development to the country began numerous social revolutions that have resulted in an improvement in the quality of life of workers.

The industrial production, had innumerable consequences in the society and without doubt, the mass education of society due to the need of highly qualified workers allowed population being much more conscious about the role that they had in the social organization. Free thinking and reflection and dissemination of ideas among broad sectors of the population, resulted in social benefits that undoubtedly improved the quality of life of many sectors of the population.

The project to open the EPHE arises from the need to continue feeding the industry through knowledge and this was not limited only to the improvement of the production processes, it was also interested in introducing radical changes in the way of carrying out trade, the world begins to be understood as a place where countries should start to make trade agreements and diplomatic relations rather than wars between them. As we have mentioned, Duruy calls the workers the new warriors and the industry the new peaceful struggle of France.

The plan was carefully prepared and based on data, there was a careful analysis of the German universities, a program had been carried out and all the subjects and institutions that would be attached to the EPHE had a reason to be there. Each piece had its place in this whole plan, that's where the brilliant role of Duruy lies. Even the laboratories where the students would work were thought to be the place where real professionals could find their successors, were designated not only for the transmission of knowledge, but also intended to generate knowledge and capture the brightest students.

Despite being a historian, he had a perfect vision of the importance that mathematics and its development had in the branches with more practical applications such as chemistry or physics and engineering, so the realization of works without direct applications in the branches of the industry were seen with good eyes.

The French school continued forward and its development didn't stop, despite the fall of the empire of Napoleon III and the war against Prussia. The project had a continuity and was not ruled out. The school followed its course and as we can read in the speech of Louis Hever for the 50th anniversary of the institution, it continued to carry out the activities in the same way that had been devised 50 years before by Victor Duruy.

Undoubtedly, this institution is a before and after in the development of scientific work and in the way in which the development of sciences was carried out in France. The scientist became an employee of the state, paid by the state, a soldier of the state, who had to fulfil his obligation to raise the name of the country by means of the generation of knowledge, which would allow the development of commerce and the economic power of the country.

On the other hand, the development of history in Mexico occurs in a very different way. In the first place, the wars had not allowed the era of industry to penetrate completely into the territory and although there were some very productive industries such as mining and textiles, it was not a generality in the country, much less a priority.

In 1860 the country was still struggling to obtain its total independence from the European countries that were still trying to establish their protectorates and colonies, in part this is precisely due to the search for obtaining resources to continue the industrial war. Mexico, being a country rich in natural resources, could not go unnoticed, which caused several economic interventions in the territory, the most important of which was that carried out by France in 1862, which resulted in the reign of Maximilian of Hapsburg, who was protected by the French army despite being an Austrian prince.

The instability not only came from abroad, at the same time the country had internal struggles because population didn't decided the type of government that our country should have fought a monarchy or a republic. It must be mentioned that Maximiliano was not only

imposed by the French government, there were also a part of the Mexican population that wanted to establish this government.

These internal and external struggles had not allowed until that moment the development of the industry, which was stopped, and the educational sector totally abandoned, because at that time the priorities were very different from the social or economic development. But without a doubt the government and the entrance of the French army allowed the arrival of many French ideas in to the country, in this way the positivism arrived and was taken as a banner of future governments until 1910, where the Mexican Revolution completely changes the course of history.

It is in this context that Justo Sierra decides to propose the creation of a university that includes a school where science is carried out and that is dedicated to the generation and transmission of knowledge. Due to the strong French influence, for the elaboration of this project he chooses the parisian school as model of institution and the plan is elaborated so that in the constitutive law of the school many of the ideas of Victor Duruy can be seen.

Unlike the parisian project, it lacked a structure, in addition almost no scientific institute had been developed in a serious way and the few that existed had been managed by people in an improvised manner, most of them were medical centres, where some scientific investigations that pretended to follow the footsteps of Louis Pasteur. On the other hand and due to the mining and oil wealth of the country, there was a sector dedicated to geology and geography that was also interested in joining this project.

Justo Sierra took many years to convince the dictatorial government of Porfirio Diaz about the importance of his project. In old Mexico you could not understand a scientific research center when there were still many illiterates, so he had to wait 30 years for the education sector to be in better conditions to be able to admit a new educational project.

Despite all the time he had to wait, the maturity of the nation was not enough to understand the importance of this project. The Mexican economic and social context was very different from the French one and the industry had developed thanks to foreign investment. Actually, all the technology used was brought from other countries, because almost no modern industry

was really Mexican. So, the generation of science and technology was not perceived as an immediate need to develop trade.

This had consequences that remained for many years rooted to our days in the country. At that time, the engineering school only had a few students, since they could not get jobs because foreign companies had their own workers, who had been educated and trained in their countries of origin. At that time, integration into the labor field was practically impossible for a Mexican. This resulted in the decline of these educational institutions and for the government it was more important to attract foreign capital that already had enough experience to develop and set up an industry, because this was the fastest and most effective solution to not lose the race for industrialization and trade.

Finally, the ENAE could see its realization as the national university, but this would not last long, since a few days would begin the Mexican revolution that asked to overthrow the dictator Porfirio Diaz and later due to this situation the school entered into a instability which could not be recovered, little by little the purpose with which it had been created was degenerating until it ended up being a faculty of philosophy and letters.

This institution was undoubtedly the one that allowed the sciences to be developed for the first time in Mexico and at the institutional level, allowed the creation of the first research centers and, above all, was the way in which the Humboldt system entered in the country. Despite not being able to fulfill its purpose, it was the place where for the first time a professor was dedicated at the same time to teach science and generate knowledge.

The Mexican Revolution resulted in much political and social instability, which lasted for many years until the arrival of President Cardenas, who in 1936 promoted the creation of the National Polytechnic Institute and it is until then that we can really say that science and technology materialize its important role in the country.

In order to understand the present of scientific activity in Mexico, it is necessary to know its past, how it emerged and how it was established. In this work and through the comparison of two institutions that were created under the same concepts and ideals, but in practice had very different results, we can see how the social context influences the course of educational institutions.

In the first place, we can say that this educational model does not materialize until after 1930, when the institutions of scientific activity really take a relevant role in the interests of the government to concretize scientific research in Mexico took place 60 years later. that in France and is a relatively recent activity, because it has not even been a century since it was formally established.

