Hydraulic Engineers and Antiquarians: Political Use of the Past in Nineteenth-Century Venice

GIACOMO BONAN

ABSTRACT: The article analyzes the relationship between hydraulics and history in the nineteenth century, often described as a period when the humanities and the sciences split into "two separate cultures." Venice, amphibious city par excellence, is a good starting point for exploring the use of history in water management debates. In the early nineteenth century, humanists and hydraulic engineers came together through multiple disciplinary approaches and in constant confrontation with the Republic of Venice's water policies. In the following decades, while making extensive use of history, these engineers realized and emphasized the diversity of both disciplines' methodologies. This evolution—seen through the writings of renowned hydraulic engineer at the time Pietro Paleocapa—illustrates how history was no longer a source of empirical knowledge but came to be used for rhetorical and political purposes.

KEYWORDS: water management, knowledge integration, historiography, hydraulic science, Venice lagoon and surrounding rivers

Introduction

Reflections on the ecological crisis have sparked debates on disciplinary boundaries and epistemological norms across different fields of knowledge.[1] These reflections have also renewed interest in the shifting relationship between humanities and the sciences, particularly in the nineteenth century, when the fragmentation and specialization of knowledge went hand in hand with the emergence of modern professions. However, recent research shows that the boundaries between the natural sciences and the humanities—and

1. Hartog, *Chronos*; Chakrabarty, *Climate of History*; Will, *Evidenz für das Anthropozän*.

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history in particular—were still much more porous than long assumed.[2] This article explores these dynamics by examining the relationship between hydraulics and history in the nineteenth century, focusing on Venice as a paradigmatic case study. Indeed, Venice is a paramount example of a "hydraulic" or "amphibious" society, and its water management is key to understanding the coevolution of socio-ecological dynamics.[3]

In the early modern period, history and hydraulics were linked to many other disciplines through an empirical epistemological approach based on descriptive knowledge, called *historia*.[4] Scholars adopted this approach to study topics ranging from civic history to physics. Despite advances in hydromechanics a century earlier, water management was still a meeting place for intellectuals of very varied backgrounds in the eighteenth century.[5]

Current scholarship has identified the Napoleonic era as a turning point for water management knowledge in Europe. Central to this transformation was the creation of modern technical bureaucracies for governing a territory, inspired by the French Corps des ponts et chaussées (Bridges and Roads Corps) model.[6] This process was accompanied by a reform of the formative training paths to access the new professions with a technical-scientific bias and a focus on physics and mathematics.[7] In Venice, this French-inspired approach remained even after the region returned to Austrian hands and the establishment of the Lombardo-Venetian Kingdom in 1815. In the long run, the new educational and professional framework sharpened the divide between scientific and humanistic knowledge, even though implementation of the Napoleonic reforms was moderate by various aspects. The educational reform introduced recruitment criteria that few students with the requisite skills and qualifications could meet. This gap was particularly evident in the Veneto area. Only by making exceptions and allowing the hiring of technicians with much more varied training and professional experience than envisaged could legislators fill the shortage of qualified candidates.[8]

2. Klemun, "Historismus/Historismen"; Bod et al., "Flow of Cognitive Goods"; Chakrabarti, *Inscriptions of Nature*; Musil-Gutsch, "On the Same Page"; Kraemer et al., "Botany and the Science of History."

3. Ciriacono, "Management of the Lagoon"; Gentilcore, "Cistern System." On the importance of the Venetian case in a global perspective: Davids, "River Control"; Radkau, *Nature and Power*, 118–23.

4. Pomata and Siraisi, *Historia*. On the relationship between history and hydraulics in the early modern period: Long, "Hydraulic Engineering."

5. On hydromechanics: Maffioli, *Out of Galileo*. For hydraulic experts' varied backgrounds in eighteenth-century Venice: Granuzzo, "Il dibattito istituzionale"; Liuzzi, "L'Itale terre."

6. Picon, *L'invention de l'ingénieur modern*.

7. The literature on the Italian context is analyzed in: Blanco, "Amministrazione, ingegneri e territorio"; Di Biasio, "Ingegneri e ingegneria."

8. Bigatti, "Il corpo di acque."

These transitional dynamics did not concern only the curricula to be followed in terms of academic or professional qualifications, but even more so a certain approach toward the hydraulic problems—an approach that had matured over time and the persistence of which can be observed well beyond the caesura marked by the institutional changes. In the French case, historian Frédéric Graber shows that in the early nineteenth century, top officials at *Corps des ponts et chaussées* resisted arguments based on theory and mathematical formulas.[9] Discussions were still founded on empirical observations, and historical documentation was used to provide new information.[10] The situation was similar in Venice, where only in 1840 was water management entrusted to someone trained in the Napoleonic period: Pietro Paleocapa, who studied at Modena's military school.[11]

The next section analyzes the role of history in the hydraulic debate that developed in Venice in the years following the fall of the republic, spanning the Napoleonic period and the return of the Austrians. This debate was fueled by repeated confrontation with the policies implemented by the Republic of Venice, and in particular with what was considered the most controversial aspect—namely, the decision to move the mouths of the main rivers of the area away from the lagoon. The following two sections explore the evolution of this debate during the middle decades of the nineteenth century through the writings of Pietro Paleocapa, the most important Italian hydraulic engineer of the period. The final section analyzes the principal characteristics of this hydraulic historiography and offers some concluding remarks.

