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Knowledge, economy, and university in the south of Europe at the end of the eighteenth century. The case of Salamanca and Coimbra

1. Introduction

In the second half of the eighteenth century, Europe witnessed a wave of University reforms that transformed several universities (Anderson 2004; Brockliss 2003; Hammerstein 2002a; 2002b). This third wave of reforms was more impressive in Southern and Central Europe and was a remarkable response to the new mentality where Governments took responsibility for citizens' education. One of the fields in which this new outlook was evident was the teaching of Philosophy (Freedman 1999; Ruestow 1973; Stewart 1990; Martins 2013; Costa 2014; Albares Albares 2006; Fuertes Herreros 2006).

In many Universities, and Salamanca and Coimbra were no exception, we saw the introduction of the disciplines of Natural History, Zoology, Mineralogy, Botanic, Agriculture, and others. And, analyzing the study plans of the Universities of Salamanca and Coimbra from 1771 to 1820, we can conclude that these improvements eventually led to a strengthening of the disciplines devoted to the study of natural products. This investment in the introduction of subjects related to the study of natural resources of animal, mineral, and vegetable origin, meets the central interest of the Portuguese and Spanish reformers: to combat economic, industrial, and commercial underdevelopment. This vision had clear economic interests because this activity should be the necessary impulse to the productive sectors of these countries. In this way, the disciplines introduced provided the ability to identify and then cataloged and explored more effectively the various natural products from their extensive colonial territories.

The materials we study here appear in the sources analyzed as 'useful knowledge' and should be the source of economic growth, alongside measures to stimulate industry and trade. Simultaneously, scientific academies and similar institutions have gained importance and proved to be more innovative. Nevertheless, it was in the universities that the largest number of students gathered. In this work we also intend, through the cases of Salamanca and Coimbra, to try to understand if

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the growing interest and the incentive in Natural Philosophy – through the curricula of Philosophy – attempted to solve the problems in agriculture and industry in Portugal.

This article aims to focus on the relationship between Universities and the economic development of Spain and Portugal during the second half of the 18th century. We will build on the contributions of Araújo (2014b; 2014a; 2017), Costa (2014), and Prata (2014). We also intend to dialogue with Pedersen (2002) about the expansion of the Philosophy curriculum throughout the Modern Period, starting from the cases under analysis. Frijhoff (2002), Anderson (2000; 2004), and Hammerstein (2002b) in their analysis of the University reforms of the 18th century gives us the general lines of this third wave, lines that we will try to follow in the case of Coimbra and Salamanca. With Santos (2013), Cardoso (2004), and Spary (1999), we intend to demonstrate the utilitarian and intrinsically linked character of the economy that the Philosophy curricula have shown.

In this way, I intend to divide my article into three parts: 1) identify the various subjects understood as ‘useful subjects’, introduced after 1771 and which are the adoption strategies followed by the two Universities; 2) compare the contents of these subjects among the two case studies; 3) try to understand if this new knowledge managed to stimulate productivity through the analysis of professional outlets.

2. The ‘useful’ knowledge

With the 16th century in mind, we see the emergence of an Italian school (Giovanni Pico, Girolamo Cardano, and others) that, among other things, advocated the idea that Nature and natural products should be in line with the needs and interests of the Human being (Ingegno 2008, 236-61). In the following century, the triumph of the *mundus intelligibilis* took place. As a consequence, natural knowledge develops in two lines: knowledge of the living beings that make up the natural world; and the forces and laws that acted in this same stage (Cassirer 1992, 65-130). Understanding this tension – between practical and theoretical teaching – is important because when we reached the eighteenth century the reforms that took place sought to convey a more practical aspect where the focus was on the introduction of various materials linked to the study of Nature. In some cases, this implied profound reforms in the faculties of Arts – such as Salamanca – or the creation of new Faculties of Philosophy – such as Coimbra.

By the 18th century, studying Nature and its resources became inseparable from the concerns with economic development. In the case of the Universities under study, the idealization of the discipline of Natural History made it possible to combine these concerns. In this sense, the content of this discipline was intended to extensively teach students how to more effectively exploit the various natural products.

Tab. 1. Medicine courses in 1771 in Salamanca and Coimbra in 1772

Year	Salamanca	Coimbra
1°	Oldest Medical Institutions and Anatomy	Materia Medica and Art Pharmaceutica
2°	Less Ancient Medical Institutions and Anatomy	Anatomy, Surgical Operations and Obstetrical Art
3°	Prima and Prognosis	Medical-Surgical Institutions (with partial frequency in the Hospital)
4°	Vespers and Prognoses	Aphorisms (also frequently in the Hospital)
5°	-----	First Chair of Practice (taught entirely at the Hospital)
6°	-----	Second Chair of Practice – to reach higher degrees – (taught entirely at the Hospital)

In this way, the scientific developments in the field of Natural History kept as their goal the concrete improvement of the social and physical conditions of the population (Cardoso 2004, 15; Spary 1999, 179). With a strong emphasis on an economic component, «the close relationship between the natural order and the economic order, which leads us to the conclusion that one could not exist without the other» (Cardoso 2004, 15).

Tab. 2. Art courses in 1771 in Salamanca and Philosophy and Mathematics in Coimbra in 1772

Year	Salamanca – Arts ¹	Coimbra – Philosophy	Coimbra – Mathematics
1	Dialectics and Logic	Rational and Moral Philosophy	Geometry
2	Metaphysics	Natural History and Geometry	Algebra
3	Aristotelian Physics	Experimental Physics	Foronomy
4	Arithmetic and Geometry	Chemistry	Astronomy
5	Algebra and Experimental Physics	----- -----	----- -----

The various study plans available for Salamanca and Coimbra show the importance of the subjects that are considered useful. Influenced by the University

¹ In 1771 in Salamanca, the Arts course encompassed the teaching of Philosophy and Mathematics.

reform of Amadeus II in Piedmont (Anderson 2004, 23),² these reforms were characterized by the adoption of more practical subjects related to Philosophy, Mathematics, and Medicine.

This change was important for European Universities. As the dominance of Theology receded, the curricular offer in other courses with a more practical component was broadened and new faculties of Philosophy and Mathematics were created in many Universities, as well as profound reforms in the curricula of medical faculties. This step was decisive so that at the beginning of the 19th century, the idea of specialization gained strength and became a determining factor. At the same time, the professors' perception of Science has changed considerably (Hammerstein 2002b, 609).

Tab. 3. **Philosophy course in 1807 and 1820 in Salamanca**

Year	1807	1820
1	Elements of Arithmetic, Algebra, and Geometry	The second course in pure Mathematics
2	Logic and Metaphysics	Natural History and Chemistry
3	Application of Algebra to Geometry	Rational Mechanics
4	Physics and Chemistry	Astronomy
5	Moral Philosophy	Optics and Acoustics
6	Astronomy and Natural History	Agriculture (bachelor's degree)
7	-----	General History and Literary History

But despite these changes, what did this idea of useful knowledge mean? At the same time, which disciplines comprised it, and what were the goals of introducing this type of knowledge?

It is during the Renaissance that we see a greater appreciation of this utilitarian aspect. The perception of Natural Philosophy becomes tripartite: speculative, active, and factive or constructive (Wallace 2008, 210). The latter, also known as Mechanics, was divided into Arts, Useful Disciplines, and disciplines that provided pleasure (such as Music). The Arts and the Useful Disciplines contained more practical subjects. For example, the Arts included subjects such as Agriculture and Navigation. However, one aspect seems to be essential in the definition of useful, its connection with the study of Nature. And in this respect, the study plans introduced in Coimbra and Salamanca are a good example of a more utilitarian vision of Nature and its resources. Mainly, what they show us is that in the second half of the

² For the Italian case see (Carpanetto e Ricuperati 1987; Ricuperati 1973; Ricuperati and Roggero 1977; Roggero 1987; Del Negro 1991).

18th century we already have different empirical approaches to studying Nature. In this way, various disciplines emerged.