Without a doubt the French influence and the entrance of the positivist ideas helped that this project was developed, but the economic and social instability due to the wars and constant revolutions did not allow that these were developed of suitable way. France, on the other hand, also suffered armed conflicts, but in spite of them, there was a continuity in educational projects, while in Mexico no institution manages to survive armed conflicts and even in times of peace, institutions disappear relatively quickly.

This lack of consistency in public policies has resulted in a delay in the education sector, which we have already discussed, being Mexico one of the countries with the lowest scores in the PISA tests of the OECD.

Throughout this history we have highlighted the importance that science has had for society, since through it and in feedback with the industry has made changes at a global level that a few years ago were impossible to imagine, the development of the technology has allowed to improve the quality of life of people, from the medical, pharmaceutical and agri-food sectors. The social movements derived from the working sectors have made it possible to improve working conditions and the integration of women into industrial sectors as workers have generated struggles that have allowed them access to education and voting.

Science alone is not capable of generating all this development, it has been accompanied by the generation of technology, science for science is not going to make a big difference, it is its applications that have allowed these advances and the sector that is linked to the distribution and commercialization of these technological advances has been industry and commerce.

Mexico is a very industrialized country, but since the porfirian era, support for foreign industry has prevailed, so many of the companies that currently operate in the country work with the use of technologies that have been developed in other countries, that is why

governments have never taken seriously the role that development and support for scientific advances have.

It is difficult to convince a population with a low scientific education and unable to understand the importance of this sector, to support public policies related to research, it is as Victor Duruy did at his time, necessary provide knowledge to the entire population, which will raise awareness and educate.

As a student of the area of biological sciences, I believe that in Mexico there is a distancing between the scientist and the population. The researcher remains within his laboratory and only has a close communication with the students, the great difference between the project of Duruy and Sierra was precisely that. In France, a whole system was established that aimed to bring technical education to the entire population, from the farmers even the sages he mentions, part of the project included sending people trained in science to give classes to farmers and in the Normal School Teachers had to be prepared to have the capacity to teach these courses.

In Mexico a project was never established to give technological education to the general population of the country, it was only sought to alphabetize the population and although Sierra mentioned the possibility of donating technical education to all the workers, in reality it only remained as an idea and never a work plan was carried out in which this type of education reached the population in general.

Conclusion

Today, 200 years after the creation of these study models by Humboldt and 150 years after the start-up of Victor Duruy, we can say that there is sufficient evidence that allows us to see the importance that universities and research centers have in the development of technology and industry and consequently in the development of the economies of the countries.

In this respect there is a theory that would be very interesting to analyze called "The Triple Helix" were university-industry-government are very close related, this was created by Henry Etzkowitz, who was interested in the entrepreneurial university and Loet Leydesdorffs' interest in the evolutionary dynamics of science, technology and innovation.

This model has been well studied and is currently taken as the basis for the realization of government projects and public policies that promote the development of these relationships. Etzkowitz himself has tried to improve his model by adding variables that could affect its functioning, for example in an early stage the model had been proposed by him in the following way:

In Triple Helix I, the three spheres are defined institutionally (university, industry, and government). Interaction across otherwise defended boundaries is mediated by organizations such as industrial liaison, technology transfer, and contract offices[212].

Later this model changed to give rise to model two, which according to him:

In Triple Helix II, the helices are defined as different communication systems consisting of the operation of markets, technological innovations, and control at the interfaces, the interfaces between these different functions operate in a distributed mode that produces potentially new forms of communication as in a technology transfer interface or in the case of patent legislation[213].

And this was changed once again by a model in which:

In Triple Helix III, the institutional spheres of university, industry, and government, in addition to performing their traditional functions, each assume the roles of the others, with universities creating an industrial penumbra, or performing a quasigovernmental role as a

[212] **Fuente especificada no válida.** p 197
[213] **Fuente especificada no válida.** p 196

regional or local innovation organizer the institutionally defined Triple Helix is premised on separate academic, industrial, and governmental spheres and the "knowledge flows" among them. Transfer is no longer considered as a linear process from an origin to an application. Historical patterns of interaction can be reconstructed. While "knowledge flows," tracked by scient metrics, are an important constituent of science-based economic growth, more intensive relations of increasing complexity have emerged in the course of the capitalization of knowledge. The emerging Triple Helix III is based on a complex set of organizational ties among overlapping spheres that increasingly break down the boundaries between them[214].

New codes of communication are being developed at all the interfaces. For example, science is no longer valued only as a quest for truth, but also from the perspective of utilization, legal systems are developed with the aim of supporting innovative processes, industries are transformed and restructured both from the perspective of control and from that of adaptation to new technological options. The institutions are involved in the transitions that they cause by their interactions[215].

As we can see the importance of scientific development within universities is a recognized issue, so it is very important to understand how these relationships occurred through history and the different variables that compose it can help us to improve educational institutions as these relationships become more fruitful in a sense of mutual support.

Undoubtedly with the completion of this research I help to understand the state of science in my country. The lack of continuity in public policies has not allowed the creation of these contact networks, which in countries such as France were natural and strengthened over time.

In Mexico, the diffusion of scientific knowledge very rarely reaches the workers sectors, who for example in the agricultural sector continue to work with artisan techniques and empirical knowledge, which despite being a valuable historical and anthropological resource of our country often relegates these people to poverty and leaves them unprotected before commercial competitions with large producers. These sectors, for example, do not know about specialized terminologies that can give added value to their products as bio and do not

[214] **Fuente especificada no válida.** p 197
[215] **Fuente especificada no válida.** p 197

understand anything about genetically modified organisms, being at an absolute disadvantage.

It is necessary to improve the education sector in the area of science in Mexico, the dissemination and learning of these in primary schools and support for scientific institutes is essential to increase the production of new technologies and patents that can be brought to the industrial sectors, this feedback process should undoubtedly be managed by the institutions in charge of linking the government with education and industry such as the Secretary of Public Education and the National Council of Science and Technology.

Tutored project

The wheat

Introduction

As part of the TPTI Master and as part of the final project in which we were commissioned, we made a research on the history of wheat techniques and industry, the team is conformed by four students of different nationalities, so it is a work done by people who come from different cultural and educational contexts. The realization of this work required the development of different skills to be able to carry it to a good term, these were developed over time through practice and good understanding between students and our tutor.

The direction of the TPTI master made the organization of the groups and chose the themes, so they were received by the students in a random way. Having received only the name of our subject, the group of students had to decide everything related to the realization of the project, so the communication was basic within the group The project consists in carrying out a study on wheat.

The first problems that we had between the students and the tutor was the communication, since three of us are not francophones, reason why it was difficult to reach several agreements at the beginning

Our Team was:

Natalia Gonçalves, brazilan; Laura Casanovas, cuban; Sam Yacuba, burkines and me, mexican. With the help of our tutor the first decision we made as a group was to carry out the work by dividing the activities according to our specialties. Sam would make the historical part, Laura the architecture, Natalia would develop the social part and me the biological.

Methodology

For the realization of the work we begin by delimiting the study area in contemporary time and geographically in the three countries concerned by the master France, Italy and Portugal. Within these countries, it was decided to delimit the region further, focusing on Aquitaine located in western France, Veneto and northern Italy and the southern Alentejo region in the center of Portugal.

The research was made using electronic resources and online databases, due to the fact that during the development of the research we had to change continuously the location. Also, during our stay in Italy, we made a field study and interviews with workers from the Bologna region.

The interviews was conducted whit the help of Giulia Marrone, an Italian from the region of Modena, who helped us with the translation and filming of the interviews, oral history resources and questionnaires were prepared by Natalia Gonçalves.

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http://www.fao.org/land-water/databases-and-software/crop-information/wheat/en/

With respect to my personal work, during the first semester, I was focused in the research of how wheat crops grow up , the life cycle of the plant and various varieties and species work. After this research and because of the type of crops in the chosen regions, my study is limited in two species of wheat, *Tritucum aestivum* and *Tritricum durum*, because they are the most cultivated in the world and especially in the countries choose.

These two varieties are the main producers of bread and pasta, being *T. aestivum* the producer of bread flours and *T. durum* used for the production of pasta. This difference in the type of gastronomy is what generates the diversity of cultures between countries, with Italy being the main producer of pasteurized flours and France and Portugal with a stronger interest in bread flours.

Results

Work done during the first semester

During the first semester in France, the work was focused on carrying out an analysis of the main varieties grown in France and to understand the physiology and anatomy of the plant, for which a glossary and representative designs were elaborated. In addition to a small historiographical part to justify the importance of this cereal for societies.

The importance of wheat in food

Historically, the importance of wheat is based on its nutritional value, which is why the increase in production and the improvement of cultivation and processing techniques are of great social and cultural importance. A clear example can be seen in the type of bread that the population consumed from the flour mixed with other grains and wheat alone and the importance of a total transformation to the consumption of breads made entirely from wheat as we can read in the following text of the Regional Center for Genetic Resources Nord Pas-de-Calais.

The term white bread at the time meant bread made exclusively from wheat flour and with the lowest possible content. This bread is recognized as lighter, more nourishing and digesting better. We also differentiated a third type of bread: the bread with a flour containing a lot more bran. Several experiments had been carried out as early as the middle of the 19th century, when workers' populations were periodically fed with brown bread and then white bread. Bread induces fatigue and increases in the number of meals taken (usually 3 to 5). This bread was known to be heavy because rich in water, but low in calories[216].

[216] Centre Regional de Resources Genetiques, 2014

It is easy to understand why, hundreds of years ago, there was a social and economic interest in improving the cultivation and extraction techniques as well as the gross yield of the plant, which led to invest a lot of technical and scientific efforts to improve this process.

Fig. 1 Traité d'agronomie by Bolonais Pietro de'Crescenzi, 1459 (Ms 340, museum Condé, Chantilly)

Glossary

Herbaceous: Plant with gentle, non-woody aerial parts that usually fade during the winter.

Glumellule: denotes a piece, of small size compared to the flower, with perianthaire value of the flower of poacées (grass).

Grass: is a herbaceous plant with flowers of the family Poaceae, the fruit is a grain containing a seed with mealy albumen.

Ploidy: The ploidy specifies and quantifies a chromosome's name of lots of a cell.

Chromosome: is the element containing the genetic information (DNA) of a cell.

Genome: all the genetic information contained in a cell.

Homologous: are the two members that make up each chromosome. They carry the same genes and each pair comes from a parent.

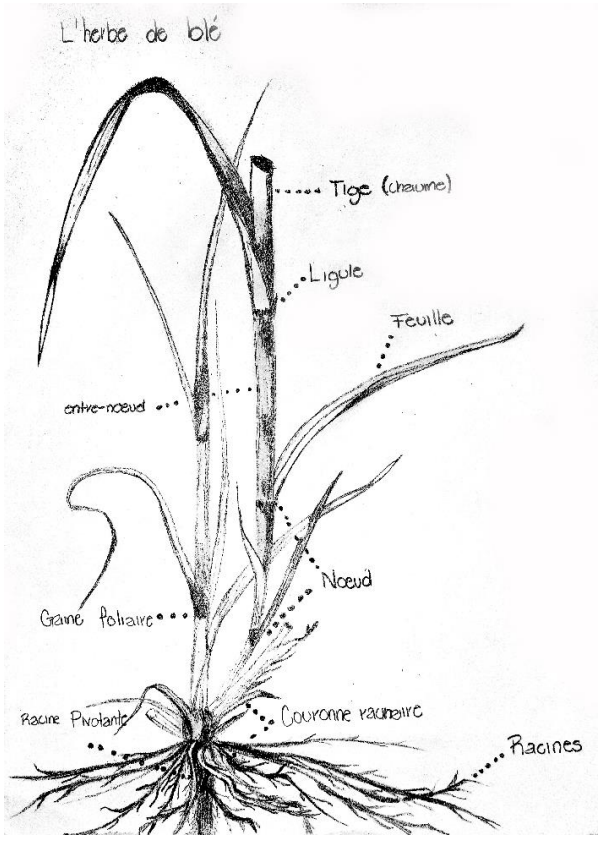

Fig. 2 Design of a wheat plant where tige corresponds to stem, ligule to ligule, feuille to leaf, entre noeud to internode, node to node, couronne racinaire to crown root, raciness to roots and racine pivotante to taproot. Jessie Jaime

Wheat biology

Wheat is a cereal of the grass family, which also includes rice, corn and oats. Under the name of wheat there is a group of species of the genus Triticum of very different characteristics, varieties distributed by the near east to those which are situated in the cultures of the world correspond mainly to two species, T. aestivum (wheat tender) T. turgidum (durum wheat)[217].

[217] Mateo Box, J. (2005). Prontuario de agricultura. España: Ediciones mundi-Prensa.

From a morphological point of view, wheat has a fibrous root system. During germination of seeds, both the radicle or primary roots, and a subcrown internode emerge: the latter gives rise to a crown near the soil surface. This structure gives rise to four to six tillers for each plant, each tiller being supported by secondary roots. The secondary root system can be quite extensive, reaching depths of up to two meters. He is responsible for providing nutrients to the plant.

The stems, or lindens of the plant, consist of five or six entrails. These are separated by dense structures called nodes, which give rise to the leaves. The stems may be hollow or filled with marrow. Wheat with stems filled with mellowness is known as a solid stem. It offers resistance to insects. The leaves consist of two sections, the blades and the sheaths. The sheaths effectively strengthen the stem and protect the growing apical meristem. Grower growth and development occurs by telescoping action so that all leaves are fully expanded before the tip moves away from the structure.

The tip of the wheat plant consists of a central axis called rachis. Each node of the raids gives rise to a spikelet consisting of a pair of outer glumes that surround three to four florets. Wheat is therefore a typical self-pollinating plant, although up to 5% crossover can occur when parasite pollen is present. Varieties with grain lengths less than 7 mm are considered to be small grain, between 7 and 9 mm medium grain and those with more than 9 mm long grain[218].

At present the varieties cultivated are of naked grain, after the harvest they do not conserve the glume, whereas the wheats cultivated formerly they conserved them and they are called of grain dress. Also the cultivated varieties are of naked grain, that is to say, after the harvest they do not preserve the glume, whereas the wheats cultivated formerly they conserved them and they are called of grain dress[219].

Wheat, tendre and durum are differentiated by their degree of ploidy and their number of chromosomes. Soft wheat has three genomes AA, BB and DD, each consisting of seven pairs

[218] Ibid
[219] Ibid

of homologous chromosomes, making a total of 42 chromosomes; durum wheat contains only the two genomes AA and BB, and 28 chromosomes.

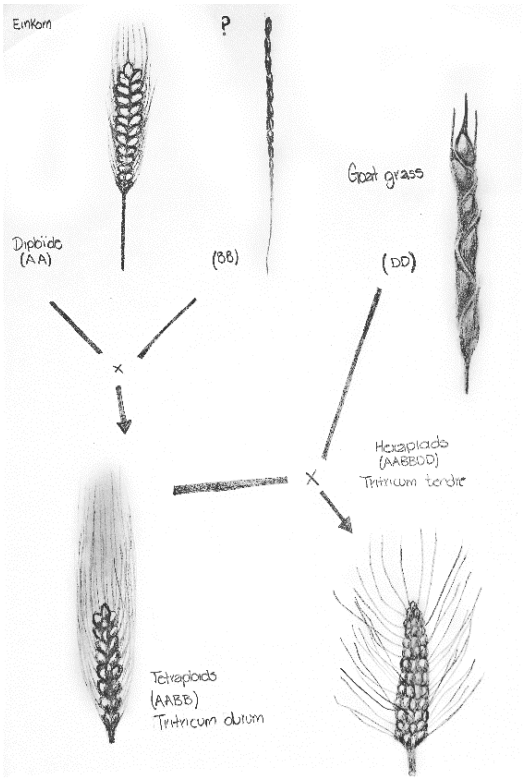

Fig 3. Design made to represent the possible chromosomal evolution of wheat. Jessie Jaime

Durum wheat grows in drier regions and is characterized by broad, oval-shaped, amber-colored, very hard grains of almost restricted texture. This class of wheat is used exclusively for pasta around the world, as well as for other specialty products, such as couscous, in some countries.

The bread is cooked with flour of hard-grain varieties, mainly of the red type. They have a high protein content and high levels of predominance of two protein fractions, gliadins and glutenins. These give elasticity to the dough during cooking, so that large breads can be produced. The bread is cooked with flour of hard-grain varieties, mainly of the red type. They have a high protein content and high levels of predominance of two protein fractions, gliadins

and glutenins. These give elasticity to the dough during cooking, so that large breads can be produced. Sweet wheats generally have lower protein contents and lower levels of both critical protein fractions. They are used in unleavened bakery products, such as pastries and breakfast cereals: in fact, white wheat flour is better for breakfast cereals[220].

In each wheat class, there are many varieties that represent the efforts of plant breeders, who routinely produce new strains with improvements in yield, disease resistance, and seed quality. An estimated 25,000 different varieties of wheat have been produced worldwide[221]. According to the FAO, wheat is grown in rainfed crops in temperate climates, in the tropics with winter rainfall, in the tropics near the equator, in mountainous areas above 1500 m altitude and in the equatorial tropics where the rainy season is long and wheat is grown as a winter crop.

Wheat is grown under irrigation in the tropics, either in the uplands near the equator or in the lowlands far from the equator. In subtropical areas with summer rains, the crop is grown under irrigation during the winter months. In subtropical regions with winter rainfall, it is grown under additional irrigation[222].

In areas of severe winters, cold winds and little snow, spring wheat varieties are grown. Spring wheat does not require cooling for the cap and is neutral to the day. However, it is also sensitive to frost. For winter and spring wheat, the minimum daily temperature for measurable growth is about 5 ° C. The average daily temperature for optimum growth and tillering is between 15 and 20 ° C. The presence of (spring) frost is an important factor in selecting the sowing date. A dry and hot ripening period of 18 ° C or higher is preferred. Average daily temperatures of less than 10 to 12 ° C during the growing season make wheat a dangerous crop. Knowledge of the genetic characteristics and in particular of the growth and development of wheat varieties is essential to meet the combination of various climatic requirements for growth development and yield formation. With pre-irrigation or sufficient rain to moisten the top layer of soil, the seeds are drilled 2 to 4 cm deep. against 5 to 8 cm in dry soils, so light showers do not cause seed germination[223].

[220] http://www.agr.gc.ca
[221] Ibid
[222] http://www.fao.org/land-water/databases-and-software/crop-information/wheat/en/
[223] Ibid

As we have seen previously, for the cultivation of wheat, it is necessary to respect certain meteorological characteristics which allow the optimal growth of the plant, in the following table the three regions chosen for the realization of this project are shown, where to observe that the climate, the temperature, the hours of the sun and the precipitations do not differ much between them. This makes them areas where the growth of the plant can be produced optimally. The possibility of farming in these countries has historically influenced much more than one might suppose[224].

Country-Region	Clima **Köppen**	**Temperature**	Température minumum	Precipita**tion maximum**	**Sun hours**
Francia-Aquitaine	Cfb Oceanic climate	16-20°C	4.5-8°C	947 mm	2200
Italie-Veneto	Cf Temperate continental and subcontinental	10-14.4°C	0-3.9°C	900 mm	2600
Portugal-Alentejo	Csa Hot and dry	15.5-16°C	11-11.5°C	900 mm	3000

Tab 1. climate in the regions where the project was carried out.

Work done during the second semester

Long before hereditary genetic processes were discovered, farmers and herders were already improving species by slow processes in which only the reproduction of certain plants and animals was necessary to perpetuate specific traits or to plant the seeds girls more desirable plants. These processes require waiting for the growth and full development of the individual, the selection processes were very slow and, in some cases, could be lost significant characteristics that were hidden or requiring specific environmental factors to observe as it is the case of resistance to certain diseases or parasites.

[224] Ibid

Since 1953, Watson and Crick have deduced the double-helical structure of DNA, which has made it possible to understand the processes of reproduction and inheritance. Through years and through new research, they have developed techniques that allow the insertion of foreign genes into other organisms, exponentially accelerating the evolutionary process of species, allowing the generation of new varieties of human interest with specific physiological and anatomical characteristics according to human needs.

Currently, in France, before the Study and Control Group of Varieties and Seeds, the registration of thirty new varieties of wheat is carried out each year, which must be accepted by the Standing Committee on Plant Varieties. This has allowed in the last 50 years to obtain a wide variety of cultures with new technologies, so that the evolution and development of both is intrinsically linked.

But this interest in the improvement of wheat varieties has also led to their specialization which leads to a decrease in genetic variability, that is to say that varieties of wheat that are specialized and specially designed to resist certain pests or to work better with specific fertilizers become practically identical between them and instead of finding a population where each individual has particular characteristics, we find that the fields of culture are composed of almost cloned plants, the genetic difference between each of them is relatively little or Nothing at all.

This specialization is the result of the desire to produce highly productive species that have the capacity to feed a growing human population, but today scientists face new challenges, where climate change and new pests and diseases play an important role where the people of the world and their food security is on the brink of disaster.

These types of clone cultures are called genetically homogenous monocultures, the majority of intensive crops are compliant in this way. That's why governments and organizations like the Food and Agriculture Organization of the United Nations (FAO) are trying to encourage producers to use old and regional varieties or to plant several varieties at the same time. time without specializing in one, but for the farmer the process is difficult because it often requires sacrificing better yields on crops.

To avoid such situations, they have also created germplasm banks, which are large cold settlements, usually located in countries or places that have very low temperatures such as Norway. Within all the seeds of different varieties of crops that exist in the world are protected and not only that, because they also protect plant species that have no commercial use, this to protect the planet and people from a disaster natural or food.

Man against hunger: Nazareno Strampelli

Nazareno Stampelli was an Italian scientist, born May 26, 1866, who studied at the Higher School of Agriculture in Portici Napoles and obtained the highest quality of farmer by the University of Pisa in 1891, which also showed a great attraction for chemistry, by doing different works in this section to finally devote his life to the improvement of the species of wheat, with the aim of obtaining the food independence of Italy[225].

At the end of the 19th century, in Italy, there was a wide variety of wheat species and with the help of the private activity of the company "Produttori Sementi" and with the work of Professor F. Todaro, the technique was developed to ensure the purity of the varieties by genealogical selection, which consists in not making cross between the varieties, if not on the contrary, always preserving the species[226].

At that time, it was believed that maintaining the purity of the species was the only way to ensure the quality of the same, as the characteristics that were known to be positive for a good quality of harvest were preserved[227] .

In 1890, he made his first crosses between two types of wheat baking and, despite not knowing the work of Mendel, he had the ability to understand the hybridization potential

[225] Cohen, J. (1979). Fascism and Agriculture in Italy: Policies and Consequences. The economic history review.

[226] Scarascia Mugnozza, G. (2005). The contribution of Italian wheat geneticists: From Nazareno Strampelli to Francesco D'Amato. Proceedings of the International Congress. "In the Wake of the Double Helix: From the Green Revolution to the Gene Revolution" (págs. 53-75). Bologna: Avenue media.

[227] Ibid

between bread species, because it was the only way to improve the crops were to extract the species that had the desirable characteristics, but for Strampelli, it was clear that to obtain the desired characteristic, a cross had to be made with the plant that already had this ability[228].

Helped by his wife made more than 800 crosses using between 250 species from around the world. After 1925, Strampelli became the instrument for obtaining the food independence that so much sought the fascist government of Italy, using as the name of the propaganda the name of "Battle of the grain" The purpose of the battle of the grain was to increase in 10 years from 4.4 million tonnes to 8 tonnes[229].

Varieties created by Strampelli have been widely used around the world. In 1940, 20 million hectares were planted in China, being the first country to use these varieties, there were subsequent plantings in the USSR in Argentina and Brazil, while in Mexico, Canada and Australia, introduced genotypes derived from the Mentana variety[230].

At the end of the 19th century, there was a wide variety of wheat species and with the help of the private activity of the company "Produttori Sementi" and with the work of Professor F.Todaro, the genealogical selection of spices was developed, which allowed to maintain the purity of the species.

[228] Porfiri; S.Ceccarelli; S.Salvi. (2013). Nazareno Strampelli, the 'Prophet' of the green revolution. *Journal of Agricultural Science*, 151-155.
[229] Ibid
[230] ibid

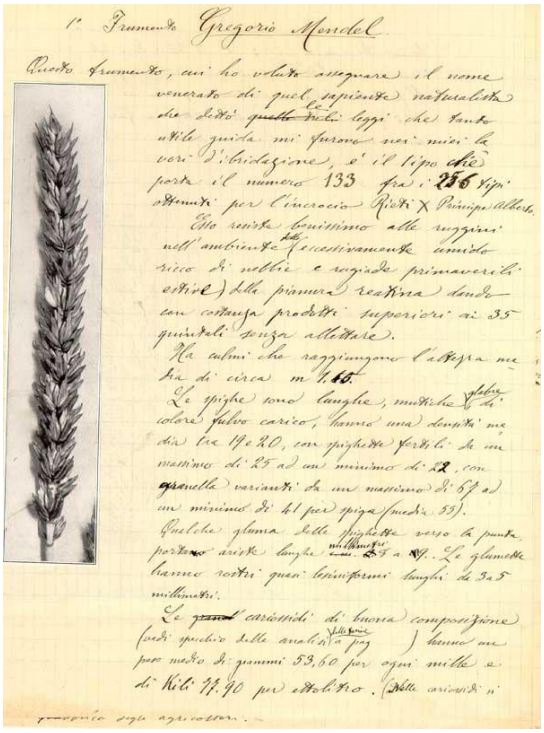

Fig. 10 Strampelli Notes on the "Gregorio Mendel" Variety from the Grain Science Museum Archive.

