Hard and soft governance mechanisms for large projects. A historical perspective

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Abstract

Purpose – Drawing motivation from the greater exposure to uncertainty and condition changes that affect large projects due to their long lifecycle, this paper aims to investigate how the time factor affects the use of governance mechanisms to pursue the success of these projects.

Design/methodology/approach – To pursue its aim, the article applies the dichotomization between the hard and soft mechanisms of project governance to the analysis of a historical case study, whose findings are organized over the short, medium and long periods. The case selected is referred to the peculiar water system, made up of tunnels named "bottini," that was in use in Siena (Italy) as the old aqueduct. Specifically, the study focuses on the project of expansion of this water system that was realized during the 14th century for the construction of the "Bottino maestro di Fontegaia."

Findings – This article highlights the different relevance that, during the lifecycle of large projects, is assumed by hard and soft governance mechanisms, with the former having main relevance in a short and medium period, and the latter usually emerging in the medium period and, subsequently, playing a growing role for the project success in the long period.

Originality/value – The article contributes to the literature on large projects by providing novel insights about how the time factor impacts the governance of these projects. Furthermore, the case study, with its unique history, highlights the relevance of combining effectively the hard and the soft dimensions of project governance to pursue success.

Keywords Large projects, Project governance, Water system, Governance mechanisms, Hard and soft project factors, Accounting records

Paper type Research paper

1. Introduction

Based on the extant literature (e.g. Lester, 2007; Turner, 2016; Flyvbjerg, 2017), a project can be considered as a series of activities and tasks – performed in parallel or in series – that: have a specific objective (scope) to be completed within some specifications (requirements); have defined start and end dates; have funding limits; consume and/or utilize resources.

Ultimately, a project may be regarded as a unique and nonrepetitive series of actions, aimed at delivering a certain result, given specific constraints. Unfortunately, reports and statistical analyses demonstrate that the percentage of failure of projects can reach astonishing levels, and this situation has taken place for quite a long time and across various industries (Hughes *et al.*, 2017).

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Previous studies have witnessed recurrent issues, such as projects that often go over budget and time and have low-quality outputs and substandard customer satisfaction (Abbasi *et al.*, 2014). Notably, such issues seem to be even more relevant when the complexity and size of the projects increase, as happens with large projects (Rezvani and Khosravi, 2019) compared to smaller ones (Rowe, 2020). Nonetheless, the analysis of large-scale projects allows for gaining extensive learning about past project management practices to be subsequently used to solve main challenges in the overall field in the future (Procter and Kozak-Holland, 2019).

Great attention has been consequently devoted to the root causes underlying the failures of projects (e.g. Pinto and Mantel, 1990) or contributing to its success (e.g. Nixon *et al.*, 2012). Among them, a growing literature has pointed out that project management tools, principles and approaches, beyond having to be classified in the "hard" and the "soft" dimensions (e.g. Crawford and Pollack, 2004; Gustavsson and Hallin, 2014), are to be complemented with appropriate project governance (i.e. the used structure of authority, processes, etc.) (e.g. Biesenthal and Wilden, 2014; Pinto, 2014), which should provide "a comprehensive, consistent method of controlling the project and ensuring its success" (Project Management Institute, 2013, p. 34). However, several aspects of project governance mechanisms are yet to be explored to strengthen their potential in pursuing a project success (e.g. