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## PROBLEMS

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### *Hydraulic Policy and Irrigation Works in Spain in the Second Half of Eighteenth-Century*

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This analysis<sup>1</sup> of the relationship between the financing of hydraulic policy and the building of major irrigation works in eighteenth-century Spain needs to be justified by two prior arguments.

First I will refer to the minor role that drainage of lacustrine lands for cultivation, as it is known in Modern Europe, had in the region I am to deal with, that is the Ebro valley and, more generally, the area of the Ribera del Ebro, in the old Kingdom of Aragón.

There is no doubt that from the Middle Ages to the eighteenth century, the areas most suited to receiving irrigation were the coastal Mediterranean areas and the Ebro valley, as well as the Balearic and the Canary Islands. These peninsular areas were not the only ones, but were in fact the ones whose situation we know best. In both of them irrigation had a major social and economic influence, often decisive, over many centuries.

Littoral areas have a dry and sunny climate, short rivers and ravines which carry fertile waters, as well as quaternary alluvial plains and marshlands. The development of irrigation has had important social consequences in these areas: the gulf of Rosas, the River Ebro and its delta, the Rivers Turia, Júcar and the great marsh or *albufera* of Valencia, near this town, as well as the River Segura, in Murcia, are outstanding cases. But the Ebro valley, flat in its central part, is an inner semi-arid area, at a long distance from the sea, and has no coastal plains. Water exists only where there are rivers, and therefore the drying up of some areas to bring them under cultivation could only have taken place, historically, in the few humid zones that emerged along the river banks, among which the major ones were those of the River Ebro, named *sotos* and *mejanas*.

From a physical viewpoint these were, in general, abandoned meanders of

<sup>1</sup> For more details see Pérez Sarrión, *Política hidráulica*.

the river, which wound about forming bends, or small plain areas where the river flow splits into two or three streams of water and sometimes produces fountains and gushes. Between 1781 and 1808 there were at least 20 documented cases of irrigation zones showing these characteristics along the 80 km of river bed of the Canal Imperial de Aragón<sup>2</sup>. There were obviously other cases along the Ebro River and along other minor rivers such as the Jalón and the Góllego. These areas only occupied a small irrigated surface, but were socially important because many of them were communal property and could therefore be divided into plots and distributed to local peasants, mainly cottagers, who did not own land to cultivate. These processes were rather more difficult on the land which belonged to the nobility and to the Catholic church.

There were also some other humid zones like the Gallocanta Lagoon in Teruel, or the Sariñena Lagoon in Huesca. They were generally small; we do not have any available information about them.

My second argument refers to the reasons behind the drainage of lands to be brought under cultivation. Historically, the main aim of draining humid zones in Europe was to increase agricultural yields in a given area. In fact we know, nowadays, that irrigation was another agrarian operation which had exactly the same purpose. In that sense we think that drainage and irrigation are phenomena which should be analyzed from a similar perspective: the agrarian growth and development which took place in Europe in modern times. Drainage of marshlands and irrigation were developed according to where the need came from; they were not opposite but alternative and complementary actions, because each of them could only occur in specific geographical areas. This paper has been written in this perspective, and I hope my contribution will be of some interest.

Having explained this, we will deal with three major issues related to irrigation. In the first place we will examine the financing of hydraulic works construction and the policies of the enlightened Spanish Government in the late eighteenth century. Then, the role that trade and the financial bourgeoisie played in this system will be considered. Lastly, we will see how a given historical case, the construction of the *Canal Imperial de Aragón*, can provide significantly interesting data for the general aspect of the subject.

