

**THE RELATIVE NATURE OF SUCCESS AND FAILURE –
FUNCTION OF TIME AND CONTEXT
What can we learn from the History of three large-scale projects?³**

In this paper, we study three long-term projects, with a life cycle of several centuries, where the environment and the economic conditions change: as well as the borders and the political regimes of the countries, the behaviours and the aspirations of men, the daily life and the perception of the world. For these large projects, their life cycle, including the classic stages of beginning, maturity and completion, the end may be far away... but sometimes it already gives an idea of the outcome of the project. To show the relativity of their success and failure, we have chosen to evoke three large projects of the same nature: whose failure or success can be appreciated nowadays. We will first study, respecting the chronology, the oldest waterway, the Canal du Midi, the most important large project of the 17th century (1667-1682), which was a success as long as it enjoyed a natural monopoly. We will then evoke the Suez Canal, which was a success, and which remains so (1859-1869). Finally, we will study the Panama Canal, which was a resounding failure under the French government (1881-1903), but which later became an undisputed success when completed by the Americans (1904-1914). Many factors have modified the destiny of these great projects, and we will try to analyze them. For these three projects, we have used archives and testimonies somewhat forgotten in time, which raises our second objective – to inform and communicate the existence of these resources because their volume requires much more effort than ours.

Keywords: Large project financing; Controversial markets; Natural monopoly; Large project risks; Man-made waterways

JEL: N60; N61; N63; N65; N65; N70; N71; N73; N75; N77; O18

1. Introduction

“Nicaragua has awarded a Chinese company a 100-year concession to build an alternative to the Panama Canal, in a step that looks set to have profound geopolitical ramifications.

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The president of the country's national assembly, Rene Nuñez, announced the \$40bn (£26bn) project, which will reinforce Beijing's growing influence on global trade and weaken US dominance over the key shipping route between the Pacific and Atlantic oceans."⁴

Can we build, today, such a large-scale projects that our ancestors have built before? What can we learn from History?

When we talk about great projects, since ancient times, we think of architectural projects, such as the Hanging Gardens of Babylon, the pyramids of Egypt, the Great Wall of China, the cathedrals, or more recent projects, such as the first trip to the Moon. But all these projects, which are great projects, don't have the same nature: some are one-time projects with a single objective, and as soon as this objective is reached, we can say that the project is a success, as the first steps of Neil Armstrong on the Moon (Apollo 11 Mission, 21.07.1969). Other projects are not one-time projects and they must necessarily be long-term: and over a period of several centuries, where everything changes, countries, people, borders, behaviours, daily life, it is difficult to have a permanent success. For long-term projects, there seems to be a life cycle, with a beginning, a maturity generating success and an end. Sometimes the end is still a long way off, but sometimes it has already taken effect. Large projects with a certain lifespan are not always permanently successful, but they are not always unsuccessful either. To show the relativity of the success and failure of projects, we have chosen to focus on three large projects of the same nature: the drilling of three canals, projects that have been going on for a long time and whose failure or success can nowadays be appreciated. We will first study, respecting the chronology, the oldest waterway – the Canal du Midi. The project was the most important major project of the 17th century, which was a success as long as it enjoyed a natural monopoly and which became a failure when another monopoly, that of the railroad, appeared. We will then discuss the Suez Canal, which was, despite vicissitudes and difficulties, a success, and remains so, but we will study it before its nationalization by the government of Lieutenant Colonel Gamal Abdel Nasser. Finally, we will study the Panama Canal, which was an abysmal failure under French governance, and which later became a very profitable project when the Americans took over. We are thus in the presence of a project with mixed success – the Canal du Midi; a project with undeniable success – the Suez Canal; and a third project that was a failure for the French management – the Panama Canal. In each case, we will try to analyze the favourable and unfavourable factors that modified the destiny of these great projects, and we will try to draw lessons from them.

2. Methodology

Our research represents a historical investigation and analysis of documents, books and articles that describe the genesis, the establishment and the completion of the three projects.

⁴ Nicaragua gives Chinese firm contract to build alternative to Panama Canal – The Guardian, 06.06.2013.

2.1. *The canal du Midi*

Our primary source, concerning the *Canal du Midi*, was the documents registered in the “Archives du Canal du Midi”, supervised by the Inland Waterways of France in Toulouse (France). Archives are classified in a systematic way and represent 3 series of documents, divided into bundles and grouped by themes: 906 bundles in 26 themes. Thus the “Construction of the canal” (as a separate topic) gathers the first 62 bundles. There is also the correspondence between Paul Riquet and Jean-Baptiste Colbert⁵, who deals exclusively with the technical elements of the project. The second series of archives concerns the accounting of the origins of the channel. It contains the folders from 910 to 1197 (according to some documents of Mr Borel from 28.05.1664 to 14.04.1665), from the year 1665, prior to the construction of the canal, until the end of 1684.

The third series of archives, concerning the accounting and the statistics, records the accounting of the accelerated navigation of the canal. The service was active until the development of the railroad (1830-1848). The third series consists of 40 boxes of unclassified records. Inside each box are preserved the monthly and annual summary schedules as well as the revenue and, often, the river freight bills justifying the income and indicating the nature of the transported products. We used the official documents registered in the archives of the channel, such as the act “*Edict du Roy, pour la construction d'un canal de communication des Deux Mers, Océane et Méditerranée, pour le bien du commerce*” (1667, Printing House Rellier, Toulouse), the act “*Procès-verbal du bornage du Canal de Languedoc*” (1784, Printing House Jean Martel, Montpellier) as well as the detailed inventory “*Recueil des lois, décrets, ordonnances, décisions et arrêtés relatifs aux actions du Canal du Midi, au profit des héritiers de Riquet de Caraman*” (1852, Printing House Le Normant, Paris). We also used some secondary sources, such as the work of General Antoine-François Andréossy “*Histoire du Canal du Midi connu précédemment sous le nom de Canal du Languedoc*” (Andreossy, 1799).

2.2. *The Panama Canal*

We used, as primary sources, the documents registered, since 1993, in the National Archives of the world of decentralized work in Roubaix. The documents, of the *Companie Universelle du Canal de Panama*, appear under the topic 7AQ. Hereby we present the information that was used in the research:

- 7AQ2: Debt issuance’s conditions in 1880, 1882, 1883, 1884, 1886, 1887, 1888; General Assembly of the *Companie Universelle du canal interocéanique*; reports of the Board of Directors;
- 7AQ3: AQ11: Newsletters of the company, 9 volumes;
- 7AQ12: Judgment ordering the liquidation of the *Companie Universelle du canal interocéanique*;

⁵ Jean-Baptiste Colbert is an exceptional person who occupies an important place in the History of France. At this period he is General inspector of finances then Secretary of State of the house of the king and Secretary of State to the navy.

- 7AQ14: Act relating to the liquidation of the *Companie Universelle du canal interocéanique* (01.07.1893) appointing Mr Lemarquis as executor and Mr. Gautron, as co-executor;
- 7AQ17: Lawsuit of Panama;
- 7AQ46: Historical Record on the case of Panama, articles, judgments, legal consultations, etc.

These archives were amputated from many technical issues, a consequence of the transfer of the French concession to the Americans (16.04.1904). The archives of the *Companie Universelle du canal interocéanique* and its liquidation were given by Mr. Lemarquis (in charge of the liquidation from the 04.07.893, and executive director of *Société Générale* in 1950), to the National Archives on 03.10.1950. Mr. Lemarquis had committed himself, preserving these archives for about twenty years.

We also used some secondary sources such as: P. Bunau-Varilla: *Panama: creation, destruction, resurrection* (Bunau-Varilla, 1892) or: L.N.B. Wyse: *Panama Interoceanic Canal: Colombia Mission 1890, 1891* – a General Report about the plan and the project profile (Wyse, 1891).

2.3. *The Suez Canal*

Research has also been conducted at the Center of the World of Work Archives, located in Roubaix. The Centre is custodian of the archives of the *Compagnie Universelle du Canal Maritime de Suez* (property of the Association of Friends of Ferdinand de Lesseps). An authorization of consultation of the Archives was obtained from its President. The countable and financial data were extracted from the original annual reports presented to the shareholders during the period of construction of the canal.

2.4. *Currency estimation*

A significant component in a historical research represents the actualization of the currency: the archives are sometimes written in pounds, *sols*, public funds of money (deniers) and sometimes in francs. The official birth of the franc goes back to 1360, by an ordinance of 05.12.1360 by John II the Good. This franc, representing a small amount of money (of fine gold), is called franc d'or. Later, the Decree concerning the weights and measures, known as the Law of 18 Germinal, Year III (07.04.1795), gives birth to the new franc d'or (the Republican logic which abolished the old physical measures to replace by the meter, litre or gram). Its adoption precedes by little the bankruptcy of the paper money (System of Law). The franc is then a devaluated currency, but it replaces the pound (1 franc = 1 pound) without currency manipulation. The franc will become a strong currency with the law of the "germinal franc" of the 7 germinal year XI (23.03.1803), which defines its value by reference to money and gold. Thus to interpret the monetary tables of the archives, where there are pounds and francs, it is necessary to consider the "approximate" parity between the two.

3. The “Canal du Midi”⁶ and the “Garonne Lateral Canal” (1667-1682) – A Great Project with Mitigated Success

The construction of the Canal du Midi, later complemented by the Canal Latéral à la Garonne, challenged common sense and measure. The construction, archaic but the object of a titanic effort, was a success thanks to the tenacity of its designer, Pierre-Paul Riquet.

3.1. Pierre-Paul Riquet, and the foundations of the Canal du Midi.

Pierre-Paul Riquet was born in Béziers, probably on 29.06.1609⁷, and studied brilliantly at the Jesuit college of his native city, especially in mathematics and physical sciences. At the age of 19, he married Catherine de Milhau, a wealthy heiress who brought him financial stability and political support. He inherited a large fortune from his father in 1630 and with the support of his godfather, he was able to buy a position as a farmer of the gabelles and in 1651 became a sub-farmer for Languedoc. For 20 years, he preserved and increased his fortune thanks to the gabelles farm (the function was very profitable because the tax collector guaranteed the tax on his personal property). Occasionally, he was a supplier of ammunitions to the army of Catalonia, in Cerdanya and Roussillon. As sub-farmer general of the gabelles of Languedoc, he was still without fief and noble titles. In 1652, he acquired the ruined donjon of Monrepos (later renamed Bonrepos) and negotiated with the Consuls of Toulouse for full ownership of the fief, on the condition that he restore it to a state of defence and protect the neighbouring population in case of a threat. Purchase after purchase, he enriched and extended his domain with several hundred hectares of farmland. Bonrepos was the operational base, the logistical support point for Riquet in the construction of the canal. The water features of his property could help him in the realistic modelling of the canal, and he had a study room built in a dungeon at the corner of the castle. By the end of the 1650s, he was a wealthy man who enjoyed the support of the Archbishop of Toulouse, Charles-François d'Anglure de Bourlemont. Making effective use of his protections, he became Fermier général des gabelles du Languedoc. With the support of the Archbishop of Toulouse, on 15.11.1662, he wrote to Colbert⁸, the King's Minister of Finance, about “*a canal that could be built in this province of Languedoc for the communication of the two seas, the Ocean and the Mediterranean*”, which was the real starting point for the construction of the Royal Canal of Languedoc, ordered to be built by King Louis XIV in 1666.⁹ The digging of the canal began in 1667 and lasted 15 years, but despite his efforts and sometimes superhuman performance, Riquet experienced financial difficulties, insurmountable technical problems

⁶ “The concern over architectural aesthetics and landscapes, which led its designer, Pierre-Paul Riquet, not only to succeeding in a technical achievement, but also to creating a work of art.” UNESCO.

⁷ His birth certificate has never been found in Béziers, nor his marriage certificate; his date of birth appears only on his death certificate.

⁸ The correspondence with Colbert, which is important, appears in bundles 20-26 for the years 1662 to 1673, bundle 27 for the years 1674 and 1679. There are also letters from Colbert to the Marquis de Seignelay (liasse 28), letters from Riquet between 1667 and 1679 (liasse 29, letters from 1662 to 1673 (liasse 30), liasse 31: Letters addressed to Riquet, liasse 32: Letters addressed to Colbert between 1667 and 1672, liasse 33: Letters addressed to Colbert between 1664 and 1666.

⁹ Edict of Saint-Germain-en-Laye, October 1666.

and all kinds of setbacks. On 01.10.1680, when he died, the canal was not finished. The canal was completed in 1681 and inaugurated on 24.05.1681 by Mr. Henri d'Aguesseau¹⁰, the king's intendant in Languedoc. It took him 3 years to write the official report, which was published on 13.07.1684 (Canal Archives, liasse 14, pièce 07a).

3.2. Construction of the Royal Channel of Languedoc

The Canal du Midi, which necessity was felt since the earliest times, was constructed in the 17th century under the reign of Louis XIV. It shortens the distances between the Atlantic Ocean and the Mediterranean Sea by approximately 5,000 kilometres. The channel was built to facilitate the trade between the North and the South of Europe, allowed to circumvent the Iberian Peninsula and avoid crossing the Strait of Gibraltar, which was costly and dangerous in those times. There was a political purpose also: the rivalry between France and Spain. The Channel allowed so to avoid paying high taxes which are imposed by Spain during the passage of the Strait of Gibraltar. Technically, it is a junction canal with a sharing reach, which connects the lateral canal to the Garonne to the Mediterranean Sea. The channel culminates in 189 m at the beginning of Naurouze, his complete length is 257 km by counting the Pond of Thau (251 km without the pond). The Channel includes 65 sluice gates, among which several are numerous and represent 104 locks.

Table 1
Receipts, expenses, and net incomes of the Canal du Midi of France, in francs, during 106 years, from 1686 till 1791 (after 1791, the paper money was put into circulation and calculations became uncertain)

Series by 10 on 10 years	Receipts	Expenses	Net income by series	Average Net Income by series
1686-1695	1 812 749,90	906 502,81	902 247,09	90 224,70
1696-1705	3 323 591,38	1 124 484,96	2 199 106,42	219 910,64
1706-1715	4 951 950,50	1 853 943,94	3 078 006,56	307 800,65
1716-1725	4 004 570,61	1 494 180,95	2 510 389,66	251 038,96
1726-1735	4 017 991,61	1 795 970,83	2 222 020,78	222 202,07
1736-1745	4 156 966,27	1 928 875,87	2 228 090,40	222 809,04
1746-1755	6 280 274,20	3 016 004,88	3 264 269,32	326 426,93
1756-1765	6 697 109,67	2 614 479,71	4 082 629,96	408 262,99
1766-1775	7 623 986,22	3 879 540,29	3 744 445,93	374 444,59
1776-1785	9 881 346,56	4 385 884,65	5 495 461,91	549 546,19
Last 6 years				
1786-1791	4 724 545,07	2 670 571,92	2 053 973,15	342 328,85
Total 106 years	57 455 081,99	25 670 440,81	31 784 641,18	31 784 641,18

Sources : Andreossy, 1799, p. 292.

Riquet had competent collaborators, such as François Andreossy, a meticulous cartographer who studied the Italian channels in 1660s, in particular the locks and the plans of works

¹⁰ The intendant of Languedoc Henri D'Aguesseau, father of the chancellor and Keeper of the Seals Henri François d'Aguesseau, will take 3 years to write the report, published on 13.07.1684 (Archives du canal, liasse 14, pièce 07a).

attributed to Leonardo Da Vinci (multiple locks, hydraulic lifts, elliptic forms, etc.). Andreossy was the leveller, cartographer and planner of the canal. The work of his grandson, General Andreossy, includes unpublished information, such as the progressive table of revenues and expenditures and the net product of the Canal du Midi (Andreossy, 1799, p. 292).

3.3. Financial management of the project

According to several estimations the building of the channel would cost between 17 and 20 million pounds (or francs). The personal contribution of Pierres-Pauls Riquet is about 20 to 25% of the total amount. According to the assessments of A. Maistre (1979, pp. 92-93), confirmed by the archives of the channel (bundles 44-51), we have more details about the funding of the channel:

The adjudication of the construction of the canal was made in two lots, the construction from Toulouse to Trèbes, on the one hand, and the construction from Trèbes to the Etang de Thau on the other hand. The total amount of the project would be as follows:

1. Financing performed by the Royal Treasury: £ 8,484,050

2. Funding provided by the States of Languedoc: £ 8,070,202

Total paid by the government: £ 16,554,252

3. Personnel participation of Pierre-Paul Riquet: £ 4,022,592

Total cost price of the channel is: £ 20,576,844

Some transactions that have been double-counted must be subtracted:

- the auction on the encashment of the gabelles due by Riquet and assigned to the construction of the canal: £ 1,000,000;
- Sums coming from the revocation of Edicts: £ 1,983,333;
- second auction on gabelle's collecting: £ 442,483

A total of: £ 3,425,816

The total price of the Canal du Midi would be £ 20,586,844 - £ 3,425,816 = £ 17,161,028.

The total project has been funded as follows:

Funding section Toulouse-Trèbes: £ 3,630,000

To finance this first part, Riquet asked to be granted (Maistre, 1979, pp. 81-82.) by:

- the subrogation and the use of the farms and salt tax in the Languedoc-Roussillon Region for 10 years in the same way as the current tenants, Mr Langlois and Mr Belleguise. The amount of £ 1,000,000 will be paid by Mr Riquet in 8 years by 8 equal payments;
- the sale of "regrats" (salt sold at retail): £ 530,000;

- the discount of 5 sols for each allocated bushel¹¹: £ 600,000;
- the sale of *septain*¹² rights: £ 100,000;
- the purchase of the fief of the first part of the project: £ 150,000;
- the channel toll: £ 50,000.

The total amount of £2,430,000 was insufficient but became official in the royal Edict of 1666. For the remaining £1,200,000, the king created offices to collect *taille* in Languedoc, a sum payable in eight years and eight equal payments. The use of the creation of offices, generators of cash, to replace a failing banking system, which was very understandable at the time, is reminiscent of current problems, where, in the subprime crisis, constraining banking management has been replaced by additional deregulation – when the bank creates problems, other techniques are substituted. In November 1666, the king created the offices of auditors of the accounts of the administrations, consuls and collectors of ordinary and extraordinary taxes in all the towns and parishes of Languedoc. It is expected that the sale of these offices will yield a profit of £150,000. The financing of the first enterprise having been carried out, it was necessary to study the second enterprise, whose financing was more uncertain:

Financing of the section Trèbes – Etang de Thau: 5 832 000 £

- the subrogation of the farms on iron mines, repurchases and expenses of various services, financed by the States of Languedoc: 2 400 000 £;
- payment from city hall of Montauban (called “La généralité de Montauban”)¹³: 600 000 £;

¹¹ *Minot* – a measure unit, the *Minot*, has eleven inches nine lines of height, on a foot two inches eight lines in diameter. The *minot* is used to measure dried things, like grains, cereals, or earth. It contains three bushels. Four bushels is equal to a *setier*. But since the Romans and their *sextarius*, the setiers are different, depending on the regions and products. The *setier of Toulouse* is equivalent to 32 bushels, or 93.3 liters, but there are setiers of 156 liters.

¹² *Septain* – rights on a territory, dependent on a city (or area).

¹³ *La Généralité de Montauban* is an administrative district of Guyenne created in 1635 and extended over two provinces – Rouergue and Quercy. *Recettes générales*, commonly known as *généralités* (French pronunciation: [ʒeneʁalite]), were the administrative divisions of France under the Ancien Régime and are often considered to prefigure the current *préfectures*. At the time of the French Revolution, there were thirty-six *généralités*.

Among the multiple divisions utilised for various purposes by the kings' administrators, *généralités* emerged gradually from 14th to 16th centuries. Initially fiscal, their role steadily increased to become by the late 17th century – under the authority of an *intendant* (reporting to the Controller-General of Finances) – the very framework of royal administration and centralisation.

Before 14th century, oversight of the collection of royal taxes fell generally to the *baillis* and *sénéchaux* in their circumscriptions. Reforms in 14th and 15th centuries saw France's royal financial administration run by two financial boards which worked in a collegial manner: the four *généraux des finances* (also called *général conseiller* or *receveur général*) oversaw the collection of taxes (*taille*, *aides*, *gabelle*, etc.) and the four *trésoriers de France* (treasurers) oversaw revenues from royal lands (the *domaine royal*)...] *Wikipedia*.

- payment from the cities of Foix, Nébouzan, Bigorre: 90 000 £;
- the remaining funds were advanced by King Louis XIV.

Construction of the harbour of Sète (This): 1,080,000 £

A third investment made by Riquet was the construction of the harbour of Cette, now named Sète. He obtained this contract from the royal authorities for £1,080,000, partly funded by the maintenance fees paid by the city (£33,000 for ten years, i.e. £330,000). Riquet obtained in perpetua the fishing rights of the harbour of Sète and those of the canal to be built on the Etang de Thau. The difference was to be funded by the revenue from the gabelles.

The construction of the canal was a complex operation, but its financing was not simple either. Global monetary management, forward planning and immoderate recourse to borrowing were the key words for the financing of this project.

3.4. The end of a natural monopoly and the beginning of another

“The arrival of the railway in the area killed the waterway transport of the river” (Minovez, 1999). The Canal Latéral à la Garonne, an extension of the Canal du Midi, was obsolete almost before it was put into service, a project for a Pyrenees Canal was never built, nor was that for a large capacity maritime canal, likely to link Bordeaux to Narbonne and allow large commercial ships and warships to pass from the Atlantic to the Mediterranean. One of the central strengths of the river navigation was the strong demand and trade of the city of Toulouse, but Toulouse itself had the claim to become an important railroad junction in the center of a dense network, and the city ended up preferring the railroad, after much struggle and procrastination. The railroad has for him its novelty, its modernity, and its adaptation to the industrial techniques of the 19th and 20th centuries. Its characteristics make it a natural monopoly and even a double natural monopoly (Numa, 2009 #116). A natural monopoly exists in a sector of activity when the availability of economies of scale favours a single company capable of ensuring the supply and services of an entire market. The Compagnie du Canal du Midi had obtained ownership of the Canal after the decree of March 10th, 1810, which allowed it to lease it to the Compagnie du Chemin de fer du Midi, which also owned the Canal latéral à la Garonne. The lease was for a period of 40 years and was subject to strict conditions such as the obligation to pay off debts existing at the time of the lease, and to administer and pay for the improvement of the waterway. The Compagnie du chemin de fer du Midi worked to divert customers from the canal to rail. After many ups and downs, the State decided to buy back the canal. On October 26th, 1897, a bill was adopted by the Chamber of Deputies, and then by the Senate, and the law of repurchase, voted on November 27th, 1897, was promulgated on December 3rd, 1897.¹⁴ The State took possession of the canal in 1898, but the arbitration commission charged with calculating the compensation to be paid to the owners submitted its conclusions on February 1st, 1901, two and a half years later. It awarded the Compagnie du Canal du Midi a 3 % annuity of 750,000 francs, with an effective date of July 1st, 1898, without giving the reasons or details of its decision. We can think that

¹⁴ In the Journal Officiel of 03.12.1897, where the law of 27.11.1897 appears, pp. 6766-6768, the two conventions of 03.11.1896 are annexed to the law.

the commission settled for making a simple arithmetical average between the claims of the Compagnie du Midi, which wished to obtain an annuity of 1,500,000 francs and the State, wished to pay nothing. It is specified that all the accounts “pending or reserved between the State and the Company will be definitively settled, without any addition or reduction being made for any reason whatsoever”. For the two canals, the Canal du Midi and the Canal Latéral à la Garonne, the State also assumed responsibility for personnel and maintenance, which, after deduction of state revenues, represented an additional annual expense of 1 million francs. Since 1956, the Canal du Midi has been conceded, according to the General Code of the property of public persons, to the public office of the Voies Navigables de France. But its boundaries are those fixed by the original fief granted to Pierre-Paul Riquet in 1666 and then fixed by the official reports of 1772. The French State is the owner of the *Canal des deux mers* and took effective delivery of it on 01.07.1898, but since its purchase, the *Canal des deux mers* (Canal du Midi and Canal latéral à la Garonne) is only a shadow of its former self. The rail and road have confined it to a tourist role. It was classified in 1996 as a world heritage site by UNESCO, being the second channel, classified (in 1996) as a World Heritage of Humanity by UNESCO. The other one is the Canadian Rideau Canal.

4. The Suez Canal before Its Nationalization (1859-1869) – A Successful Major Project

There is little in common between the South of France – mountainous, with rugged to irregular hydrography, with a watershed and a temperate climate; and desert Egypt, where sand dominates, or even equatorial Panama – a realm of rain, wind, and storms (most of the year). Robert Courau (1932) and André Siegfried (1941) have analyzed accurately the two major projects of Suez and Panama and we recall in the next two sections some aspects of the construction and life of these two canals and their influence on the evolution of the world maritime routes.

The Suez Canal has a length of 161 km, 193 if we consider the diversion channels in the Red Sea and the Mediterranean Sea. Its original dimensions, a width of 54 meters and a depth of 8 meters, were modified many times to remain today with a width of 170 meters, but it is doubled for 67 km and its depth is 20 meters. It connects the city of Port Said located on the Mediterranean Sea and near Lake Manzala, to the city of Suez, north of the Red Sea. On its road several salt lakes – the Small Amer lake, the large Amer Lake and the Lake Timsah punctuate its road. The canal is lined with a railway and a road tunnel under the canal was built in 1981. The site of the canal is thus a privileged set of communication routes. Completed in 1869 under the direction of Ferdinand de Lesseps, we can go from Europe to Asia without going around the Cape of Good Hope.

4.1. Ferdinand de Lesseps and the Suez Canal concession

The foundation of modern Egypt was established by Mehemet Ali (1769-1849), who created a real State. Despite his attempts, Mehemet Ali was not able to free Egypt from the tutelage

of the Sublime Porte¹⁵ – the traditional suzerain supported by Russia. But he nevertheless laid the foundations of a modern nation by engaging European experts, by launching a policy of reform of the administration and the army, and by developing a policy of large public projects (Siegfried, 1941). He was aware of the strategic location of Egypt for France and England, concerning the trade with India and the Far East. Mehemet Ali was a friend of Ferdinand de Lesseps' father and when the latter arrived in Egypt in 1831, the viceroy entrusted him with part of the education of his 13th son, Mohammed-Saïd. On the death of the sovereign, Abbas I Hilmi became pasha in his turn, but was assassinated by two slaves on 13.07.1854, Mohammed-Saïd, his uncle, succeeded him. Grateful to his former mentor, on 30.11.1854, he signed a firman¹⁶ granting the concession of the construction of the future canal to Lesseps. This firman, unilaterally modified six months later, complicated Lesseps' relations with the British Foreign Office for many years. But with this beginning of official recognition, Lesseps began the second part of his life. He was born in Versailles on 19.11.1805, into a Scottish family who had long been established in Bearn and the Basque Country. After studying law, he chose, like his father and brother, the consular career, which took him to Lisbon, Tunis, Alexandria and Barcelona. In spite of an exemplary career and a remarkable record of service, his tense relations with General Oudinot in Italy earned him a reprimand from the Conseil d'Etat and the first part of his career ended in 1849. Reflecting the work of the engineer Lepère on the possibility of a canal, and those of Savary on the establishment of a trading company in the East, his great idea took shape (Jeanne, 1941). Upon learning, in 1854, of the death of Abbas Pasha and the accession of Mohammed Said, Lesseps immediately congratulated Mohammed Said, who officially invited him to Egypt. There, on November 15th, he presented his project to create a company to build and manage the canal. The sovereign accepted it and announced, ten days later, in front of the general consuls and the viceroy of Egypt, that he had decided to open the Suez Isthmus and to entrust the project to an international capital company, established by Ferdinand de Lesseps (Siegfried, 1941). Only the British General Consul does not approve the project. The concession became effective on November 30th. Its duration was 99 years and at the end of the concession, the canal became the property of Egypt. To ensure the logistics of the construction site and to manage the finances, Ferdinand de Lesseps created the Compagnie Universelle du Canal Maritime de Suez.

4.2. Construction and opening of the Canal de Suez

The granted concession was challenged by the United Kingdom, which throughout the works engaged, directly or indirectly through Turkish or Egyptian or even French intermediaries, in a war of attrition on many fronts.

¹⁵ Egypt was under the dependence of the Sultan of the Ottoman Empire, and it was governed by a Viceroy. The Sublime Porte was the gate of honor of the Topkapi Palace, the Vizirat of Constantinople, the seat of government of the Sultan, Master of the Empire. The Sublime Porte was the diplomatic term used in Europe in the foreign ministries to refer to Turkey or Constantinople, depending on the context. It is in 1936 that the Turkish name of Istanbul will be definitively imposed.

¹⁶ A firman (decree in Persian) is a royal text promulgated by a sovereign of an Islamic country (Turkey, Iran, Mughal Empire).

- *Establishment of the company*: The first step is the creation of the Universal Company of the Canal de Suez. It was created in 1858 after the three official firmans concerning the Concession of 1854, 1855 and 1856. The capital of 200 million francs is divided into 400,000 shares of 500 francs par value (Statutes, Article 6): there were subscribed 207,111 shares by French investors (51.77% of the capita), 177,642 shares by the Viceroy of Egypt (44.41%), and 15,247 shares for foreigner investors. Only 10 Egyptians bought shares. According to the Statutes (Article 7), the securities are denominated in German, Italian, Turkish, English, and French. The company is run by a board of Directors (32 members), where the directors are appointed for eight years. A Management Committee of four members is headed by a President. Each Administrator must own 100 shares. The president is assisted by three vice-presidents. General Assemblies may only deliberate if a quorum of 1/20 of the share capital is present. Article 51 of the Statutes, skillfully drafted, states that 25 shares have 1 vote and that a shareholder cannot have more than 10 votes: thus, the Viceroy of Egypt, with 177,642 shares, had only 10 votes and when he gave its participation to England, they had only 10 votes. This limitation was common in the customs of the time. The distribution of profits, under section 63, was as follows:
 - 15% for the Egyptian Government;
 - 10% for the founders;
 - 3% for directors;
 - 2% in a pension fund;
 - 70% for the shares, depreciated or not.

The Viceroy's 177,642 shares were paid by *sanal tanab* – Egyptian Treasury bonds (Convention of August 6th, 1860).

- *Cost estimation*: The original budget was 200 million francs¹⁷. But the budget has been exceeded and the expenditures in 1869, at the end of the construction, were 432 million francs. The company was saved from bankruptcy only by the willingness of a couple of investors who subscribed to a large amount of bonds. In 1929, the total cost had increased further to exceed one billion francs, but the franc had weakened considerably, and this amount is equivalent to 570 million euros today¹⁸. The financing of such an amount was provided, a half, from the initial capital and loans, and the other half from the future profits. In the early years, the construction of the canal employed, according to the firman of 1854, 25 000 fellahs, paid 3 or 4 dollars per day, food included. England, supported by the Egyptian Foreign Minister Nubar Pacha and the Duke of Morny, managed to overturn the clause of compulsory labour, and the works could continue, after the arbitration of

¹⁷ To have an idea of the current (2021) equivalent, we can use the following methods: 1 franc 1860 = 15,23 francs 1999 and 1 franc 1999 = 0,20 Euro 2021 – a conversion coefficient of 1 franc 1860 = 15,23*0,20 = 3,046 Euro 2021. We can also use a parity based on gold: the 0,2902 gram of gold of a germinal franc (5 g. of silver to the title of 9/10 of end, law of the 17 germinal year XI, April 7, 1803) worth 14,44 Euro today (July 2021).

¹⁸ Using the Franc-Euro converter of the French National Institute of Statistics (INSEE) updated in March 2013.

Napoleon III, with only 12 000 Egyptians paid more than before, and a lot of foreigners, often with a troubled past, such as some escaped Austrian criminals.

- *Capital and various contributions*: The subscribed 400,000 shares paid the 30% required by Article 12 of the Statutes, which is 150 francs per share, plus 150 francs the following year. The company committed to not make the 3rd call before 1861. The shares received a statutory interest rate of 5% per year on the amount paid up, until the construction of the canal. The results of 1871, 1872 and 1873, insufficient to pay the dividends, were compensated by consolidation bonds. In the end, they were paid as well as all the subsequent dividends. From 1891, the dividends exceeded 20% of the capital. The share price, 500 francs par value, experienced mixed fortunes – down to below 200 francs between 1866 and 1872, but exceeding 1000 francs in May 1880, and 1250 francs in December 1880 just before the crisis of 1929, the title worth 26 500 francs, or about 80 719 of our current Euro (2021).
- *Subscribed bonds*: the initial capital of 200 million francs equalled the first investment, which, we have seen, was far exceeded. It was, therefore necessary to issue 423 million bonds and 34 million consolidation bonds with 8% of interest (a total of 457 million francs equivalent to 1,39 billion Euros today). For the loan management, Ferdinand de Lesseps decided to not use a bank, refusing the deal from the Rothschild and Fould's bank. He considered that the bank commissions were exaggerated and decided to ask the public directly, mainly in France. For that, Ferdinand de Lesseps rented a place in Paris – place de Vendome, for the modest sum of 12,000 francs.
- *Inauguration and opening of the canal*: the Empress Eugenie inaugurated the canal on 17.11.1869 – the Emperor Napoleon III, suffering, could not travel. There was an opportunity for the Viceroy of Egypt to show that his country was a modern, worthy to be compared with the great European nation states, and he treated royally the hundreds of guests. They mobilized the entire Egyptian population to clean up the area around the canal (rat hunting, cleaning houses) to honour the procession of 77 ships taking part in the official opening of the canal. A religious ceremony involving Muslim and Catholic faiths gave the signal for departure. The Eagle – the French Imperial ship with Empress Eugenie on board, and the Greif – the ship of the Austrian Emperor Franz Joseph led the procession. According to the journalists, the inauguration banquet of the ceremony would have cost two million francs. This event should not make us forget that about one and a half million Egyptians took part in the canal's construction and that about 125,000 died, mainly from cholera.

4.3. *The International life of the Suez Canal*

- *England takes the financial control of canal*: The expensive lifestyle of the Viceroy of Egypt led him into debt and he was forced to give the right to use his shares for a period of 25 years to Crédit Foncier de France.¹⁹ The French government did not understand the

¹⁹ Article 63 of the statutes of the Company stipulated that 15% of the profits would be paid to the Egyptian government. The Viceroy sold this participation to the Crédit Foncier de France in 1880, for

interest of such an investment, and it was Disraeli, head of the English government, who reacted in the right way: the viceroy had given an option to France for 92 million francs, equivalent to 4 million pounds sterling. With the authorization of Queen Victoria, who committed the guarantee of England, the Rothschild bank advanced the funds. The French bankers and the government did not object. This was not a bad thing, since France and England became co-owners of the canal, with France having a majority on the board of directors and England being the principal shareholder, whereas a canal owned exclusively by France would have raised many diplomatic problems in a region located on the road to the English Indies, where English ships carried more than 50% of the traffic. But the precaution of Lesseps, who had locked the governance of the canal company, with article 51 of the statutes, which specified that a single shareholder could not have more than 10 votes, was also required for England. The years 1869-1876 were difficult for the shareholders of the canal company, who were deprived of dividends, and for the Egyptians, who had to develop their country and suffered from the effects of the international economic situation, in particular the fluctuations in the price of cotton, during and after the American Civil War. The financial difficulties forced both the English and the French to create a condominium. But the stronger will of the English allowed them, with the agreement of the French and the Turks, to take over Egypt in 1882 and to consolidate their position in 1916 with the Sykes-Picot agreements approved by the Russians and the Italians, which divided the Middle East between France and England, but gave France control over Lebanese Syria (present-day Lebanon), Cilicia (Anatolia in present-day Turkey) and Syria, and left the United Kingdom to control Palestine and Egypt – and therefore the Suez Canal.

- *Science and Technology to the rescue of the canal*: The canal began to make substantial profits when steam navigation replaced sail navigation: the Red Sea and the canal are areas of light winds, unlike the Atlantic or the Indian Ocean. It was not until the number of steamships (only 5% in 1859 when work began) increased and their speed exceeded 20 knots per hour, and their coal consumption became lower, that transport by modern ships was preferred to transport by sailing ships – slower but less expensive. From that moment on, the canal was able to establish its superiority over routes such as Liverpool-Bombay (6,223 miles via Suez instead of 10,680 miles via Cape Town, a saving of 42 per cent), or Liverpool-Yokohama (14,436 miles via Cape Town and 11,113 miles via Suez, a saving of 24 per cent). An adjustment of the rates increased the superiority of Suez on the long routes (Siegfried, 1940, pp. 82-86). In 1888, the Treaty of Constantinople gave the Suez Canal international status, which has not always been respected.
- *International Incidents and World War I*: A first serious incident, called the Aqaba incident, took place between the Turkish Empire and Britain, concerning the Hijaz railway project planned by the Ottoman Empire. The United Kingdom considered this project to be a threat to Egypt and the Suez Canal and threatened the Ottomans with war. The Ottomans, fearing a naval battle at their disadvantage, gave up the project after the crisis. Almost 10 years later, the Suez Canal was caught up in the First World War: on

22 million gold francs for a period of 25 years. The CFF entrusted the management of this fortune to one of its subsidiaries, the Société civile pour le recouvrement des 15% du Gouvernement égyptien.

28.01.1915, the 4th Turkish army of Djemal Pasha attacked the British army stationed in Egypt, in order to take control of the Suez Canal. The United Kingdom, under the command of Major General Maxwell, inflicted heavy losses on the Turkish army, which withdrew to its initial positions on February 3rd. A few days later, England and its allies launched the Dardanelles offensive, both land and sea, to seize Constantinople.

After the First World War, the canal continued to flourish: 486 crossings were recorded in 1870, but 6,635 in 1937 (Siegfried, 1941, p. 91). The most dramatic events were the nationalization of the canal in 1956 and the Six-Day War in 1967. Today, despite these terrible crises, the canal is still a geostrategic gateway of the greatest importance: 14% of the world's maritime traffic passes through it, i.e. about 20,000 ships per year. The Universal Company of the Suez Canal became a financial company, the Suez Financial Company, founded with the indemnities received after the nationalization of the canal in 1956 and developed thanks to the judicious purchase of non-operating assets acquired with the retained profits. It later merged with Société Lyonnaise des eaux et de l'éclairage (SLEE), founded in 1880, to form the Suez group, which merged with Gaz de France in 2008. The GDF Suez group is the world's second-largest energy group and the world's largest service company. The company was deprived of the canal, which has been managed since 1957 by the Suez Canal Authority, responsible for its governance and operation, and remains the world's largest canal. The second is the Panama Canal, which we will discuss in more detail below.

5. A Great Project that Failed: The Panama Canal in the French Version (1881-1903)

The Panama Canal is about 77 kilometres long. Between Columbus Bay (Aspinwall), located on the Atlantic Ocean, and Panama Bay, on the Pacific Ocean, it crosses a mountain, the Culebra, which rises to 98 meters above sea level. Making a trench in this mountain was the major difficulty in the construction of the canal, and one of the reasons for the failure of the Panama Canal Inter-Oceanic Company. The depth of the trench finally built was 55 meters and its length was 13 kilometres. Ferdinand de Lesseps wanted to build, as in Suez, a level canal, but to reduce the volume of excavations, the engineers who succeeded him preferred a canal with locks, and they considerably reduced the volume of materials to be evacuated. There are two series of locks on the Pacific side (Pedro Miguel Locks, Miraflores Locks), separating a central lake located 26 meters above sea level in Gatún. On the opposite side, there are three series of locks on the Atlantic side (Gatún Locks). Let's pass over the numerous failed projects to mention the one of the French Geographical Society, which sent to Panama Lucien Napoleon Bonaparte Wyse and a team of engineers (Wyse, 1886; Wyse, 1891), several of whom did not return. The real destiny of the Panama Canal was cast.

5.1. *The difficult creation of the Universal Company of the Panama Inter-oceanic Canal.*

Bonaparte Wyse²⁰, commissioned by the Geographical Society of Paris, made a precise topographical survey with his team²¹ and prepared a project including tunnels and locks²². An initial discussion opposed him to Ferdinand de Lesseps, who was convinced of the superiority of the level canal. Wyse ended his mission by making an agreement with the Panama Rail Road, holder of the concession of the railroad since 1848, and with the Colombian government²³ for the concession of the inter-oceanic canal (Wyse, 1886; Wyse, 1891). Once these preliminary projects were completed, Wyse handed them over to Lesseps, who decided to prepare an International Congress for the study of the inter-oceanic canal, which was held in Paris in May 1879. Two preliminary projects were selected out of the 50 presented: a project in Nicaragua, with a long route and a cost of 770 million gold francs, and a project in Panama, with a route five times shorter but valued at more than one billion gold francs. Lesseps chose the second project, which required a very deep trench. The congress estimated the construction time at 12 years. The planned length of the canal was 74 kilometres, its depth 8 meters and its width 22 meters. The estimated cost of the project was 1.174 billion francs:

- 612 million for the work,
- 153 million – unforeseen expenses,
- 130 million – maintenance costs,
- 38 million – administrative and bank charges,
- 241 million – loan interests.

The Congress endorsed Ferdinand de Lesseps (Courau, 1932) and gave him a blank check. In June 1879, Lesseps quickly provided the two million francs needed to pay the Colombian government for the concession and to cover the initial set-up costs. On 05.07.1879, he bought the concession from Bonaparte Wyse, his studies, plans and contracts with the Panama Rail Road on behalf of the future company. On August 6th and 7th, 1879, the first issue of shares for 400 million was offered to the public, but it was almost entirely unsubscribed (30 million subscribed). F. de Lesseps then opted for communication: he gave conferences in France, North America, England, Belgium and Holland. During these conferences, subventions and bribes, modestly described as “largesse”, were paid to the press and banks. “In October 1880, the canal company finally received the benefit of Ferdinand de Lesseps’ efforts. The second share issue was a success²⁴: the 300 million gold francs, or 1.5 billion paper francs, requested

²⁰ Lucien Napoleon Bonaparte Wyse was the great grandson of Lucien Bonaparte. He was a great entomologist, of Irish nationality, a lieutenant of ship. He reached his maturity as an entomologist in the 20th century.

²¹ Of the eight engineers in his team, three will die in Panama.

²² There was a choice between a lock tunnel, requiring less earthwork, and a level tunnel, requiring the digging of a deep trench. The second one was more expensive.

²³ On 18.05.1878, when the concession was granted, the Republic of Panama did not yet exist, and Colombia had the jurisdiction over the isthmus. French National Archives 7AQ 1.

²⁴ Syndicated agreement for the subscription of shares, archive 7 AQ 2.

were largely subscribed. The issue was doubled (600 million gold francs), but there was already a bad habit of paying the press, banks and people likely to make difficulties. The Compagnie universelle du canal interocéanique took over the assets of the Société civile du canal interocéanique du Darien, founded at the instigation of Louis Napoléon Bonaparte and managed by L. N. B. Wyse (Wyse, 1886; Wyse, 1891).

5.2. *The surprises and difficulties of a mismanaged reality*

What is the difference between a lock canal and a level canal?

A level canal is a canal that will connect two water basins that have a similar water level – example: the Corinth Canal (1882-1893).

A lock canal is a canal that must play with important differences in level, both in the water basins and in the terrain to be crossed – for example: the Canal du Midi, and the Panama Canal (in the second stage).

In the case of the Panama Canal, we have an important difference in tides between the Pacific Ocean (where the tidal differences are between 5 and 6 meters on the east coast) and the Atlantic Ocean (where the tidal differences on the west coast are between 0.5 and 1 meter). But surprisingly, Ferdinand de Lesseps initially decided to go for a level canal, which was strongly disapproved by the engineers involved in the project at the time, including a certain Gustave Eiffel.

The studies of 1880 and 1882 estimated that between 75 and 120 million cubic meters of excavation would be required for a level canal. The canal with locks would have saved 40 million cubic meters.

By the end of 1888, the canal company had cleared 55 million cubic meters. Another 30 million cubic meters would have been needed. Of the 55 million cubic meters used by the French, the Americans used 23 million and still extracted 259 million cubic meters, four times more than the Suez Canal. The Americans lowered the bottom of the canal to 12 meters, instead of the 8 meters initially planned. The least we can say is that the preliminary studies were conducted with little care. It is important to underline also that at the time of these large projects, and in general, managers considered that the efficient management of companies and projects should be based on 3 pillars: production, finance and marketing. In fact, the first project management guidelines appeared in the 1990's²⁵ when they tried to generalize decades of experience in project management. In the case of the Lesseps version of the Panama Canal, each of the three pillars had significant flaws:

²⁵ One of the first books recognized as a Project Management framework is Linn Stuckenbruck's work with members of the Southern California Chapter of PMI: *The Implementation of Project Management: The Professional's Handbook* – Addison-Wesley Publishing Company, 1981.

5.2.1. The Production pillar

First, the lack of preliminary studies: Lesseps distrusted engineers, such as Gustave Eiffel or Philippe Bunau-Varilla, who had always preferred the option of a canal with locks, and he listened to the bad advice of men who were incompetent, devious and duplicitous (Degos, 2011). The lack of prior studies on volumes and costs was then aggravated by the neglect of time calculations. In the Panama project, there was no precise conceptualization of the project, no real preparation of the construction site (study of the times, study of the ranges of operation, coordination of the excavation works, transfer of the cuttings, consolidation of the riverbanks) – no scientific approach. The great authors of the organization, F. W. Taylor, H. Fayol, E. Mayo, will come later. As the preliminary studies and the setting up of the construction site were not thought out, there was no way to control the cost and time variances. It was the same thing at Suez, but Suez is a dated, traditional project, not a modern industrial project. The Panama project is anchored in the present of modern industry and its three imperatives of resources, costs and deadlines. What the engineers of the English railway succeeded at the beginning of the 19th century, the engineers of Panama, a few years later, were unable to reproduce (Cermoise, 1886). Those in charge of the canal company did not use all the civil and industrial engineering science that was available in their time, even if they were of excellent level, as the American engineers who took over from them recognized between 1904 and 1914.

5.2.2. Financial pillar

The range of financial and stock market resources available to Lesseps was small and rudimentary: shares, founder's shares, or bonds. These limited funds were badly used. The property titles and the founder's shares were distributed too generously, the debt securities were granted with too generous conditions, even if they were not scandalous, compared to the financial market of the time, a market which was far from being efficient and ensuring optimal choices.

5.2.3. Marketing and communication pillar

Lesseps had a very personal conception of marketing: trips offered to Panama, large receptions, large parties, banquets, financial gifts, checks to politicians, to journalists.²⁶ The sums paid to journalists and politicians (who sometimes wore both hats, like Clémenceau) were very opaque and could be described as advertising expenses, but also as an attempt at corruption. Ferdinand de Lesseps, obsessed with the canal, thought that the end justified the means.

²⁶ Ferdinand de Lesseps paid a lot of money to the press, a practice that was common at the time and to which Émile Zola testifies in his novel *L'Argent*.

5.2.4. The unexpected conditions

- *Yellow fever*: about 27,500 people died²⁷ on the two construction sites, French and American, of the Panama Canal between 1882 and 1914, from yellow fever without anyone really knowing what this epidemic was. It was only at the beginning of the 20th century that the Americans, successors of the French, solved this major and unforeseen problem, which did not exist in Suez. The Yellow fever every day brought its share of corpses²⁸ and gave the survivors a sense of precariousness that encouraged them to live their life in excess: gambling, drugs and prostitution. The labour force of the canal, which was available, attracted the dregs of humanity who saw a unique opportunity to make a fortune on the cheap. It was not easy to reconcile hard work and corrupting leisure.
- *The geographical conditions*: the climate in Panama is characterized by seven months of torrential rains and five months of drought. The option had been taken to orient the canal north-south (vertically in relation to the two poles), whereas the Atlantic-Pacific relations are of the east-west type (horizontally in relation to the two poles). Each year, it was necessary to preserve the work of the previous year and to divert the Chagres River, to avoid flooding. On the Atlantic coast, it rains six times more in Panama than in France, four times more on the Pacific side.