Tab. 4. **‘Useful’ knowledge introduced in Coimbra and Salamanca, 1771-1820**

Disciplines
Experimental physics (Philosophy)
Materia Medica and Art Pharmaceutica (Medicine)
Natural History (Philosophy)
Botany (Philosophy)
Chemistry (Philosophy)
Zoology (Philosophy)
Mineralogy (Philosophy)
Agriculture (Philosophy)
Metallurgy (Philosophy)
Hydraulics (Philosophy)
Astronomy (Mathematics)

As we can see (Tab. 4), the study of natural resources in the curricula of Coimbra and Salamanca was translated into more than a dozen subjects that were divided among the courses of Philosophy, Mathematics, and Medicine. Through these disciplines, we can also see that this utility was based on the exploitation of various natural resources.

Although, it is perhaps in the Philosophical faculties that this sense of the useful was felt most.

In 1801, the Portuguese authorities issued a royal charter that provided for significant improvements in the teaching of Natural Philosophy, and proved to be a considerable strengthening of the 1772 proposal: «[...] it is appropriate to apply the lights of Natural Philosophy to the discovery of the immense riches and treasures, which Nature has liberalized with My Kingdoms and landlords [...],³ thus promoting the exploitation of products from the various areas of the Portuguese colonial space, in order to develop the productive sector (in agriculture and manufacturing), similar to other European countries.

In Salamanca, a few decades later, we witnessed a new change in the scheme of disciplines that studied Nature; which then had two groups of disciplines. The first group of subjects was to be dedicated to the study of Nature and included subjects such as Cosmography, Natural History, Zoology, Botany, Mineralogy, Physics, and Chemistry. The second (Natural Sciences and Useful Arts), included Rational Mechanics, Astronomy, Optics and Acoustics, Agriculture, and Arts and Crafts.⁴

³ Arquivo da Universidade de Coimbra (AUC), *Legislação Académica*, 1772-1824, IV-1º E 8, Tab. 3, nº4, 127v.-128. Translated from the original by us.

⁴ *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instrucion Publica* 1820, XXIV.

In this way, we see that this idea of the ‘useful’ is linked to various fields of knowledge that studied (Cardoso 2004, 14), for the most part, Nature, and rational ways to exploit its resources.

3. The content of the new disciplines

Of the various disciplines introduced in the Universities under study, we have chosen to focus on the most important ones, which were a significant novelty with the teaching taught since the early 18th century. We are therefore talking about Natural History, Botany, Mineralogy, Zoology, Agriculture, and Chemistry. These disciplines were, as we will show, the central point in a strategy that aimed to change the teaching of Philosophy, to train specialists in the area of natural resource exploitation. In this way, the Portuguese and Spanish reformers tried to overcome a situation of economic backwardness through the exploitation of natural resources. But let’s start with the Natural History subject⁵.

This discipline was introduced at different times: in Coimbra in 1772 and Salamanca in 1807 (Addy 1966). But despite the time difference, its content was very similar, and with a clear practical component. In Coimbra, it was taught in the second year of the philosophy course and was understood as a basis that students had to acquire to continue their studies in physics and in «[...] all the Arts [...]».⁶

The study of Nature in Coimbra had its high point with the creation of the subject of Natural History. This matter had two main objectives: «[...] to make an exact description of each one of Nature’s products: Second, to collect the substance of all the observations [...]». The exposition on its content should start with Zoology, Botany, and only then Mineralogy. Not only in Natural History but also in Chemistry itself, there is one obvious characteristic: the choice of the products used in the lessons, of which the students had to have vast and precise knowledge, would have to be based on their utility – the utilitarian aspect, for commercial and economic exploitation purposes. This argument had a greater presence in Coimbra’s curriculum. Thus, «[...] the Animals[...]» that could be commercialized or useful in agriculture (or other economic activity), were important for Zoology. The link between human needs and natural products should be essential for any student who wanted to graduate in Philosophy. For instance, in Botany, should be prioritize, 1) the knowledge of plants and 2) their use, privileging direct experience.

The major changes in the curricula – where philosophy’s study of nature was an essential part – that occurred in 1772 were the direct consequence of the will of the central authorities to encourage a more effective exploitation of colonial wealth (Santos 2013):

⁵ For the evolution of this discipline in the period in question, see (Browne 2003; Cook 1996; Dear 2006; Drouin e Bensaude-Vincent 1996; Farber 2000; Findlen 2006; 1996; French 1994; Guntau 1996; Jardine 1996; Koerner 1996; Larsen 1996; Roche 1996; Sloan 1996)

⁶ *Estatutos da Universidade de Coimbra (1772)* 1972, Livro III: Cursos das sciencias naturaes e filosoficas: 239-44. Translated from the original by us.

[...] the challenges opened by the exploitation of colonies [...] the need for a strong administration and a properly qualified technical staff [...] have [...] contributed to the political decision and introduce deep reforms in education [...].⁷

In the case of Salamanca, in 1820, we identify the same idea of defending the relationship between agriculture and the development of commerce and industry (the real reason for the introduction of this chair in the University) – «[...] will establish the teaching of Practical Agriculture: and for this, in attention to the present state of the Nation [...]».⁸ In the same mindset was the professor at the University of Coimbra, Avelar Brotero, in 1824, when he stated that this relationship is fundamental, also adding more disciplines, such as Zoology, Botany and Mineralogy «[...] because of their great use [...]»⁹ in areas such as medicine and trade.

However, in the case of Coimbra, we witnessed an interesting phenomenon. Two decades after the introduction of the chair of Natural History, we witnessed a fragmentation that led to a proliferation of new knowledge. Thus, we gradually began to have Zoology, Mineralogy, and Botany, taught autonomously, for some time. The rapid evolution of this knowledge forced the University authorities and even the central power to act several times to create new disciplines. However, we also saw that these new creations kept much of their content, although with some updates.

Early in Botany, the study of plants was circumscribed to their usefulness, not only commercial but also medical. In Salamanca (1799), this subject was mainly linked to the study of Medicine. But in Coimbra (c.1790), the offer was broader; students not only had to study plants for medicinal purposes. This was because the connection between Botany and Medicine, although stimulated and necessary, was considered not the whole, but only a part of a philosophy student's learning. And Coimbra, since Botany moves away from natural history, it seems to have been associated with another, of Agriculture¹⁰. This situation continues until c.1800, when it returns to its original form and is taught in conjunction with Natural History. This change occurs after several complaints from teachers, as in 1792. Professor Luís António de Sampaio believes that Botany and Agriculture should not be taught together due to their content: «[...] as they are very different sciences dependent on several principles that should be treated separately [...]».¹¹

⁷ Translated from the original by us.

⁸ *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instrucción Publica* 1820. Translated from the original by us.

⁹ AUC, *Processos de Professores*, Cx. 26. Translated from the original by us.

¹⁰ Arquivo Nacional da Torre do Tombo (ANTT), *Ministério do Reino. Instrução. Requerimentos da Universidade de Coimbra*, 1778/1799, Mç. 504, Cx. 628.

¹¹ ANTT, *Ministério do Reino. Instrução. Requerimentos da Universidade de Coimbra*, 1790/1795, Mç. 502, Cx. 602. Translated from the original by us.

The discipline of Agriculture does not appear in Salamanca until 1820. And with an identical content, which demonstrates its importance for the development of the country: «What is there to learn scientifically this most useful art to all nations, and especially to fertile Spain [...]».¹²

In the case of Zoology, since 1772 in Coimbra, while it was still included in natural history, its goal was to provide students with knowledge of animals that could (for various reasons) be traded or used in Agriculture. Instead, Mineralogy almost always ended up being linked to other sciences. However, its study should focus on the study of the various soils and minerals, and their best use. Later on (c.1800), these two disciplines keep their content and was taught together.¹³

Of the various subjects we have seen above, one aspect stands out, the study of various natural products. However, not all products were of interest, regardless of their origin, vegetable, mineral, or animal, in Portugal and Spain the criterion for choice would be the usefulness of these products. The objective was a rational and efficient exploration of these products, in a logic of modernization and stimulation of the commercial balance (Costa 2014, 181-84).

This group of disciplines, however, excelled at identifying and characterizing the various products and their purposes. But to complement this group another discipline was needed, dedicated to the transformation of mainly plants and minerals, we are talking about Chemistry. Miguel Bernardes, a Spanish physician, in 1767 had already demonstrated the importance of Chemistry for the study of natural products. In one of his letters, we see that the richness of this science lies in the versatility that will provide his students with the ability to transform products: «[...] the particular nature and action of natural bodies, be they water, minerals, plants, or animals [...]».¹⁴

At the university of Coimbra, its introduction dates back to 1772 and at Salamanca in 1799. In the Portuguese statutes, this discipline was considered the third part of Natural Philosophy. At this university, conducting experiments was a very important component, where even a mandatory number of practical classes was stipulated. However, the big difference was in the products used in class. In Coimbra, saline, metallic and liquid products should be used, therefore, from a much more varied range; while in Salamanca, we note that, as with other disciplines, chemistry was also very much geared towards the teaching of Medicine, therefore, the products used in the classroom would only be those that could have medicinal purposes.

The case studies we have seen are an excellent example of a strategy that thought of universities as agents of transformation and change, with the aim of

¹² *Informe de la Universidad de Salamanca. Sobre Plan de Estudios, ó sobre su fundacion, altura y decadencia, y sobre las mejoras de que es susceptible: con cuyo motivo presenta un proyecto de Ley sobre la Instruccion Publica* 1820, 56. Translated from the original by us.

¹³ AUC, *Registo das cartas de provimento da Faculdade de Matemática e de Filosofia*, IV-1º E 8, Tab. 4, n.º10-A.

¹⁴ Archivo Historico Nacional (AHN), *Consejos, Universidades, Legajos* 5459-nº6. Translated from the original by us.

preparing a concerted response to the needs of society. More precisely, in the fight against the economic backwardness of Portugal and Spain. This economic aspect linked to physiocracy (Escartín e Velasco Morente 2009; Lluch 1996a; 1996b; Lluch and Argemi 2000; Cunha 2011; Nokkala e Miller 2019) was essential in the reforms under study. Which demonstrates the intrinsic link between physiocracy and the management of trade and finance. With the 18th century, Monarchs and Ministers began to support not only the study of Nature but naturalists themselves. In this way, we see a kind of science of natural economy (Spary 2000, 13).

4. The problem of the employment between philosophers

The investments made in curriculum reform and the construction of various scientific equipment, such as laboratories, have been impressive. In the pedagogical and scientific area, we conclude that, in relation to a previous situation, and in comparison with other reforms in Europe, Coimbra and Salamanca, at different stages, have achieved significant improvements (Alves 2021). However, independently of these transformations, it was impossible to solve another problem: the professional future of philosophy students¹⁵. In this aspect, the Universities of the Holy Roman Empire achieved significant advances. Hala, but especially Göttingen, stood out in this period (Hammerstein 2002b, 606; Turner 1974). Its faculties of philosophy played a very active role, ensuring similar privileges to other faculties. This ensured jobs that were later filled by philosophy graduates. In fact, this seems to have been the ‘solution’ followed by several countries, including Portugal and Spain. Although, with different results. Let’s take a closer look at the Portuguese case.

The decline of the Portuguese economy has been evident since 1780, despite the greater integration of the primary sector in international trade and the importance of the Empire; however, it was strongly marked by two decisive moments: the earthquake of 1755 (which destroyed the fixed capital in many regions) and the French invasions (in a period where a recession was already visible due to the decline of gold extraction) (Costa, Lains and Miranda 2016, 164-65). Sectors such as the agricultural sector, despite the great diversification of crops, a result of market incentives that positively affected the standard of living until at least 1760 (Palma and Reis 2016), still showed a very low capacity to innovate (Costa, Lains and Miranda 2016, 164-85). At the same time, the industrial sector benefited from pressure from national authorities, which allowed, «[...] promoting new forms of organizing labor with good results in exports manufactures to colonial markets.» (Costa, Lains e Miranda 2016, 164-85). From 1630 to the mid-18th century, and despite some phases of decline, the Portuguese economy grew steadily, in terms of income per