<sup>2</sup> Pérez Sarrión (1984), chart n. 42, in pp. 494-499. Here are some toponymic place-names of ploughed, brought-under cultivation and irrigated lands: *Soto de la Mejana onda, Ebro Viejo, Soto Islado* (Ribaforada, 1788, 1793-1794, 1799), *Soto del Espartal, mejanas del conde, Soto de la Barca* (Buñuel, 1790, 1797), *Mejana junto al río Ebro* (Cortes de Navarra, 1805), lands and *sotos* belonging to the areal of *Las Fuentes* (Zaragoza 1788-1796), *soto del Marqués de Ayerbe* (Zaragoza 1806), *soto del Gran Prior* (Buñuel, Ribaforada or Fustiñana 1799), lands of *la Mejana, Ebro Viejo y las Rozas* (Luceni, 1800), *Soto de Polliguera* (Cabañas de Ebro, 1799).

## The financing of hydraulic policy

A central point of this analysis will be to describe the main characteristics of the system that the Enlightened State set up to finance its hydraulic policy, as drawn up by the Secretary of State, the Count of Floridablanca.

The enlightened Spanish politicians attached great importance to agrarian policy, which aimed to rationalise agriculture and manufactures, and to promote public works, mainly roads and canals for irrigation and navigation. These measures were adopted to improve communications, to develop the trade of goods between the centre and the periphery, and to link up domestic inland markets. This process speeded up in the second half of the eighteenth century, especially after the famous riots of 1766. The enlightened politicians attached great importance to these actions; authors such as Francisco Cabarrús<sup>3</sup>, the Count of Floridablanca<sup>4</sup>, the Count of Aranda, Pedro Rodríguez Campomanes, and others, widely referred to it.

The achievement of such agrarian objectives implied a fundamental change in the distribution of land revenue as well as of landed property, which obviously was impossible as it undermined the privileges of the aristocracy and the church, both land owners, and political support for the enlightened monarchy.

The politicians raised this question on several occasions, but unsuccessfully. The large seigneurial properties, the large estates (i.e. *latifundios*) and agrarian revenue such as seigneurial rights and tithes (*diezmos*) were truly untouchable. Therefore other forms of intervention, such as the ploughing up of communal lands for dry farming, or hydraulic policy, involving the construction of irrigation canals and ditches, were finally of great interest and fulfilled a substitute role for agrarian reforms.

The demands of enlightened policy created a need for the state to increase financial resources to implement it. According to Barbier and Klein, military costs were the most important in the budget for these years<sup>5</sup>, but agrarian policy required a lot of resources as well: furthermore, its real monetary cost has not yet been evaluated.

The state could have never engaged in a broad reform of taxation to develop income tax (plan for the *Unica Contribucion*) because this would have

<sup>3</sup> Cabarrús (1820), pp. 347-362.

<sup>4</sup> Floridablanca (no date, 1952).

<sup>5</sup> Barbier and Klein (1981), pp. 486-489. The authors state that the amount and distribution of the expenses were directly ordered by the King; this seems to be a debatable matter. They argue, as well, that as the expenses for defence were given priority over any others the security of the state was a more important political objective than enlightened reforms (p. 489). I especially disagree with this point: the scale of political priorities of a government is not always in direct proportion to the amount of each objective within the budget.

damaged the aristocracy and church, the social supports of the late feudal regime. So, it attempted three other main ways. The first was to manage directly again some public rents whose administration had been given to private citizens, in order to retrieve the profits. The second was to increase taxes on consumption and the trade in goods, especially with America. The third was to issue national and foreign public debt.

The management of taxes and incomes brought a limited increase in revenues but had no relevance. The issue of debt was the easiest resource and at the same time the most risky; in fact this was what drove the Treasury to bankruptcy. The debt was created to finance the construction of the Canal Imperial (1768-1773) and increased during construction (1785-1788) and as a result of the wars and threats of war against England and France (1777-1783 and 1789-1795).

The question regarding the increase in taxation on consumption (excise taxes), above mentioned, must be considered too. The reform of colonial trade, carried out in 1778-1792, can be interpreted in this sense: according to J. M. Delgado the state did not really intend to create an active export sector controlled by the national bourgeoisie, but rather to generate taxable wealth in order to strengthen its revenues and its role as redistributor of incomes<sup>6</sup>.