Work done during the third semester

This plant has accompanied man since immemorial times. It is an essential part of their daily life and around them have been built societies that have used it to nourish not only the body, but also the cultural imaginary through parties and celebrations and sometimes also to justify political decisions that give sustenance to a whole government system.

Te Battle of Wheat (Battaglia del Grano) in Italy and the Wheat Campaign (Campanha do Trigo) in Portugal were crucial events for the institutionalization of fascist regimes in each country. In both countries, due to the type of dictatorial government, the process was very similar, since it clearly sought to achieve autarky as an economic system.

The mobilization for selfsufciency in food brought to proliferation of institutes, commissions, and boards responsible for controlling the entire wheat circuit (production, imports /exports, stocking, quality, distribution) and constituted the first materialization of the New State in which organic corporatist relations were to replace capitalist ones in an authoritarian framework. However, in France, the politization of wheat was carried out in a very different way.

Circulation will not be limited to relations between countries. The paper also tracks the "seeds of victory" produced by plant geneticists as these seeds left laboratories and experimental plots and were sown in farmers' felds. Te experiments that were being carried out inside laboratory walls, when scaled up, were responsible for drastic changes in the landscape. Te laborious task of scaling up from controlled laboratory spaces to entire regions will be studied in close proximity to the geneticists' work of producing stable forms of life able to circulate among scales. Sensitivity to the wheat labscapes of the Po Valley in northern Italy and the Alentejo in southern Portugal will help us turn the elusive concept of fascism into something more material[231].

In Portugal Oliveira Salazar would be the dictator who placed agriculture at the heart of the new order. And as in Italy, there was no contradiction between ruralization and modernization. Te prevailing image of Portuguese fascism as dominated by a traditionalist establishment, reduced to the famous trinity "God, Fatherland, and Family," does not do

[231] Cohen, 1979 Op. cit; p. 459

justice to the relevance of technoscientifc elites in the building of the Estado Novo. Salazar seems to validate the traditionalist interpretation with his proverbial suspicion of urban life and praise of pastoral modest virtues. But if he does not bring to mind the futurist visions of other dictators such as Mussolini it is also true that his public image was carefully designed around the myth of the chaired university professor of fnance who fnally put the Portuguese state fnances in order. In 1933, the year a new constitution was approved, formally institutionalizing the New State, he proudly declared: "When everyone thought that the Dictatorship would crush everything in an adventure of military violence, one sees a government by, almost exclusively, superior professors; strength serving justice; improvisation giving way to scientifc training[232].

From 1927 to 1933 the wheat felds of the Alentejo region in southern Portugal, which alone accounted for around 60 percent of the national production, were expanded by 28 percent, or approximately 391,000 hectares. The total annual production of the country grew from 280,000 tons for the years 1925–1929 to some 507,000 tons for the years 1930–1934[233]

The discovery of these campaigns to achieve the highest wheat production in these two countries is a sample of the impact that scientific activity in the laboratory often takes to political levels that can have huge impacts on the population.

During our stay in evora, we had the opportunity to talk with producers who work with the "Montado" system, in addition to the effects they had on the Alentejo fields are visible, as the landscape of this region is heavily intervened and degraded.The recovery of this type of traditional techniques, with the help of new scientific knowledge, used with moderation and without political purposes, can lead us to improve the quality of life of the inhabitants.

[232] Cohen, 1979 Op. cit; p. 477
[233] Cohen, 1979 Op. cit; p. 481

Analysis of results

Based on this principle, I started my research by trying to find the main varieties grown in France to try to create a genetic relationship between them, but progressing in research, I discovered that every year new species are recorded in national catalogs of official crops and that at present diversification of plantations is encouraged to eradicate monoculture and loss of genes due to species cloning. In this way, it seeks to protect agriculture against specific diseases and pests, avoiding the extermination of large areas through diversity, giving the opportunity that not all organisms die because each individual reacts differently. However, if all cultures were clones the opportunity to have survivors is diminished, which jeopardizes food production.

But this knowledge of the genetic problem has not always been acquired and it is in recent decades that the experience and new scientific progress of recent years have shown us that it is better to have genetic diversity because it offers a long-term natural protection. term that can hardly be obtained artificially or under the strictest sanitary controls.

Subsequently the development of this research led me to focus on post-war public policies and the military dictatorships of Italy and Portugal, where scientific arguments were sought to support decision-making. in the economic and social development of the countries. The fear engendered by the famine and the poverty engendered by the first and second world wars, managed the creation of institutes in charge of the development of alternatives to ensure the food protection of the population.

As a first step and with the new discoveries in genetics of the time, groups of researchers from around the world devoted themselves to the creation and improvement of crops, one of the main objectives being wheat, the basis of the food in many cultures around the world, such as Italian pasta, French baguettes and Portuguese breads.

This species improvement has taken the simple step of improving the breeding of specific varieties and the production of cloned crops from these improved varieties, because they are

considered the most efficient food producers, but the experience and the science tell us that this is not the best solution to our dietary problems.

Each country is in different economic, political and social contexts, develops differently its research programs and institutes where information gathering and policy proposals have been made, so that each case diverges in the result. Being mainly visible is the case of Portugal, a country that currently buys about 70% of wheat abroad to satisfy the consumption needs of its population.

The reasons for these results are not only given by political and social questions, there is also a great climatological influence that justifies the consequences. Therefore in this research is important also to carry out an analysis of the climatic conditions in each region, observing that the type of soil and the climate of the Alentejo are not favorable to the cultivation, because their earth is acid and poor in nutrients, in addition to having a severe water shortage.

Bringing laboratory work to the field should be one of the main objectives, especially when there is money and government resources in between, but the realization of these projects of such importance and that directly affect the inhabitants of a region, should not be brought out in a way that the policy is the one that wants to handle the results that science gives us to its convenience.