A Contested Legacy

Berdardino Zendrini's *Memorie storiche dello stato antico e moderno delle lagune di Venezia e di que'fiumi che restarono divertiti per la conservazione delle medesime* (Historical memoirs of the ancient and modern state of the lagoon of Venice and of those rivers that were diverted to conserve it) was published in Padua in 1811.[12] This magnum opus of two volumes features a short preface; eight books in an annalistic style retracing events concerning the Venetian lagoon and surrounding rivers from 1300 to 1700 (preceded by synthetic summaries); an appendix of documents with renowned hydraulic experts' writings on the relationship between the rivers and the lagoon; and a cartographic appendix with thirty-six plates. Zendrini (1679–1747) drew on the Venetian magistrates archive, "from the decrees and parts thereof, from the visits and itineraries made by those who presided over the waters,

9. Graber, "Purity and Theory."

10. Graber, "Decision-Making," 953. Porter, *Trust in Numbers*, 114–47; Reuss, "Art of Scientific Precision."

11. Sambo, "L'amministrazione dello stato."

12. Zendrini, *Memorie storiche*.

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from the depositions of experts and from the reports of the engineers."[13] He focused on hydraulic matters, with minimal reference to political, economic, or social issues—and only on general events if they interrupted hydraulic projects.

Zendrini's opus immediately became a key reference point for scholars interested in the evolution of the Venetian hydraulic network and remains an essential source today.[14] Its success was partly due to Zendrini's fame as an illustrious hydraulic expert. In Venice, he had been awarded the title "mathematician and superintendent of the waters of the rivers, lagoons and ports of the Venetian state," and he started the construction of the Murazzi, the most impressive lagoon defense works up to that time. His reputation spread beyond the Republic of Venice; his advice was sought in Lucca, Modena, and Ferrara, as well as in Austria.[15]

Remarkably, his famous volumes were not originally intended for publication. The text was completed around 1726 but only published posthumously a century later, sixty-four years after the author's death. Zendrini willed his papers to the secret chancery (*cancelleria secreta*), which contained confidential documents.[16] They were placed there, alongside military documents, "since there is much similarity between the one and the other. That whilst these aim at the protection of the state, those aim at the internal defense of the city against the might of the rivers and the sea." Only subsequently were the memoirs copied for the Savi alle acque archive (water management board).[17] So Zendrini and the Venetian authorities thought that the text should be reserved for a selected audience: the republic's political leaders and officers entrusted with hydraulic management.[18]

The promotor of the memoirs' publication in 1811 was Angelo Zendrini, Bernardino's great-grandson, also a hydraulic expert and a professor of mathematics at the University of Padua between 1815 and 1817, before he abandoned teaching due to poor eyesight.[19] Angelo also signed the preamble to the memoirs, a dedication to the emperor and a eulogy to Bernardino

13. Zendrini, *Memorie storiche*, 1:li

14. Ciriacono, *Building on Water*, 111.

15. Indicative of his prestige is one of the first biographical notes by Gaspard De Prony: De Prony, "Zendrini Bernardino." Also Bonomelli, *Bernardino Zendrini*; Giacomelli, "Le opere chiave"; Castellozzi, "Zendrini Bernardino."

16. De Vivo, "Ordering the Archive"; Antonini, "Kept within Their Chests."

17. Maria Francesca Tiepolo, "Archivi propri diversi," 65, ASVe, https://asve.arianna4.cloud/patrimonio/27a98bc7-59fb-4bf9-9d55-3cddedbc08e8/311-bis-f-%C2%ABarchivio-proprio-bernardino-zendrini%C2%BB-1958.

18. The Venice State Archive holds the manuscripts: *Archivi propri Zendrini*, folder (hereafter b.), 68–69, ASVe. Ventrice, "L'ingegneria idraulica" (336) notes that "the printed work differs somewhat, at least in style from the original manuscript." The differences are in the style, as Angelo wanted to simplify and synthesize the text.

19. Venanzio, "Commemorazione di Angelo Zendrini."

tracing his life and main works.[20] No other documents shed light on the reasons for publication and the editorial process. Surely Angelo wanted to enhance the reputation of such an illustrious forebear, to whom he dedicated other writings.[21] Christian Mathieu's hypothesis seems valid—that publishing the manuscript within that precise historical context was motivated by what today is defined as political use of the past (i.e., the use of the past with explicit politico-pedagogic objectives).[22]

Publishing the memoirs was part of the hydraulic policy debate begun in the final phase of Venetian rule. As the late eighteenth century saw unusually frequent and destructive flooding of the rivers that crossed the Venetian mainland—particularly the Adige and the Brenta—a series of projects aimed to better regulate the waterways was proposed. These were often commissioned directly by the Republic of Venice and involved leading hydraulic experts; some were invited to propose schemes and others to evaluate these proposals. The best-known names were Antonio Maria Lorgna, Paolo Frisi, Leonardo Ximenes, Ruggero Boscovich, and Simone Stratico.[23] The debate steadily broadened to include various members of the Venetian elite, who proposed alternative projects or opposed preexisting ones, at times acrimoniously.[24] As with many other aspects of Venetian politics at that time, this broad, multifaceted debate did not lead to practical outcomes and, at the fall of the republic, all the proposals to manage the main waterways remained on paper (see figure 1).

The end of Venetian domination, however, radically changed the framework of hydraulic policy debates. Importantly, the aforementioned proposals all started from a common premise: the banishing of the rivers from the lagoon. This had been a nonnegotiable keystone of Venetian hydraulic policy since at least the seventeenth century, when works were completed to divert or remove the main waterways flowing into or near the lagoon basin.[25] These changes were motivated by the need to prevent the sediment carried by the rivers from silting up the lagoon, causing health problems and navigation issues. Diverting these rivers, however, had lengthened the riverbeds in areas with no gradient, making it increasingly difficult to deal with flooding and maintain drainage in the countryside. Thus, the protection of the lagoon came at a price for the mainland territories, which were forced to put up with frequent flooding and poor drainage.[26]

20. Zendrini, *Memorie storiche*, 1:v–xlviii.

21. Rusconi and Ventrice, "Ulteriori approfondimenti storico-tecnici."

22. Mathieu, *Inselstadt Venedig*, 24–26.

23. Ximenes and Stratico, *Perizia intorno alla misura delle acque*; Turazza, *Memorie del Lorgna*; Borgato and Fiocca, "Teodoro Bonati"; Borgato, "I progetti di Lorgna."

24. Donà, "Alcune proposte di sistemazione idraulica."

25. On Venetian hydraulic policy: Caniato, "Il controllo delle acque."

26. Mathieu and Grabas, "Zur Dekonstruktion eines 'Ökomythos'"; Vergani, "Venezia e la Terraferma"; Zannini, "Un ecomito?"

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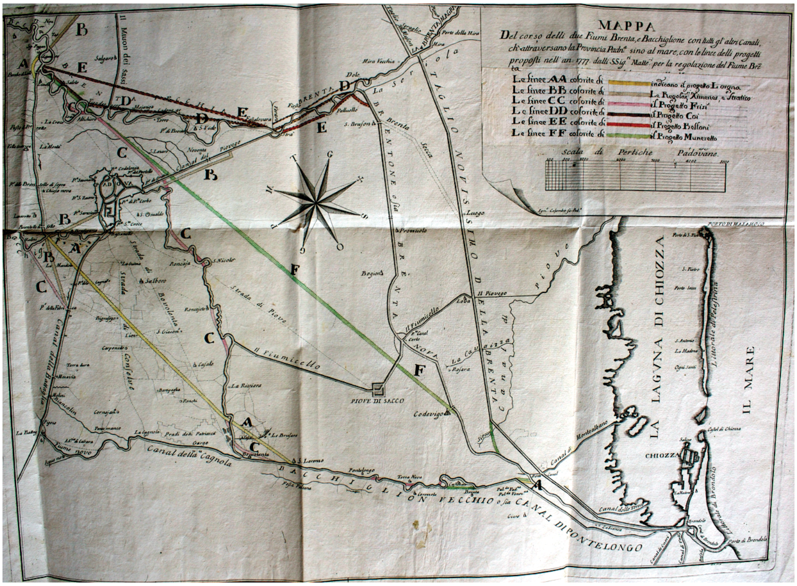

FIG. 1 Paper Projects. Late eighteenth-century plans show Brenta river routes proposed by leading hydraulic experts. Some were commissioned by the Republic of Venice (lines AA indicate the route proposed by Antonio Maria Lorgna), while others emerged from discussing previous projects (lines BB indicate the changes to the Lorgna project by Leonardo Ximenes and Simone Stratico; lines CC are Paola Frisi's proposed changes). At the fall of the republic, these projects all remained on paper (Source: BUP, ms. 87).

The balance of power changed after the fall of the Republic of Venice. Especially when Veneto was annexed by the Kingdom of Italy (1805), Venetian issues now were considered a departmental rather than a state capital concern.[27] This changed institutional context encouraged the demands of urban centers and agricultural interests on the mainland. Radical measures were requested to solve the hydraulic problems, including reintroducing the rivers into the lagoon. These claims found institutional support, so much so that in 1808, Giovanni Paradisi, director of the Dipartimento di ponti, argini e strade (Department of Bridges, Embankments and Roads), commissioned engineer Antonio Luigi Romanò to bring the waters of the Sile back into the lagoon by reopening the Businello, a channel once used to discharge the river's flood water but then closed in the Venetian period.[28]

The publication of the memoirs was arguably motivated by a desire to reaffirm the validity of the republic's major hydraulic works and to strengthen the position of that tradition's adherents. Indeed, Zendrini's text was not a neutral presentation; it articulated a celebration of Venice's achievements, starting with the removal of the rivers from the lagoon. This bias already emerges in the title of the text, where the relationship between "conservation" of the lagoon and the diversion of the rivers is taken for granted, despite the fact that there were conflicting opinions at that time. The document appendix is also revealing: Domenico Guglielmini, who supported the river ban, is included as an external expert, while the well-known Benedetto Castelli (Galileo's favorite pupil), who had proposed reintroducing the Brenta into the lagoon, is not.[29] Similarly, Cristoforo Sabbadino of the Venetian ruling class, an ideologist of the ban on rivers, is included; Alvise Cornaro, who unlike Sabbadino championed the mainland's interests, is not.[30]

Zendrini's memoirs immediately became an essential reference in the lagoon and rivers debate, both for supporters of the republic's hydraulic policies and for those who stressed the damage that those policies caused on the mainland. This was possible because the annalistic part of the memoirs, while evaluating positively the work leading to the removal of the rivers, also included contradictions and gaps, given the diverse sources used by Zendrini.

Already in 1812, the noble and erudite Paduan Jacopo Filiasi had published a pamphlet highlighting the memoirs' limitations and weaknesses. His alternative interpretation of the evolving relationship between the rivers and lagoon differed from Zendrini's in the extent of the lagoon in ancient

27. Castellano, "Il corpo di acque e strade."

28. Leoni, *Voti per la restituzione de' fiumi*, 38. On Paradisi: Capra, "La generosa nave"; Rossi, "Paradisi Giovanni."

29. Omodeo et al., "Benedetto Castelli's Considerations."

30. On Sabbadino and Cornaro: Cosgrove, *Palladian Landscape*; Benzoni, *Verso la Santa Agricoltura*.

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times and the rivers' impact before they were diverted.[31] In 1817, Angelo Zendrini replied by adding notes to a Giovanni Poleni text he had edited. This sparked a dispute, also concerning the relationship between history and mathematics in hydraulics. Referring to the Polenian theory of water's mixed motion, Angelo Zendrini affirmed, "when the physical-mathematical evidence serves as a guide, it is strange to resort instead to historical conjunctural deductions, often uncertain and often opposed to each other."[32] In his response the following year, Filiasi denied

> that things pertaining solely to history and erudition can be believed to be true only by using physics and mathematics. If, therefore, over the centuries, histories, charters, documents, and parchments prove that the Lagoon was never where those of the mathematical sciences want it to be. . . . We are dealing with a fact, and theories placed against the facts are worthless.[33]

Many scholars in the humanities and the sciences shared this assessment at the time.[34]

The dispute between Filiasi and Zendrini continued until the decade's end.[35] Other writers also confronted this thorny relationship between the rivers and the lagoon with its overlapping hydraulic, historical, and political issues. In 1815, engineer Romanò resumed the plan to reintroduce the rivers into the lagoon that he had examined in the Napoleonic period. To underpin his solution, he wrote two volumes in three parts: the first was a lengthy reconstruction of Venetian hydraulic history and a critical analysis of Zendrini's memoirs; the second envisaged returning the Brenta and Sile rivers to the lagoon, starting with Romanò's earlier project for reopening the Businello; and the third part was about upgrading the port of Malamocco.[36]

On the opposing side, Pietro Lucchesi, former engineer for the Magistrato alle Acque (the magistracy overseeing waterways in the Venetian period), intervened in favor of the river ban with a reply to Romanò.[37] Lucchesi held the same views as Angelo Zendrini, but from an epistemological perspective resembled what Filiasi would argue with Angelo Zendrini: he defended the

31. Filiasi, *Osservazioni sopra l'opera Memorie Storiche*. On Filiasi: Preto, "Filiasi Iacopo."

32. Zendrini, *Delle lagune venete*, 16. That the editor is Angelo Zendrini is clarified at the start of the volume (pages not numbered, but corresponding to 3–5).

33. Filiasi, *Risposte e riflessioni generali*, 14–15. The text is often erroneously attributed to Abbot Giuseppe Grones, who edited it, while from the opening pages it is clear that the author is Filiasi, as confirmed by the bibliography in Fontana, "Filiasi Jacopo."

34. Daston and Most, "History of Science and History of Philologies"; Ten Hagen, "How 'Facts' Shaped Modern Disciplines."

35. Filiasi, *Riflessioni sopra i fiumi e le lagune*; Zendrini, *Lettera all'autore*; Filiasi, *Osservazioni sopra la lettera*; Filiasi, *Osservazioni sulle cause*.

36. Romanò, *Prospetto delle conseguenze* (the first part is in vol. 1, 99–422).

37. Lucchesi, *Prospetto di verità*. On Lucchesi: Franzin, "Lucchesi Pietro."

river ban policy by referring to historical sources ("of facts which, according to authentic documents"), despite contradicting general mathematical theories. He chose as a reference point once again Bernardino Zendrini's memoirs.[38] The controversy continued for years, rejoined by Romanò, followed by further sallies from Lucchesi.[39]

"The Prince of Modern Hydraulics"

The year 1818 was a turning point, as the institutional forces favoring the reintroduction of the rivers into the lagoon seemed to prevail. Despite opposition from the Venetian government, the Austrian authorities ordered an experimental reopening of the Businello. They also asked director of public works Joseph Schemerl to present a plan for reintroducing the Brenta and Bacchiglione rivers into the southern lagoon.[40] The following year, a young assistant engineer, who would become a central figure in both politics and hydraulics, entered in the debate: Pietro Paleocapa (1788–1869).[41]

At the age of thirty-one, after scarcely two years at Venice's Corpo degli ingegneri di acque e strade (Waters and Roads Engineering Corps), Paleocapa's first publication examined Benedetto Castelli's and Alfonso Borelli's views on the Venice lagoon (*Esame delle opinioni di Benedetto Castelli e di Alfonso Borelli sulle lagune di Venezia*).[42] The text was dedicated to Angelo Zendrini, with whom Paleocapa established a lasting friendship, and firmly supported the river ban.[43] The author rebutted well-known seventeenth-century mathematician Castelli and his pupil Borelli's proposals to reintroduce the rivers into the lagoon. His real target was not those two scientists, however, but their followers, who were still advancing traditional ideas two centuries later, without considering recent theoretical advances and empirical evidence. His conclusions were clear: "The introduction of the rivers into the lagoon will be the ruin of Venice. And as for the issues of the mainland, it can be seen that the problems beheld in the water system derive from other reasons than the diversion of the rivers."[44]

38. Lucchesi, *Prospetto di verità*, 13–16.

39. Romanò, *Confutazioni al signor ingegnere Lucchesi*; Lucchesi, *Riflessi di verità*; Lucchesi, *Seconda parte dei documenti*; Lucchesi, *Ragionamenti tenuti da Sabbadino*; and Lucchesi, *Il Businello del Sile*.

40. Fontana, "Pietro Paleocapa a Venezia." On Schemerl's plan: *Kriegsarchiv*, KPS LB K V, 909, OeSta.

41. The bibliography on Paleocapa is vast, but fragmentary; major works are quoted in Gottardi, "Paleocapa Pietro."

42. Paleocapa, *Esame delle opinioni*. On works published by Paleocapa in his lifetime: Torelli, *Elenco generale*, 71–82.

43. For some letters between Paleocapa and Zendrini: *Miscellanea manoscritti*, b. 157, ASVe. For correspondence between Angelo Zendrini and Antonio Tadini: *Archivio Tadini*, b. 7, file (hereafter f.) 116, BAM.

44. Paleocapa, *Esame delle opinioni*, 96–97.

Paleocapa also criticized the way the debates had been conducted in the past. He refused

> to examine the arguments drawn from erudition; neither do I have enough learning to do this, nor would I want to even if I had. And it would be wasted work, since many other facts and events have been brought to light that prove the contrary. These make it clear how little one can trust results that derive from ancient records, when they have been interpreted with such partisan bias.[45]

His conclusions about supporters of reintroducing the rivers were even more extreme:

> But if the support provided by the authority of Castelli and Borelli is taken away from them, who will stay to support the introduction of the rivers into the lagoon, what other names can encourage them and what other works can they read to provide themselves with valid arguments in the dispute? In truth, none. They will therefore take refuge in the archives and scratch around, revealing their repugnant approach. Most of them will ignore or twist opposing arguments, collecting coarse stories and inconclusive tales; and by garbling these materials they will continue to write those pamphlets that they strive to bring to the light of day, and which should remain hidden in the dark forever.[46]

Paleocapa clearly thought that the hydraulic debate should be restricted to issues—and related experiments—of a physical-mathematical nature. Indeed, the essay's appendix, on reopening the Businello, addresses the topic with extensive use of differential calculus.[47] Historical sources are given little weight to evaluate the appropriateness of a specific intervention; and those who use them due to lacking theoretical foundations try to confuse the debate for partisan purposes, he wrote.

Scholars consider Paleocapa a key figure, representing the transition from the hydraulics of the early modern period to the modern engineering of the nineteenth century.[48] Confirming this description is the inscription on his statue in Venice, initially erected in Campo Sant'Angelo, then moved to Papadopoli Gardens: "The prince of modern hydraulics."[49] Paleocapa's career undoubtedly developed during a period of profound changes in hydraulic knowledge and policy, yet an analysis of his evolving thoughts on the lagoon and neighboring rivers reveals a more complex situation. And the historical dimension assumes a different role than in his early writing.

45. Paleocapa, *Esame delle opinioni*, 9–10.
46. Paleocapa, *Esame delle opinioni*, 96.
47. On Paleocapa's mathematical knowledge: Ghetti, "Le conoscenze idrauliche."
48. Zucconi, "La cultura degli ingegneri"; Minesso, "Dal 'Proto' all'ingegnere"; Calcagno, "La figura dell'ingegnere"; Zalin, "Cultura idraulica."
49. Scanzi, *Il Paleocapa rimosso*, 81–83.

The year after the publication of his essay on Castelli and Borelli, Paleocapa left Venice and moved to Milan, where he worked on creating the new cadastre, a job that meant a lengthy stay in Vienna (1825–28).[50] He returned to Venice in 1830, becoming chief engineer at the Direzione delle pubbliche costruzioni (Office of Public Works). In 1840, he was promoted to director of the Direzione generale delle pubbliche costruzioni (General Directorate of Public Works). The decade following his return to Venice saw frenetic activity on many fronts: regulating the Adige; coastal defense work; construction of the dam to improve navigation in the port of Malamocco; and above all, seeking a solution to the unresolved problematic relationship between the lagoon and its neighboring rivers.[51]

After the reopening of the Businello, despite numerous proposals over the years, the unabated controversy and discussions between mainland and lagoon supporters had not delivered a definitive solution. To break the impasse, the Austrian authorities appointed a technician from outside Veneto who could not be accused of prejudice. They chose Tuscan hydraulic engineer and politician Vittorio Fossombroni, thanks to his great reputation with reclamation projects, and the dynastic connections between the Grand Duchy of Tuscany and the Lombardo-Venetian Kingdom, both ruled by the Habsburg family.[52] Fossombroni was asked to draw up an organic plan for regulating the region's waterways, and, in doing so, he studied documents on the Venetian hydraulic system. However, due to his advanced age and numerous ministerial commitments, he was not able to visit the area to carry out site inspections and surveys. Consequently, in 1834, the Venetian authorities sent an engineer to Tuscany with all the necessary information for Fossombroni and to help him draft the plan.[53] Paleocapa, now considered the ablest hydraulic engineer in the Venetian state, was transferred to Tuscany from January to May 1835, when the "Fossombroni plan" was presented to the Austrian authorities.[54] The most controversial part of the plan was reintroducing the Brenta into the lagoon, specifically into the southern strip, the Chioggia lagoon.

This plan obviously represented a radical change from Paleocapa's position in 1819. Evidence of a remarkable convergence of views with Fossombroni, however, is correspondence written to Paleocapa: "The project could be called more yours than mine, especially for the influence that your scientific and local knowledge has had on the conclusions I have adopted."[55] After delivering the plan, moreover, Paleocapa strongly supported all the

50. Locatelli, *Riforma fiscale*, 82–83, 127.

51. Tiepolo, *Contributi su Pietro Paleocapa*.

52. Biagianti, "Il sistema idraulico." On Fossombroni's hydraulic works in Tuscany: Biagianti, "Vittorio Fossombroni."

53. *Presidio di governo*, 1830–34, XII, b. 723, f. 2/15, ASVe.

54. *Presidio di governo*, 1835–39, X, b. 920, f. 4/3, ASVe.

55. Biagianti, "Il sistema idraulico," 247.

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proposals. In the following years, when the plan was blocked by conflicting opinions among the Austrian authorities, it was Paleocapa who forced the issue—to at least reintroduce the Brenta into the lagoon, in his view the most important proposal.[56] After yet more flood damage by the river in the autumn of 1839, Paleocapa took advantage when the viceroy, Archduke Ranieri, was on holiday in Stra, to take him to the places most damaged by the flooding and convince him of the need to intervene, at least on the lower stretches of the river.[57] This strategy was effective. The reintroduction of the Brenta into the lagoon was authorized in January 1840 and completed in April; the remaining works were finally approved in 1842.[58]

Between Hydraulic Science and Hydraulic History

After Fossombroni died in 1844, his heirs requested that the plan be published with support from the Venetian government, which purchased four hundred copies to distribute at the congress of Italian scientists, held in Venice in 1847. Paleocapa wrote the lengthy preface (signed "engineer P. P.").[59] Very different from the one published thirty years earlier, Paleocapa's essay helps explain his changed views. While reiterating the advantages of the river ban for the lagoon and the city of Venice, Paleocapa admits that those solutions "were no longer tolerable in the current political context."[60]

His reasoning does not rely on new hydraulic theories. Like mathematical formulas, the theories do not appear in the text. His argument is rooted entirely in the historical-political context. He reconstructs the region's vicissitudes, from the conflicts between Paduans and Venetians over managing the Brenta and Bacchiglione rivers in the late medieval period up to the implementation of the Fossombroni plan. However, the format differs from Zendrini's memoirs, with their fragmentary and sometimes contradictory exposition of narrowly defined hydraulic events. Paleocapa's text is synthetic and linear, with water management often placed in a political context. Still, Paleocapa could not resist restating his youthful polemic against "scholars

56. *Governo veneto*, 1835–39, I, b. 4652, f. 10/8, ASVe.

57. *Governo veneto*, 1840–44, LXIII, b. 6695, f. 8/4, ASVe; *Ufficio provinciale delle pubbliche costruzioni (1807–1849)*, b. 39, ASVe. On the initiative as communicated by Paleocapa to Fossombroni in a letter dated December 20, 1839: *Archivio Fossombroni*, b. 12, f. 4, ASAr.

58. On the reintroduction of the Brenta into the lagoon: *Direzione generale delle pubbliche costruzioni*, b. 571, c. I, f. 26, ASVe. On the following works: Casetta, "La memoria idraulica."

59. Fossombroni, *Considerazioni sopra il sistema idraulico* (preface on ix–lxiv). The Fossombroni family's records show that Paleocapa edited Fossombroni's text: *Archivio Fossombroni*, b. 12, 2–6, ASAr. On the congress: Casalena and Mogavero, *Scienziati italiani a congresso*.

60. Paleocapa, "Prefazione," l.

who, forgetting that we are dealing with a natural issue pertinent to physical geography, a simple issue when one returns to first principles, decided that they wanted to resolve it by rummaging through archives, chronicles and old lore."[61]

Yet the rest of his text has a clear historical approach. Paleocapa acknowledges that the plan was based on a historical account especially drawn up by Camillo Vacani, an engineer in the Austrian army and friend of Paleocapa from their time at Modena's military school.[62] As with Zandrini's memoirs, Vacani's text was only published later, five years after the author's death, in 1867, at the behest of Minister of Public Works Stefano Jacini. Despite similar titles, the second work has no reference to the ban on rivers: *Della laguna di Venezia e dei fiumi nelle attigue provincie* (Of the lagoon of Venice and of the rivers in the contiguous provinces).[63] The first "hydrographic" part of this work describes in detail the complex relationship between the mainland, the lagoon, and the sea. The third "technical" part analyzes the main early nineteenth-century proposals to regulate Venetian waterways. The second and most substantial "historical" part traces events from the first settlements in the lagoon up to 1829, the year when Vacani wrote the work.

The approach is still annalistic. Yet, the close interdependent relationship between political changes and the evolving hydrographic network is immediately evident from the format. Every page has the heading "progressive series of simultaneous events" and is divided into two columns: on the left, events "in the political order," and on the right, "in the hydraulic system," further describing hydraulic interventions, with the actors and interests that had solicited or opposed them, reconstructing the institutional context of the discussions and implementation.[64] Introducing the work is a letter from Paleocapa to Jacini dated October 20, 1866. It praises the text, recalling its central role in elaborating the Fossombroni plan, but it specifies that "Vacani's text is not a recollection of hydraulic science but of hydraulic history," as if they were two distinct disciplines.[65] Paleocapa then returns to the relationship between history and science in relation to water management. Over the years much had changed, however, including his position.

In March 1848, after the proclamation of the republic in Venice, Paleocapa became minister (of public works, later of the interior) in Daniele Manin's government; in July, he was sent on a mission to Piedmont, where he remained in exile—after Veneto returned to Austrian hands—and continued his political career. In 1849, he was appointed minister of public works in the Kingdom of Sardinia, but he was forced to resign in 1857 due to worsening

61. Paleocapa, "Prefazione," xxv.

62. Paleocapa, "Prefazione," lvi–lvii. On their friendship and Modena's military school: Giordano, *Gli ufficiali della scuola militare*.

63. Vacani, *Della laguna di Venezia*.

64. Vacani, *Della laguna di Venezia*, 50–302.

65. Vacani, *Della laguna di Venezia*, 6.

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eyesight that ultimately left him blind; he was also a member of parliament until 1854, then a senator. Political commitments did not prevent him from pursuing his hydraulic interests, and in 1855, he was appointed to the International Commission for the piercing of the Isthmus of Suez, evidence of the international prestige he had by now achieved. Though offered the presidency of the commission, he declined due to his worsening eyesight.[66]

Paleocapa wrote the preface to Vacani's work on the eve of the plebiscite for the Veneto's annexation to the Kingdom of Italy—in other words, when he could return to Venice after almost twenty years in exile. On October 6, before the Austrians had even left the region, Paleocapa presided over a commission studying proposals to improve the Venetian ports and lagoon.[67] He was appointed despite bitter criticism in previous years due to the new outflow of the Brenta river bringing sediment into the Chioggia lagoon, causing increasingly evident and damaging swamp conditions, harmful for both the economy and health.[68] However, his prestige was such that none of the public engineers employed in the area questioned the choice.

Paleocapa started the commission's work with a report, describing the ancient and current state of Venice's estuaries, that turned out to be his last published work: *Dello stato antico delle vicende e della condizione attuale degli estuari Veneti* (Of the ancient state of events and the current condition of the Venetian estuaries).[69] The title illustrates that this report was yet another historical reconstruction of the changing relationship between the rivers and the lagoon, examining earlier hydraulic works in light of their political context and the interests involved. Both in content and style, the text adopted and expanded the Fossombroni plan's preface, thus modeled on Vacani's work. Despite the critique and caveats, when it came to defending earlier efforts and planning future work, Paleocapa again relied not on "hydraulic science" but "hydraulic history."

In nineteenth-century Venice, the water management debate was mainly a historical debate, especially when it was being discussed by hydraulic experts. The themes at the center of the debate depended on the historical and ecological context of the area—that is, the much-stated relationship between the city's fortunes and the works aimed at making the lagoon environment as functional as possible for urban needs. As Elizabeth Crouzet-Pavan has shown, the myth of Venice was based on this relationship, which the state's rhetoric had promoted to legitimize its political power and the institutions emanating from it. The Venetian elite were also keen to present the image of a cohesive community addressing the challenges imposed by the need

66. Gullino, "Pietro Paleocapa"; Giuntini, *Il Canale di Suez*; Curli, "Camillo Cavour and Pietro Paleocapa."

67. Rusconi, "Il Magistrato alle Acque."

68. *Scritti sui lavori di sistemazione dei fiumi*.

69. Paleocapa, *Dello stato antico delle vicende* (his last essay intended as a monograph).

to manage the lagoon's ecosystem.[70] Reinterpreting that experience from a hydraulic history perspective was part of a broader nineteenth-century debate that led to revising the myth of Venice, along with its political and institutional history.[71]

The Venetian case is representative of a widespread and articulated interest in history within the hydraulic debates of that period. No summary framework sheds light on the themes, approaches, and aims of the historiography written by hydraulic engineers. However, the scholarly literature on the evolution of bureaucracies involved in public works engineering reveals the spread of the phenomenon.[72] More information is available for the leading figures, Paleocapa's peers and contemporaries like the most-studied expert Carlo Afan de Rivera (1779–1852), for a long time general director of bridges and roads in the Kingdom of the Two Sicilies. His writings, while using limited physical-mathematical knowledge to discuss hydraulic issues, present numerous political, economic, and historical insights.[73] The person who best knew how to interweave scientific with historical expertise was Elia Lombardini (1794–1878), collaborator with Carlo Cattaneo on various projects and director of the Office of Public Works in Milan between 1848 and 1856.[74] His library, donated to the College of Engineers and Architects in Milan, enables historians to reconstruct the research that inspired his historical insights. As historian Giorgio Bigatti writes,

> it is impressive to see how skillfully and easily he moved among the weighty tomes of the *Antiquitates Italicæ Medii Ævi, sive Dissertationes* collected by Muratori, or the complete works of Carlo Sigonio, a sixteenth century historian. Impressive also to find precise marginal notes in the volumes of the *Storia dell'augusta badia di S. Silvestro di Nonantola* by Girolamo Tiraboschi, or in *Istoria della città, e ducato di Guastalla* by Ireneo Affo.[75]

The comparison could extend to private hydraulic experts, or to similar phenomena in other national contexts.[76] For example, historian Alice Ingold has shown that George Sorel's historical thinking was rooted in his

70. Crouzet-Pavan, "*Sopra le acque salse*. "

71. Povolo, "Creation of Venetian Historiography"; Infelise, "Venezia e il suo passato."

72. Blanco, *Amministrazione, formazione e professione*; Bocquet, "Engineers and the Nation"; De Lorenzo, "Problèmes de mesure."