In the second half of the eighteenth century quite a lot of major navigation and irrigation canals were built. The state came to have a share in all of them, from the very beginning or during the process of construction. Moreover, there were numerous private initiatives to build, alter or widen canals and ditches, but the state only participated if it had to for political reasons or if they were large or of complex management. Among the waterways designed for navigation, we could mention the *Canal de Castilla* (made up of three waterways), the *Canal de Guadarrama* and the *Canal de Manzanares*, in Castile; and along the axis of the River Ebro, the *Canal Imperial de Aragón-Canal Real de Tauste* and the *Canal del Bajo Ebro* or *Canal de Amposta*.

The most important work among them, from an economic point of view, was the *Canal de Castilla*, which was exclusively financed by state revenues coming from this very region, Castile. Regarding irrigation works, some of the most important projects were the reservoir of Tibi<sup>7</sup>, in Alicante, and Lorca, in Murcia; and the *Acequia Real del Júcar*, in Valencia, which was rebuilt and widened. Another major project, the *Canal Imperial de Aragón*, was a waterway for navigation and irrigation which was designed for navigation in the middle part of the River Ebro and to provide an extensive irrigated area all around Saragossa.

The *Canal Imperial* flows along the right bank of the Ebro. It originated from an irrigation ditch created in the sixteenth century by the Emperor Charles

<sup>6</sup> Delgado (1989), p. 659.

<sup>7</sup> It was rebuilt up on the River Montnegre to secure water for cultivated areas near Alicante. It dates from shortly the decade of 1730.

V (Acequia Imperial de Aragón), which was rebuilt between 1766 and 1793. In 1781 the Canal Imperial Company purchased the old much smaller *Acequia Real de Tauste*, which winds along the same section of the river but upon its left bank. Together they formed the *Proyecto del Canal Imperial de Aragón y el Canal Real de Tauste*.

The *Canal Imperial* was initially conceived as a ditch for irrigation only; its financing was undertaken by a regulated private company through the issue of bonds, that is, by means of private debt. The regulated company, called "Badín y Compañía de Madrid y Zaragoza", was composed of several French and Spanish partners. Its first bonds were dated 1768 and 1773, and were issued in the Amsterdam financial market to many small investors. The company failed because of mismanagement, the high technical complexity of the work itself, and the severe financial problems. Then, the Count of Floridablanca, who was appointed as Secretary of State (1777-1792) in February 1777, retrieved the project for the Government, in view of political considerations. He sorted out the company, settled its debts and supported the construction, which was mostly carried out between 1778 and 1791. In its practical aspects the plan was executed by an enlightened Aragonese canon, Ramón Pignatelli. Besides Floridablanca directed the Government's hydraulic policy and its financing.

The main works consisted of a large dam on the River Ebro, the digging up of about 80 km of river bed from the 120 km projected, and the building of many bridges and buildings. According to an estimate made by Llauradó<sup>8</sup> the work amounted to 98,1 million *reales de vellón*. This was almost totally financed by the issue of national and foreign debt: bonds in Holland in 1778 and 1779 worth 52.45 million *reales de vellón*, and *vales reales del Canal Imperial* (a sort of IOU) in 1785 and 1788, worth 99 million *reales de vellón*. The difference between total income (159.5 million) and expenditure (98.5 million) was used to pay the interests on loans, bills of exchange and bank drafts, as well as financial commissions. Moreover, this debt was paid off only in part, and bore interest throughout the nineteenth century.

In summary, then, the state had to issue about 150 million *reales de vellón* between 1770 and 1790 to build the Canal Imperial. To this important need many others were added, especially the expenses resulting from the wars against Great Britain (first as a threat, 1777-1779, after as a fact, 1779-February 1783), and by the French Revolution and the war against the Convention (1789-1795).

On account of all this the financial needs of the Royal Treasury increased considerably. Excise taxes such as American colonial custom duties were raised as a response, and new public debt was issued. As a result, the state was faced with the need to increase and improve the management of financial

<sup>8</sup> Llauradó (1878), pp. 654-655. This estimate can be seen too in Pérez Sarrión (1984), p. 456.

resources. In order to do this, Floridablanca outlined at least two responses. He tried to encourage private business men and traders to take part in financial operations run by the state, and set up a public bank (*Banco Nacional de San Carlos*, 1783) so that the Treasury could have its own financial management and proper means to get cash and loans in national and foreign markets.

### **The role of the financial and commercial bourgeoisie: public interests, private profits**

The analysis of the agents that financed the *Canal Imperial de Aragón* and other hydraulic works allows us to step into a rather unknown world, ruled by vigorous banking men and traders settled in Madrid and Cádiz. These traders also had their private business and operated in national and colonial markets from privileged positions. They traded with fewer and minor risks, due to the fact that the state regulated their companies or granted facilities to them. It is significant that no regulated or non-regulated companies in Barcelona are included and so we can assume that the colonial network that was developing in Catalonia at that time, was not part of this system.

The *Compañía General y de Comercio de los Cinco Gremios Mayores de Madrid* operated in this way. It obtained contracts to supply goods to the Army and capital city of Madrid; it took royal revenues on lease; it possessed exemptions in customs duties and monopolies for the sale of various goods in America; it discounted bills of exchange to pay for government works and it issued *vales reales* in the market. This company, like many others, made a great amount of profit, and in exchange it was forced to give financial support to government plans such as the *Canal Imperial de Aragón*, to undertake extremely risky trade operations, and to loan cash to the Treasury which was liable to be returned in extremely uncertain instalments.

A key person was the merchant and banker Francisco Cabarrús, French born, who was closely connected with traders and bankers established in Paris and Cádiz. Cabarrús carried out major commercial and financial operations for the state and obtained large profits from them as well. For instance, he managed the first three issues of *vales reales* (30-Aug.-1780, 20-Mar.-1781 and 22 May 1782) through affiliated companies, and gave loans to the Treasury in association with the French banking houses of Lalanne and Lecoulteulx de la Noraye. He also managed half of the debt originated by the war against Great Britain, to the value of 451 million *reales de vellón*, with high profits, and carried out the creation of the *Banco Nacional de San Carlos* in June of 1783. Thanks to his close connections with domestic and international financial markets many shares of the Bank of San Carlos were bought by banking houses in France (Lalanne, Lecoulteulx de la Noraye) and Holland (Hoppe), as well as by many bankers and institutions in Spain<sup>9</sup>.

The bank was created by Floridablanca who aimed to supply the Government with loans, to finance the import and export trade to America, and to substitute cash with the issue of banknotes when shipments of metal did not arrive on time. Besides, the bank had another aim: to prevent the economic positions of the merchants involved in the American trade from weakening because this traffic generated revenues to the Treasury which were essential to finance the policy of hydraulic and public works directed by Floridablanca. For this reason the Government took an interest in traders earning cash in American trade, since it was a reward for their economic support.

The bank was founded by Cabarrús; he carried out important tasks for Floridablanca and the Government, but he also attended to his own interests. He speculated with the purchase price of the shares of the bank in spite of the fact that he was one of the bank's managers, and made his house of commerce operate with it. To sum up, he used the bank for his own business, as he admitted openly<sup>10</sup>. The *Banco de San Carlos* was in fact a public bank but it was under private control; therefore, at the same time as managing operations such as the financing of the *Canal de Guadarrama* Cabarrús carried out others that were, in fact, quite immoral, and moreover risky for the bank. Thus Lecoulteulx de la Noraye, being a share holder, managed to get a loan worth 20 million *reales de vellón*, which amounted no less than 15% of the capital assets.