¹⁵ In the royal charter of June 9th, 1801, a detailed plan already appears concretely, aiming to guarantee professional outlets for graduates in mathematics, linked to commerce and industry, Repositório Digital da História da Educação, Legislação, Século XIX, *alvará de 9 de Junho de 1801*, http://193.137.22.223/fotos/editor2/RDE/L/S19/1801_1810/1801_06_09alvara.pdf.

capita and population, leading to the Portuguese Gross Domestic Product (GDP) in the 1750s being larger than other European countries, notably England and Holland (Palma and Reis 2018, 3). However, starting in the 1750s, and despite population growth, the Portuguese economy dropped considerably until the middle of the 19th century (Palma and Reis 2018, 3-4).

But, with a new training, both in philosophy and mathematics, where could these new graduates find their jobs, in order to help these countries overcome their state of economic stagnation?

It is possible, that this decline may have limited the professional aspirations of the few philosophical students graduating from the University. In this way, the lack of jobs available for philosophy graduates was even considered one of the reasons for the failure of this reform. The great obstacle would be the inability to absorb these graduates, due to the same backward situation that was to be fought against: «Both the Mathematics and Philosophy graduates, true levers through which the country's development should pass, had nowhere to be professionally placed [...]» (Prata 2014, 344-45).¹⁶ Another consequence of this difficulty is the reduction in the number of students enrolled in the philosophy course (Alves 2021, 109; Vasconcelos 1941, II: 111-40).

The Portuguese authorities had to intervene, although without much success. Initially, the option seems to have been directed at attracting new students, through funding for those who wanted to study. The rector at the time, Francisco de Lemos, was quite active in putting forward measures to secure places for philosophy students (Lemos 1980, 106). However, these measures had been insufficient. In 1781, we have another missive where it is indicated that it was necessary to ensure more professional opportunities: «[...] the same Privilege must be expanded, since experience has shown that it is not enough to attract listeners to the Philosophical Faculty [...]».¹⁷ In essence, this request was intended to ensure that these students after their training could be admitted to the subject of Rational and Moral Philosophy, which would then be taught in secondary schools.

However, despite some concrete measures, the results were still insufficient. But let's continue to look at the Portuguese case, the most enlightening. In 1811, a well-known philosophy professor, more precisely of the chair of metallurgy, delivered a broad reform plan for the philosophy course. In this proposal, the professor enumerated many of the difficulties that this faculty faced at the beginning of the 19th century. However, one problem seemed to be already endemic: the lack of jobs for philosophy graduates¹⁸. But unlike before, this time the proposal for possible places for philosophers has gradually increased. If before, the actions taken were mainly aimed at teaching positions, José Bonifácio de Andrade intended to change this paradigm. He quickly concluded that what would attract students to the Phi-

¹⁶ Original translated by the author.

¹⁷ ANTT, *Ministério do Reino. Instrução. Consultas do Concelho de Decanos da Universidade de Coimbra*, 1779-1831, Mç 517. Cx. 643. Original translated by the author.

¹⁸ ANTT, *Ministério do Reino. Instrução. Consultas*, Mç 517. Cx. 643.

losophy course would be the «[...] lucrative and honorable jobs, to which he could legally aspire [...]».¹⁹

Contrary to other European states, which in the teacher's opinion were already benefiting, in Portugal, the lack of articulation between the course in Philosophy and the future of these philosophers was still real. Thus, for the first time, a proposal emerges that contemplates concretely the initial ambition for the construction of a new philosophy course, and the introduction of new subjects such as Natural History, with the impotence of having individuals with a Philosophy background working in key areas of the economy.

The list presented is extensive, but it covered three essential areas: industry, administration, and commerce. For example, in the area of (public) administration, the positions of secretaries of the overseas governments, intendants of the provincial arsenals, mint scales judges, or even directors of the senate of Lisbon, should be occupied by philosophy students.

However, it was in the area of commerce and industry that the professor's contribution was most interesting. The positions to be occupied by philosophers were deeply related to trade with the colonies. In this aspect, the positions reserved for philosophers would be mainly: deputies of the sugar inspection board, customs judges in the provinces, judges of the balance of the mints and judges of the general casting of the mints, or even director of the tobacco customs. These are only some of the suggestions of the Philosophy professor, but it shows, finally, a concrete plan that was articulated with the teaching that the philosophy faculty was providing after the reform of the studies of 1772.

But this contributor also understood the need to secure places in the industry. For example, inspectors of mines, smelters, and metal factories, superintendents of county factories, and also directors of the management of the silk and water works.

The link between economic growth and the absorption of Philosophy (and Mathematics as well) graduates is an aspect that deserves further study, even involving a more detailed study of their career paths. However, two ideas seem important. First, the reforms of the Philosophy course coincided with a period of decline in the Portuguese economy. The reforms in education (including the University) were one of the responses to this reality, although with little effect. Second, the articulation between Philosophy graduates and the industrial and commercial sectors was practically nonexistent, despite the various proposals in this regard.

5. Conclusion

In this paper, we have seen how an economic development strategy is based on educational reform. To this end, new courses and new disciplines were devised to provide new and more effective ways to exploit the abundant natural resources in Portuguese and Spanish colonial spaces. In this sense, it was the Philosophy course

¹⁹ Original translated by the author.

that best reflected this strategy; and it was this course that served as the 'home' base for useful knowledge. This definition was considerably broad. The various disciplines that were considered useful were divided among the courses of philosophy, mathematics, and medicine. But despite this, what is clear is that all of these disciplines were devoted to the study of natural resources.

Of the set of disciplines introduced in Coimbra and Salamanca in the second half of the 18th century, the most relevant was Natural History, Botany, Mineralogy, Zoology, Agriculture, and Chemistry. In Coimbra, Natural History had two main objectives: firstly, to identify and describe natural products with economic potential and, secondly, to initiate the observation and collection of information on these products. The content of this course encompassed the three 'kingdoms' of nature, which means that the lessons dealt with products of animal, plant, and mineral origin. At the University of Salamanca, the content of Natural History was similar, the only change was the introduction of Astronomy (Addy 1966, 373). However, in 1820, Astronomy was replaced by Chemistry.

The chair of Natural History and its evolution well demonstrates the rapidity of scientific developments at the time. This chair quickly gave way to other disciplines. Botany was perhaps one of the most important. In Salamanca it was aimed at medical training and in Coimbra it was linked to the chair of Agriculture (briefly); its objective was similar in both universities: the study of plants and their usefulness. Although, in Salamanca, the plants studied in the classroom were mainly for medicinal purposes.

In turn, Zoology and Mineralogy were the disciplines that complemented the study of the other 'kingdoms' of nature: the study of resources of mineral and animal origin. In Agriculture, the students had a more complete overview of soils, seeds, and the best methods of cultivation. In Chemistry, the students put into practice much of the knowledge acquired previously, this time in the transformation of the products.

The extensive curricular transformation, and the varied pedagogical offer that emerged after 1771 in Salamanca and 1772 in Coimbra, were indeed innovative. Compared to the teaching that would have been in place before these reforms, we have seen considerable pedagogical and scientific advances. However, in the broad plan of industrial and commercial reform, the capacity to absorb the new philosophy graduates failed. The difficulties in getting a job where they could apply their knowledge was often insurmountable obstacle. As in many universities, the solution seems to have been the use of decrees to secure philosophy students some jobs.

The Portuguese case is exemplified. Since 1772, several reports, mainly from university professors, state that enrollments decreased considerably, one of the causes being the lack of professional opportunities. However, many of the measures did not achieve the desired results, and it was only in 1811 that we had a concrete plan. José Bonifácio de Andrade, professor of Metallurgy, designs three areas where Philosophy students should be integrated: industry, administration, and commerce.

The metallurgy professor's plan did not have a practical application. In practice, this led to a continuation of the problem.

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