5.3. *From the financial distress to the financial crash*

The greatest industrial works of the last two centuries could only be achieved because their funding was rationally conceived and properly secured. The Suez Canal, the relocation of the Abu Simbel temple above a dam, the Apollo projects, are examples of this. The Panama Canal, on the other hand, is a combination of poor judgment, ignorance of the reality of the terrain and financial errors.

1880-1885: The period of normal funding²⁹

An initial capital of 300 million francs was projected, and the costs represented 7.5% of the total, or 22.5 million, of which 9 million were for the financial syndicate's commissions. The amount of these expenses is not exorbitant for the time. The investment syndicate had a particularly comfortable position: the syndicate did not give any underwriting guarantee. It undertook to facilitate the emission and it paid 4 francs per share (for 10 000 shares is 40 000 francs). If the issue succeeded, the syndicate was reimbursed for its stake and received in addition 20 francs per share, in total 240 000 (net amount 200 000). If the issue failed, the syndicate lost 40,000 francs. More than a subscription with a firm commitment, it was an

²⁷ 21,900 workers died between 1882 and 1888, with some days having 40 deaths, but under American leadership there were another 5,600 deaths between 1904 and 1914, or about 27,500 in total. The Americans had finally solved the problem of yellow fever, but malaria, tuberculosis, cholera, diphtheria, and bubonic plague continued to take their toll. By way of comparison, the construction of the Palace of Versailles caused more than 100,000 deaths.

²⁸ Robert Coureau (1932, p. 149) notes that 27 engineers from the Ecole Centrale arrived in 1885 and 1886, and that 11 had already died in 1887.

²⁹ National Archives: Ref. 7 AQ 2.

option. The financial syndicates of the time were not really involved in the operations they were supposed to coordinate. As the National Archives file 7 AQ 2 shows, from 1882 to 1884 there were 935 million bonds issued (1880, 1882, 1883, 1884), plus 720 million in 1888. The first bonds had a nominal value of 500 francs and an interest rate of 3%; from 1884 the interest rate increased to 4%, with the addition of a substantial premium of 167 francs, resulting in an issue price of 333 francs and a redemption price of 500 francs. In 1883, the issue of 300 million bonds yielded only 171 million francs net.

1885 – 1887: The period of the first difficulties

In May 1885, Lesseps resigned himself to issuing loans in batches, after the third quarter of the capital had been called. The crisis began at the end of 1887. The Company had already obtained a total of 935 million, of which 225 million in shares and 710 million in bonds, representing a liability funding divided into 1/4 of equity capital and 3/4 of foreign capital. And in the 3/4 of foreign capital, there are not many assets in return. Financed by private funds not guaranteed by the state, the equity was insufficient. The canal, like the railroads, should have been financed with 10% equity in a liability guaranteed by the state, but the Panama Canal, far from France, did not have the same economic appeal at the time as a railway company that was a factor of economic progress and military security.

1887-1888: The period of the deep crisis leading up to the crash

From 1880 to 1888, cashless, the company increased the number bond issues but with varying success. A billion francs of shares and bonds were on the market, fully saturated. The latest call for funds was November 1888, which was the last chance: it would have taken 400 000 obligations for the company to survive (which concerns 350,000 savers). Lesseps gets government support to extend the three-month maturities of the debt, but the Chamber of Deputies, in December 15th, 1888, rejected the government's proposal by 256 votes against 181. In December 1888, Lesseps called Panama to stop the work. He knew he has lost, and he lost everything. There will still be a slight reprieve, because of the nearly two years' period before the company entered in liquidation, and before the scandal broke (Siegfried, 1941).

5.4. The questionable but inevitable fall of the Lesseps' project

On 05.02.1889, the court of the Seine pronounced the dissolution of the Universal Interoceanic Canal Company.³⁰ Ferdinand de Lesseps was a victim of his own negligence, of his ignorance of the Central American hard realities, but also of the financial world, which had reserved the advantages of Panama emissions³¹ and of the unscrupulously greedy deputies. The government was reluctant to bring to light the Canal case. The nationalists – represented by Paul Deroulede, the Socialists – by Georges Laguerre, and the Royalists – by Baron Mackau, were divided between them, but they had a common interest to burst the

³⁰ Judgment of 04.02.1889, Archives 7 AQ 12.

³¹ In the financial syndicate there were 9 banks with sometimes exorbitant demands: The Comptoir d'escompte, the Société générale de crédit industriel et commercial, the Société des dépôts et des comptes courants, the Société générale, the Banque de Paris et des Pays bas, the Crédit lyonnais, the Société financière de Paris and finally the Banque d'escompte de Paris.

scandal. The difficulties of the company were often used by those politicians to fight against their opponents. The government had tried to cover the scandal in June 1890 (attacked by Provost de Launay MP), in March 1891 (attack by Gauthier de Clagny MP), and in June 1891, just days before the canal company is stripped of its concession. The government, under the pressure of the deputies, accepts only to open an investigation. Gauthier de Clagny returned in charge, asking where are 718 million from 1500 million, for which the company cannot justify the spending. He was relayed by Mr. Delahaye (MP) denouncing many of his colleagues (the “chéquards”), who ended up by getting a commission of inquiry, the Committee of 33. The Committee established that Mr. Reinach, main corruptor of the Parliament, received 9,879,145 francs (testimony of councilor Prinnet) and that he has distributed 4,390,475 francs in various checks (testimony of Mr. Thierrée – a banker). The government itself has received 300,000 francs (testimony of Georges Laguerre). From September to November 1882, journalists tried to finish the company.³² To appease the spirits, on 17.12.1892, Charles de Lesseps, Fontanes and Cottu – administrators of the company, are incarcerated. Councilor Prinnet, who was in charge of investigating the case, submitted his final report to the General Attorney in June 1892, aware of the relative weakness of his arguments. The French period of the canal ended up with several trials, a main trial for fraud, cancelled for F. de Lesseps because of procedural weaknesses³³, and an accessory trial for corruption. In the Panama cases and trials, Ferdinand de Lesseps and his son failed miserably, but above all, the political morals of the French Republic and its justice system failed.

In 1894 the polytechnic engineer Philippe Bunau-Varilla, created the new Panama Canal Company, which cannot survive, and Bunau-Varilla (1892) sold, on 10.11.1903, the rights for the exploitation and the construction of the Panama Canal to the United States. The engineers of the US Army, under the leadership of the Chief Engineer Colonel George Washington Goethals, have developed a new project involving the construction of three sets of locks and the creation of an artificial lake – the Lake Gatun. After more than ten additional years of work and an additional budget of 2 billion gold francs spent to buy the French company, to build military defenses, to widen and to deepen the waterway, the canal was finally completed and inaugurated on 15.08.1914 – the first day of the First World War. The ship Ancon inaugurated the crossing. The Canal remained under US administration until

³² In particular Edouard Drumont in his newspaper *La libre parole*. Drumont had already published the anti-Semitic pamphlet “*La France juive*” in 1886; the Boulangist newspaper *La cocarde* accompanied *La libre parole* in its demolition. By linking *La France juive*, the Jews and the Panama scandal, Drumont was heavily responsible for the development of anti-Semitism in France, culminating in the Dreyfus Affair in 1895. Archives 7 AQ 15 and 7 AQ 16 present the report made on behalf of the commission of inquiry and the testimony given before the commission.

³³ Ferdinand de Lesseps never went to prison. According to article 479 of the Code of Criminal Investigation, which was specifically referred to in the law of 20.04.1810, concerning the grand officers of the Legion of Honor, he should have been summoned directly, the only way to interrupt the statute of limitations which had been running since 1888. However, the act of the Public Prosecutor, who had proceeded with a simple indictment, did not interrupt the statute of limitations, and at the time of the judgment, all of the facts charged were time-barred, and the defendants were released on 16.06.1893.