The final steps in the financial management of the *Canal Imperial de Aragón* occurred between the Revolution of 1789 and the destitution and trial of Floridablanca (February 1792). They concern the activities of many merchants and trade companies of Cádiz and Madrid who were involved in the financial network run by the Secretary of State, as well as the kind of privileges they held in return for their financial support of Floridablanca. These consisted of exemptions on tariffs, licenses to export shipments of goods under a regime of monopoly, and permission to discount private bills of exchange with issued *vales reales*, which became currency henceforth.

A key agent, the *Compañía de los Cinco Gremios Mayores de Madrid*, has already been mentioned. *Cinco Gremios* participated in the financing of the *Canal Imperial de Aragón* from 1777 to July 1791, and was finally appointed Treasurer for the Canal. Another important but scarcely known agent was Juan Bautista Condom. Being a trader established in Madrid, he was the sole initial investor partner of the very first *Badín y Compañía* company. The state took back the enterprise in 1777, then Condom remained in his position and became a close collaborator of Floridablanca, for whom he performed numerous financial intermediary tasks in Madrid, Cádiz, Paris, Amsterdam, The Hague and other financial centres in Europe.

Even a most superficial look at Condom's activities shows the important role that the trader played in the financing of this irrigation work. But they

<sup>9</sup> Tedde (1987), pp. 532 and 546; Tortella (1986).

<sup>10</sup> Tedde (1988), pp. 87-91.

mostly induce us to raise another question: the intricate web of public interest and private profit that could be woven around such an hydraulic work and, furthermore, they cast light on the system governed by Floridablanca to finance his hydraulic policy. As a final result the activities of Cinco Gremios, Condom and others show the confusion that existed between public and private estates, between the public interests of state and the vested interests of the commercial and financial bourgeoisie.

At the end of 1789, Condom was creditor for a large amount of money he had lent in advance to the Canal in cash and bills of exchange, to pay off for government interests and debts the Canal in Holland. At this point, it must be acknowledged that the debts of Condom as a businessman were hardly distinguishable from those he had incurred as a debtor in his position as Treasurer to the Canal and as Floridablanca's financial agent.

Between the end of 1789 and July 1791, the French Revolution cast its long shadow upon this scene. Condom found himself in trouble because he needed financial backing to maintain his commercial prestige and to be able to keep on issuing bills of exchange; Floridablanca supported him in several ways since he wanted to build the canal to Saragossa at any cost. As a result, Condom was able to pay off all the works but was unable to avoid bankruptcy. After a while, in July 1791, he was replaced in the office of Treasurer by *Cinco Gremios Mayores de Madrid*, a company which was still solvent. In February 1792 Floridablanca was removed and taken to trial (1792-1794) at the same time as Condom (1793-1801). Floridablanca was accused of having used Treasury funds to support private business. These trials are, nowadays, an important source of data for the financial activities of Floridablanca as well as for showing how and why he financed his hydraulic policy<sup>11</sup>.

### **The irrigated zone of the Canal Imperial de Aragón and its economic and social framework**

The third and last part of this paper deals with several questions on drainage and irrigation, having as reference a well-known regional case, the *Canal Imperial*, which flows along the Ribera del Ebro, and other general data on Spain considered as a whole. I will particularly focus my analysis on wet farming.

The first important question to consider is why the ploughing up and drainage or irrigation of new lands took place, provided that such an action seemed to aim at increasing land yields.

A major factor is population. The reconstruction of the *Canal Imperial de Aragón*, as well as the reorganisation of the old irrigated areas and the ploughing up and irrigation of idle land occurred between 1764 and 1808. Parochial documents and population censuses made in Aragón in 1711, 1768, 1787 and

<sup>11</sup> See Floridablanca (1792) y (1795).