73. On de Rivera's lack of scientific knowledge: Bovolin, "Aspetti idraulici." On his use of history: D'Elia, "La scrittura degli ingegneri"; Mazzotti, "Engineering the Neapolitan State."

74. Barca, "Running Italian Waters."

75. Bigatti, "Cultura tecnica," 55.

76. As for the first case, a famous example is *Sull'economia delle acque da ristabilirsi nel Regno di Napoli* (1809) by Teodoro Monticelli. Foscari, *Teodoro Monticelli*. Also Gentilcore, "Decadent Infrastructure?" For the second case: Duarte Rodrigues and Toribio Marín, *History of Water Management*.

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work as a hydraulic engineer, which he carried out for over two decades in the Pyrenees.[77] Hydraulics is only one branch of natural science wherein many late nineteenth-century experts adopted a historical approach. An excellent example is Adolfo di Bérenger, who trained as a forest inspector in the Veneto area and is considered the founder of scientific silviculture and forest history in Italy.[78]

Conclusion

As the texts compared above show, the characteristics and purposes of the historiography written by hydraulic experts varied considerably. Works by Bernardino Zendrini and Camillo Vacani have in common that they were not written for publication. Both were based on archival research and on an annalistic model. They differed in style and methodology, partly because they were almost a century apart. Pietro Paleocapa apparently did not frequent the Venetian archives.[79] His historical writing was based on secondary sources (particularly the works of Zendrini and Vacani) and was mainly for printed circulation. In his early writing on Castelli and Borelli, he had shown no interest in the historical dimension of hydraulic problems, but over the decades, he often analyzed works implemented by the Republic of Venice to regulate the relationship between the lagoon and neighboring rivers. However, Paleocapa considered "hydraulic science" and "hydraulic history" two very distinct activities, unlike other late nineteenth-century scholars who adopted a historical approach in the natural sciences.[80]

This distinction indicated a more complex process of specialization involving many disciplines, including hydraulics and history. With the former, the new training and professional models introduced by the Napoleonic reforms favored the progressive transition from an empirical-qualitative to a quantitative approach.[81] At the same time, the "century of history" marked the decline of the antiquarian model linking the humanities and natural sciences.[82] The birth and increasing definition of the profession of historian was characterized by important innovations in research practices and methods, but also by a progressive shift of the thematic focus toward legal and political issues.[83]

77. Ingold, "Penser à l'épreuve des conflits."
78. Di Bérenger, *Saggio storico*. On di Bérenger: Agnoletti, "Fra storia e tecnica."
79. Morachiello, "Pietro Paleocapa," 166.
80. Ten Hagen, "History as a Tool."
81. Minesso, "Engineering Profession." On quantification in Italian hydraulics: Parrinello, "Charting the Flow."
82. Rao, "Tra erudizione e scienze."
83. Porciani and Raphael, *Atlas of European Historiography*.

Yet Paleocapa reveals an aspect that continued to bring together history and hydraulics in the debate on water management. Paleocapa's use of history is arguably linked to his career path. He wrote his essay on Castelli and Borelli as a young engineer in public administration. By the time of his subsequent writings, he was an official with increasingly important political responsibilities, what might be called a technocrat.[84] Paleocapa was trained and worked in a period when history still played a central role in political legitimacy, including hydraulic policy.[85] In his writings, history was no longer used as a source of empirical knowledge, but mainly for rhetorical purposes.

This role is still evident at the start of the twentieth century. When seeking to implement hydraulic improvement works linked with modernizing the territory's economy, local elites—particularly the technical elite—increasingly insisted on measures that took account of the peculiarities of the Veneto context.[86] They emphasized the area's uniqueness compared to the rest of Italy, not just hydrographically, but above all in terms of the historical events behind water management.[87] This insistence bore fruit in 1907, with the creation of a new dedicated office, the Magistrato alle Acque, responsible for all Venetian provinces. This name evidenced clear continuity with the republic's homonymous magistracy.[88] The new office's leaders continually asserted this link. They deliberately associated future technical-scientific work with initiatives celebrating the Venetian hydraulic tradition, of which they considered themselves the heirs.[89] In doing so, they mobilized the past to engineer the future.

Giacomo Bonan is assistant professor in modern history at the University of Turin. He has worked at the Royal Institute of Technology in Stockholm, the University of Italian Switzerland, the University of Bologna, the Goethe-Universität Frankfurt, the Rachel Carson Center at Ludwig-Maximilians-Universität in Munich, and Ca' Foscari University of Venice. His works include *The State in the Forest* (White Horse Press, 2019) and *Le acque agitate della patria* (Viella, 2020). He would like to thank Marco Cavarzere, David Gentilcore, Simon Stott, and the *Technology and Culture* editors and reviewers. The author gratefully acknowledges funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation program (grant agreement no. 833834, "Water-Cultures, The Water Cultures of Italy, 1500–1900").

84. Maccagni, "Pietro Paleocapa." On the genesis of technocracy: Fumian, "Le origini della tecnocrazia."

85. Cavarzere, *Historical Culture*.

86. Bonan, *Le acque agitate*, 63–64.

87. Veronese, "La laguna di Venezia."

88. Rusconi and Ventrice, *Magistrato alle Acque*; Ballini, "La nascita del Magistrato alle Acque."

89. For notable initiatives from 1916 (including monographs on "Ancient writers of Venetian hydraulics"): Ventrice, "Nota introduttiva," 7–11. Also Averone, *Saggio sull'antica idrografia veneta*.

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