1979, when it was reassigned to Panama (Treaties Omar Torrijos³⁴ – Jimmy Carter). The Panama Canal (14,000 ships, or 5% of the world trade³⁵), currently managed by the Panama Canal Authority is planning to exceed the Suez Canal, its direct competitor, for the transit of container ships and liquefied natural gas. Work almost as important as that of its construction, required the pouring of 4 million cubic meters of concrete, new locks of 4,200 tons can accommodate Post-Panamax ships of 420 meters long³⁶.

6. Conclusion

The three canals we have just studied have several points in common: despite their respectable age and the ups and downs of their life curve, they still exist and for two of them, are doing better than simply surviving. Their life curve, all things being equal, includes an initial launch phase, at the time of the feasibility study, financing and construction, then a more or less chaotic take-off phase, a maturity phase and a decline phase. The first canal, the Canal du Midi, has undoubtedly a new life which is devoted to the green tourism.³⁷ As for the other two canals, Suez and Panama, they have not yet experienced their phase of decline, and they are adapting, sometimes with considerable effort, to the new situation of international trade and maritime navigation, which requires increasingly large tonnages to be transported. Transport volumes are now considerable and ships, whether tankers, ore carriers or container ships, are very large. A new approach to global transport logistics has emerged and is developing. At one point or another in their life cycle, the three channels mentioned above have had the advantage of a natural monopoly, and they have also benefited from the fact that this natural monopoly could not be challenged. But sometimes, the conditions of competition have changed and the authorities responsible for managing them have had to draw the consequences, but this has not always been possible: Suez took advantage of the emergence of steamers to turn what might have been a problematic nature of sailing ships and wind into an advantage, but its administrators had no influence on this technological evolution. In the same way, the technology of oil and gas pipelines, or of the construction of hyper-tankers, was a factor to be considered, not a parameter to be modified. But nothing is

³⁴ Omar Torrijos was the father of Martin Torrijos, Panama's recent president from 2004 to 2009, who once again re-launched the work to modernize the canal.

³⁵ Reuters.

³⁶ The main constraint – and the main weakness – of canals is their gauge: the old French canals had a modest gauge, and in the 19th century Freyssinet tried to increase it. Then, the European canals had a larger gauge, but still insufficient to compete effectively with other transport means. The Suez Canal can only accept Suezmax ships and the Panama Canal can only accept Panamax or post-Panamax ships. The largest ships built by mankind, the VLCC Very Large Crude Carriers, which can carry 150,000 tons, and the ULCC Ultra Large Crude Carriers, which can carry 300,000 tons, cannot pass through the Suez Canal, the Panama Canal or, a fortiori, any other European canal. These huge vessels can only transit the Cape of Good Hope and Cape Horn, and their competitors can only be oil pipelines, on certain continents, but not on the major oceans.

³⁷ According to a survey conducted in 2019 by Voies Navigables de France (VNF) – the national operator of inland waterway activities in France – inland waterway tourism in France generates an annual turnover of 1.4 billion euros with 15.6 million passenger-days and more than 6,100 employees working in the industry. More than 20% of this turnover comes from the Canal du Midi.

definitely won or lost. The Panamanian government has decided to considerably increase the capacity of the Panama Canal and to equip it with the most modern electronic equipment. The Egyptian Suez Canal Authority has approved a system that allows large oil tankers to be emptied at the entrance to the canal, to transit the oil through a pipeline parallel to the canal, and to reload oil tankers at the exit. All these technical solutions extend the “maturity” phase of the product life curve. The Canal du Midi has lost its advantage over the railroad, but perhaps it will find a new life in a context where ecology and sustainable development will take priority over unbridled energy consumption. Insofar as their traffic and turnover allow them to do so, the canals still have a role to play. The Suez Canal allows 20,000 ships to transit each year, i.e. 14%³⁸ of the world traffic; the Panama Canal is currently more modest, since it receives only around 14,000 ships and 9% of the world traffic³⁹, but its ambition is, with the improvements made in 2014, to overtake Suez one day, which may be possible depending not only on economic contingencies, but also on political and religious ones: the Middle East is much more unstable than Central America, which is now closely monitored by the United States, and this may be an obstacle to international traffic. On the other hand, Asian countries, led by China, have made the Panama Canal a privileged strategic issue to increase their market share in America. We must not forget that the main world maritime route passes through the major ports of Western Asia, crosses the Pacific Ocean, passes through North America, crosses the Panama Canal, then the Atlantic Ocean, and passes through Europe and the Mediterranean, thanks to the Suez Canal reaches the Indian Ocean and the loop closes on Eastern Asia, its starting point.

It should not be forgotten either that large projects, like small ones, are sensitive to traditional economic conditions: they depend on demand, their funding method, their prices, and their costs, absolute but above all relative to the competitiveness of other projects, and to technological developments. Like all human enterprises, even if they are driven by extraordinary feelings, they are subject to the common constraints of prices, costs, distances, and delays. The management that governs them must be neither frightened nor shy but must show imagination and creativity.

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³⁸ Suez Canal Authority.

³⁹ Reuters.

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ANNEX⁴⁰

Technical and economical comparison between the Suez Canal and the Panama Canal

	Suez		Panama	
Work Kick-off	1858		1881	
Opening	1869		1914	
Actual Status	Active		Active	
Authority	Egypte		Panama	
Type	Sea-level canal		Lock canal	
	1870	2020	1914	2020
Overall length km	164 km	193,3 km	74 km	80 km
Width	61/91 m	313 m	33 m	33 m
Water depth	8 m	24 m	8 m	14 m
Max Draft of Ship	22 feet	66 feet	40 feet	50 feet
Max tonnage (DWT)	5 000	240 000	52000	240000
Transit time (hours)	40 hours	12-16 hours	no information	8-9 hours
Last year (2020):				
- Turnover (billion USD)	5,61		3,44	
- N° Vessels	18 829		13 469	
- N° tonnage (000)	1 170 000		475 200	
Average tall per vessel (approximately)	\$ 300 000		255 000	
Average cost per ton	\$ 4,79		7,25	
Initial Cost	432 M Golden Francs		639 M USD*	
Actualisez (2021) cost	8,6 B USD		19,3 B USD	

* The initial cost does not consider the additional work to increase the capacity of the channels. Thus, according to Maurer and Yu (Maurer, Yu, 2008), the cost assigned to the construction of the Panama Canal is 287 M USD on the French side (equivalent to 9.17 billion USD in 2021 according to the GDP Deflator) and 352 M USD (equivalent to 10.13 B USD in 2021). For example, the expenses for the military fortifications (23 M USD in 1914) are not considered.

⁴⁰ All economic and technical information is retrieved from the websites of the Authorities that govern the two channels: historical data and financial statements. To cross-check this information, we have verified some data, when possible, in other information resources such as the Encyclopedia Britannica but also Lloyd's records and the US Congressional Library.

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Year (* 366 days)	Suez				Panama			
	N° (Vessel)		Net Ton (1000)		N° (Vessel)		Net Ton (1000)	
	Total	Daily Avg.	Total	Daily Avg.	Total	Daily Avg.	Total	Daily Avg.
2010	17 993	49,30	846 389	2 318,87	14 250	39,04	300 800	824
2011	17 799	48,76	928 880	2 544,88	14 684	40,23	322 100	882
2012*	17 224	47,06	928 472	2 536,81	14 544	39,74	333 700	912
2013	16 596	45,47	915 468	2 508,13	13 660	37,42	320 600	878
2014	17 148	46,98	962 747	2 637,66	13 481	36,93	326 800	895
2015	17 483	47,90	998 652	2 736,03	13 874	38,01	341 000	934
2016*	16 833	45,99	974 185	2 661,71	13 114	35,83	330 000	902
2017	17 550	48,08	1 041 576	2 853,63	13 548	37,12	403 800	1 106
2018	18 174	49,79	1 139 630	3 122,27	13 795	37,79	442 100	1 211
2019	18 880	51,73	1 207 087	3 307,09	13 785	37,77	469 600	1 287