1800, show a slight annual increase of 0.89% for the period 1711-1787 and of 0.54% for 1787-1800; while for the region of the *Ribera del Ebro*, where the *Canal Imperial de Aragón* and the *Canal Real de Tauste* flow, registers and censuses show a sharp annual increase of 1.33% for the period 1713-1768 and of 0.25% for 1768-1787. In the capital of the old Kingdom of Aragón, Saragossa, which had about 42,000 inhabitants in 1787, the rise in population was more regular, being of 0.51% in 1723-1768, and of 0.63% in 1768-1787 due to rural immigration. The conclusion that clearly emerges from these numbers is that the irrigation of the *Canal Imperial* was carried out during a period of sharply rising population which caused a general trend to plough up pasture and idle lands. Let us remember that the first project of *Badín y Compañía* for the *Canal Imperial* was a canal exclusively dedicated to irrigation.

The rise in regional markets also had an influence in the digging of irrigation canals and ditches; in fact they were made to yield crops for consumption and export. The canals of Castile, Manzanares and Guadarrama were designed to supply Madrid and to give Castilian wheat the possibility of being exported to America. In the same way, all the navigation and irrigation canals built along the River Ebro (*Canal Imperial*, *Canal Real de Tauste*, *Canal de Amposta*) were designed to link the Atlantic Ocean to the Mediterranean Sea; not just only attending to strategic military objectives, but also aiming to increase agrarian yields in the Ebro Valley and to enable exportation to littoral Catalonia, Valencia and America.

Nevertheless, as far as Aragón is concerned, we must draw attention to the fact that the irrigation areas of the Ebro valley were far from the sea. Coastal areas which could be irrigated had an easy access to foreign markets by sea, and we all know the great importance for trade that has been attached to maritime routes in modern centuries. Aragón had no coasts and hence the old kingdom had a relative disadvantage compared with coastal areas when the possibilities of exporting rose, since it only could export by sea through Navarra and País Vasco, in the west, and mainly through Catalonia and País Valenciano, in the east; and for this reason it carried higher costs and considerably more customs and political difficulties than other Spanish countries.

Throughout the eighteenth century, Spain underwent a major process of growth and specialisation in agriculture. This process took place both in Catalonia and Aragón. In Catalonia the rise in rural settlements and the greater possibility of shipping goods to America encouraged the growth of agriculture and the development of a regional market centred on Barcelona, which became a central point for consumption and services.

Within this process, western Catalonia, situated behind coastal mountains, in the Ebro valley, experienced strong agrarian growth, based on the ploughing up of new lands and improvements in irrigation networks<sup>12</sup>, intended to yield

<sup>12</sup> Especially in the Lérida area, in the irrigation canals of Piñana and Fortanet. There were some improvements in irrigation networks in other areas, such as Termens, Torres

grain to supply the littoral areas of Catalonia. Aragón received a boost from the development of the Catalonian market, as well as from an increase in population, mainly in Saragossa, which rose from 25,000 inhabitants in 1700 to about 50,000 around 1800. Thus the old kingdom enjoyed intense agrarian growth on land mostly spread out over the low regions and plains of the centre of the basin (*somontano, tierra baja*). This was based on the Mediterranean trilogy (grain, mainly wheat and barley, wine and olive oil). Sheep livestock also rose in these areas, and caused conflict with the migrating flocks which came periodically from the Pyrenees and Teruel highlands, north and southbound, to the central basin of the River Ebro.

The extensive irrigated surface which spread along the Ribera del Ebro, permitted an increase in wheat and olive yields. Olive oil was produced preferably for the Saragossa market. Wheat was originally produced mainly for the Aragón market, but the sharp growth in demand from Catalonia encouraged big shipments from the River Ebro, including wheat cultivated on irrigated lands. Lastly an extensive vinegrowing area produced wine and brandies for the American markets.

In conclusion, the spread of irrigated lands was originally planned to supply the local and regional market with wheat and oil. Nevertheless, the sharp demand which came from other areas led to an economic regional structure based on the steady exportation of wheat and a progressive increase in vineyards for the same purposes<sup>13</sup>. This foreign demand stimulated the enlightened plans which aimed at using the Ebro as a waterway to export the agrarian yields of Aragón to the littoral of Catalonia and America.