Conclusions

This work was done by people of different specialties, each one gave a little of their personal perspective and with respect to their personal and academic interests, so the result from my point of view is very rich and very well prepared.

By contributing Laura with her knowledge in architecture, she allowed us to appreciate how the landscape of each region has been affected by the economic activities related to the cultivation and sale of wheat. We were able to know the wheat cellars and to realize the impact that the architecture has on the development of the techniques, these constructions have a very important visual effect, besides that it must be specialized architecture and adapted to the scientific needs of the production techniques.

Sam helped us to understand the historical importance of wheat in the formation of societies, he brought us cultural knowledge focusing on the more theoretical part of the social research. Natalia showed us the way of not losing sight of the social side of technical research and to make the information more graphic and comprehensible to transmit it to people who do not know about certain specific themes.

I think the integration of the project was very enriching thanks to our different formations and cultural origins so at first it was the greatest difficulty for the integration of the team but finally it became the strongest point of our collaboration.

Summary of activities in two years of the TPTI master.

I knew this master through my Mexican tutor, who had already been in contact with the TPTI organization through former students who had had the opportunity to participate in it. Since I was aware of its existence I started working on my project trying to focus it so that it had an international format that could be of interest and be of benefit not only to my country, but also to both nations, since I consider the greater importance of this type of project lies in the exchange of ideas and values, which undoubtedly enriches us.

The master is developed as follows:

Semester 1 in Paris France based at the Sorbonne University School of History. This for me was one of the most important mainly since the School where we took some courses are located in the main building of the Sorbonne, which for me has a very significant importance, because many of the stories that I have read for my research happened in this place and many of the personalities that I had to familiarize with worked here.

During our stay in Paris, the general topic of studies was related on seminars focused in understanding the heritage legislation, also another one of the great topics was the historical and social point of view of the use of techniques and industry, its influence on societies and the way that it has had influenced and modified the current and historical reality of nations.

Through projects such as Paris Patrimoine, we took on the task of an a collectively analyzing in detail of the urban parisian structure, the historical burden it has and how we continue to live with these structures without realizing it, since the city is the place where we live and develop all our activities.

One of the most important discoveries for me, and the one who made me understand for the first time in my life the influence of industry, science and technology have in our lives without even realizing it, was during a seminar related to steel industry and the Eiffel Tower. That wonder of engineering that now so many people around the world dream of visiting. Today is considered one of the most romantic symbols of our times but this monument is a consequence of the technological development and the need to show the scientific advances of the time and expose them in their greatest splendor to show the world what men were

getting through the new scientific advances, the experimentation, the production of knowledge and research. This incredible monument hides the names of the most famous French scientists and from my point of view it is a sadness that being so famous monument around the world, it is little known about its history and its true origins and tourists admire it most of the times without understanding its importance as a historical monument and not only as a tourist attraction.

I think monuments like this, which are so admired around the world, should be used to tell the world that we, the current society are the consequence of this historical and social process, it should be taken as an opportunity to show the importance of science, the importance of investment in scientific research programs and support for universities and young talents who day after day dedicate their lives anonymously to improve our quality of life and the development of our societies through their hard work , because only through research and scientific development, wonderful technological works such as the Eiffel Tower can be achieved. The largest and most well-known symbol of Paris has an industrial past, a technological past and was a laboratory for scientific research but not many people know that.

The integration of this information, historical, technical and musicological, the first notions legislation and the chairs on the influence of the industry, in the lives of people and societies, were something that at this time had not yet taken a form in my mind, but that little by little began to take its place as we were integrating the knowledge of the next universities.

Semester 2 in Padua Italy, based at the Università degli studi di Padova. This semester was mainly focused on analyzing industrial heritage from an architectural point of view. The seminars were focused on analyzing the old ships and their new uses, understanding how cities were growing on many occasions around the industry and how many communities were born thanks to it.

I understood the importance of valuing industrial heritage and seeking its valorization. Since I started this master's degree, I have had the opportunity to meet people from all over the world and I have found great difficulty in making people understand what industrial heritage is and why it is important to value it. This incapacity does not come from a specific culture or from a region of the world, from a continent or from a town, I believe that society

in general has not been taught about the importance that this human activity has had in our societies.

I have seen in this path of heritage appreciation, that society has an inability to perceive the industry as one of the main modelers of its current reality, but it is not the fault of the people, but rather is a work for specialists like us , who should put society in contact and show the importance of safeguarding the roots of our new generations.

In this semester I was able to get in touch with the heart of the cities, work was carried out in villas that have been totally created to house factories such as Crespi d'Adda, which we had the opportunity to meet, like Milan, a city that is currently considered one of the main and most important in the world for fashion and design and that took this destination thanks to the abandoned industrial buildings that turned out to be the perfect setting for photo shoots and fashion shows.

The industrial city and its buildings, keep a rich history of our origins and our present, many of our families migrated from the countryside or changed city to enter work or as we could learn in the museum Dalmine, the entrance of the women to the world of work, since the industry had to continue working despite the fact that the men were in the war and all the consequences that this had at a social level to promote the struggle and the empowerment of women.

The industry has had a deeper impact than could be perceived at a glance for a person who is not related to the topic, in this semester, to understand and study the industrial village made me understand that they are not only buildings, but drawn histories because of the spatial configuration of these constructions, which day by day govern our roads, even without our perceiving, that is why it is important, not only to speak about safeguarding buildings, but at the same time to safeguard stories.

Semester 3 in Évora Portugal based at the University of Évora. On this occasion most of the seminars were focused on the study of landscape as part of our environment, how industry has transformed the landscape and to value the immaterial, what is also inherited, but it is not so easy to see. We learned to touch the intangible and value it.

Courses were held on UNESCO legislation, classifications of different types of heritage, how to choose the criteria and carry out the procedure for inscription of a monument or a tradition. The heritage was treated from a point of view not only physical, but also social. All the elements of which I had spoken earlier made sense and were unified.

We learned to take information from less obvious sources such as images, paintings, photographs, to perform analyzes and infer the social and technical situations of a population. Some study trips were made to mining areas and to a hydroelectric plant, where we could clearly observe how the landscape is influenced on a large scale by human activities. This type of route allows us to know not only in the theory, what is a landscape, but also to see directly the intangible, live it and feel it through the homes of the workers where they lived, talk with the grandchildren, the families of the people, learn to perceive what is not so obvious and try to capture it.