Finally, we will briefly refer to the question of social and economic profitability. The exact evaluation of the profitability of a work such as the *Canal Imperial de Aragón* is complex and difficult to sum up in a few lines. Moreover it is a risky task because it is subject to gross simplification. Let us take for granted that an enterprise under the Old Regime was profitable as it produced obvious economic and social profits in a reasonably short period of time.

From this perspective, and using as a reference the fifty years between 1766 and 1808, the *Canal Imperial de Aragón* and the *Canal Real de Tauste* as a whole were very profitable, although not as much as their main promoters, the Aragonese Count of Aranda and the Murcian Count of Floridablanca thought they would be. Irrigation permitted a slight but clear rise in oil yield for local consumption, and in wheat and brandy for local consumption as well as for Catalonia and America. It also provided water and therefore crops for small landholders. This had important social consequences, as it gave vital security to peasants.

de Segre or Verdú, according to Vicedo (1991), chapters 2 and 5.

<sup>13</sup> Pérez Sarrión (1984), chapters VI y VII.

Water also provided many poor labourers and servants with access to land ownership and modified quite substantially the sharing out of land revenues. The payments of irrigation rights caused a significant redistribution of land revenue. When this question was raised the general manager (*protector*) Ramón Pignatelli, opined that the tithes paid on ploughed up and irrigated lands which belonged to the Crown (the most extensive) had to be regarded as tithes of newly cultivated lands (*novales*)<sup>14</sup>, and thereby were not supposed to be paid to the church but to the King together with irrigation rights (*alfardas*)<sup>15</sup>. Consequently the peasants who cultivated the newly settled lands not only became land owners but were subject to taxes that were lower than the ones paid in the close seigneurial villages. So the peasants came to be freed, in fact, from heavy feudal charges they once had to pay.

This process also had notable failures. The irrigated vineyards of Saragossa yielded a wine of low quality which had to be transformed into brandies. Moreover, ploughing up and bringing lands under cultivation was a far too long process: the canal was started in 1768, the great sharing out of irrigatable lands was carried out in 1782-1784, and in 1808 there were still plots which remained idle or were not cultivated in a proper way. Lastly, and above all, the canal never attained the length which had been planned originally, and so the central part of the River Ebro was never easy for navigation. Furthermore, the most extensive farming lands, situated downstream, were left with no water. The main purpose of the construction of the canal was to enable navigation on the entire river, and this objective could not be fulfilled.

In spite of all this, the extension of the canal had a very positive influence on the demographic and manufacturing development of Saragossa in the nineteenth and twentieth centuries. Navigation along the canal came to an end because of the rise of railways in the nineteenth century, and the "surplus" of water which was left over became an essential factor for the urban and demographic growth of the town. Saragossa had 50,000 inhabitants at the beginning of the 1800s; nowadays it has over 600,000, a remarkable industrial network and a very extensive irrigated agricultural area. Today Saragossa is still nearly entirely supplied with water from the historic *Canal Imperial de Aragón*.

<sup>14</sup> The tithes or *diezmos* (i.e. "tenth parts") were taxes of medieval origin, originally due to the church, which comprised a 10% of crops. The *novales* lands were idle or pasture lands which were ploughed up and brought under cultivation for the first time. The Pope had conferred the tithes of the *novales* lands to Spanish kings through several bills from sixteenth century and after.

<sup>15</sup> The taxes that were traditionally paid for water were called *alfardas*. The irrigation rights were cashed by the Canal Imperial for the water that was supplied to land tenant farmers. The proposal of Pignatelli comprised both concepts, the *diezmo* and the *alfarda*, so that the total amount was smaller than the sum of both taxes if they were paid separately.

In short, we can conclude that the Canal Imperial had an economic cost which was somewhat ruinous and that it was never built according to original plans, but it was truly a very profitable enterprise from a social point of view. On the other hand, we can also conclude, that economic facts drove politicians to face up to the limits of human expectations and, more specifically, to the illusions raised by the reforms taken on by the Spanish Enlightenment.

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