Semester 4 based at the Sorbonne University and 7 weeks at the Polytechnic University of Prague. During the beginning of the semester, a stage was held in Prague, which for my personal project was very enriching, since topics related to the universities were dealt with. There, I was able to obtain a very interesting bibliography on the beginnings of education and its importance for the militia of the at that time, I understood how, little by little, the characters who made science and how they participated in war campaigns carried out some engineering works.

In Prague we also received a seminar related to the creation of the University of Nancy, which was one of the pioneers in receiving and supporting international students, who were responsible for disseminating knowledge about engineering around Europe, we were told about the importance of these institutions for scientific and technological development.

After my return to Paris, I started with the development of my project, which has been very enriching, since through it I can link all the learning points obtained through the 3 semesters and the stay in Prague. It is very enriching to discover that in the end you have acquired the ability to integrate all the knowledge in a research work that not only allows you to know data out of curiosity, but also can have an application in the future.

Future perspectives

My work and everything I learned during this Master helped me a lot to understand the present, the present and the circumstances in which we find ourselves today, the context of the globalized world, the cultural exchange, as the economic activities they have been relating and creating indestructible bonds between nations and communities.

Economic activities have always influenced the way and beliefs of society, this master gave me a broader perspective, I had the opportunity to know the economic centers of some countries, in Italy for example we travel across the industrial cities and we participate in conferences on urbanism and the modeling of cities, we had access to documents where the greatest thinkers of the time capture their ideas about the generation of knowledge, the importance of universities and educational centers for technological improvement and the development of scientific advances. As M. Duruy calls him in his letters and reports, "the new peaceful struggle", that which has allowed us to evolve, generate knowledge and technology that have given our societies an improvement in the quality of life, which have allowed us to have the society with the highest educational rank in the history of humanity and that has allowed us to create magic.

It is necessary to understand this type of situation and to be aware of where we want to direct the destiny of our nations. Currently and despite all the progress that has been made thanks to these silent struggles in the economic and technological race, there have also been serious consequences. We are currently paying the price of having advanced without measure or without reasoning, a war that despite being peaceful or silent, despite being economic and not deaths, can also lead us to the destruction of our planet and the destruction of our societies.

That is why the importance of conducting this type of studies, which can help to find solutions in our past, also can make us reflect on the well-being acquired and also the discomfort they have caused, this is a world suffocated by industry and as I mentioned earlier, one of the biggest difficulties I have encountered when meeting people and explaining what I am studying, is that the industry is seen as something bad, it is demonized, it has been viewed like these for years and that is not the reality at all. It is just a simplistic reality to believe that all the ills of the world have been generated by it and that the destruction of our planet is leader by the industry.

The industry has allowed us to change wars for economic silent wars, the realization of agreements, sign treaties and increase knowledge about the world and about the universe, the development of science has been broad and everything that surrounds us has come out of a laboratory or of an investigation, formal or informal and if we had the capacity to understand that sometimes public policies have to be applied to generate progress in certain areas due to the difficulty of roads, distances or abundance of water and that's why sometimes some areas that are currently experiencing strong social upheavals.

I think it is the researchers' job to disseminate this knowledge so that it does not stay in the classrooms and it should be spread in to society, I hope someday to be able to explain what I study without seeing myself facing the problem of rejection and the false idea that the past industrial and the present are the worst things that could have happened to humanity, because it is not entirely truth and it is necessary to discuss these issues in order to direct the destiny of our countries.

The industry has shaped us, thanks to it we are the current society that strives to continue achieving more equality, more equity, to obtain a better life and despite the fact that many mistakes have been made and that we have diverted the way on multiple occasions, hiding these facts and stop the discussion will not help to find clear solutions for our future. It is important to keep the history of all that came after us, those children, women and men who worked hard inside factories, or building roads, who often suffered the harsh working conditions and who fought to make this world a more equal place.

Only through the study and analysis of our past and current circumstances will we be able to reach a consensus at national and international levels regarding what concerns the future of humanity. There is a lot of work to be done, life and our circumstances continue to evolve, in the past we had to find solutions to the problems faced by societies, today we must do exactly the same to be able to bring the road of humanity to a successful conclusion, because today we are more connected than ever and we cannot think of isolated regions, the decisions that are made today will be decisions for everyone in the future.

I want to thank the TPTI master for giving me the opportunity to study and work with you, I hope that the experience has been pleasant for you as it was for me. Thank you for opening my mind to new ideas and show me a panorama that I never imagined and about which I had

never reflected. Today I believe that this master has turned me not only into a professional, but also into a better settler in the world, I hope to be able to carry out my professional aspirations and thanks to the knowledge I have acquired, I will never forget my principles and values.

Thank you for giving me a better understanding of the world, of our new globalized world, interconnected and with big problems to solve. I hope I can help and be part of the change.

¡A los que me miran en el cielo!
¡A los que se fueron cuando estaba aquí!
No voy a echar tortillas y no es
que no sea digno, es solo porque
soy floja y no quiero.

Résumé

Buts industriels de l'École Pratique des Hautes Études et leur comparaison avec l'École des Hautes Études Mexicain.

Ce travail est une comparaison entre deux écoles qui ont été créées avec les mêmes besoins pour améliorer le niveau d'instruction dans les établissements d'enseignement supérieur, car le secteur industriel créait de nouveaux besoins commerciaux et technologiques. Bien qu'ils aient été créés selon le même concept et dans le même but, leur développement était totalement différent en raison des contextes politiques et sociaux différents de leurs pays d'origine, l'un en France et l'autre au Mexique. Tous le deux ont été des pionniers dans la rupture des systèmes éducatifs en proposant de nouvelles politiques publiques susceptibles de changer le secteur de l'éducation.

Mots-clés :

Enseignement supérieur, Industrie, Université, Technologie, Victor Duruy, Mexique, Justo Sierra, Humboldt, Science.

Abstract

Industrial purposes of the École Practique des Hautes Études and its comparison with the Mexican School of Higher Education.

This work is a comparison between two schools that were created with the same needs to improve the educational level at institutions of higher education because the industry was generating new business and technological needs. Although they were created following the same concept and for the same purpose, their development was totally different due to the different political and social contexts of their countries of origin, one in France and the other in Mexico. Both were pioneers in breaking educational schemes by proposing new public policies that would change the education sector.

Key words:

Higher Education, Industry, University, Technology, Victor Duruy, Mexico, Justo Sierra, Humboldt, Science.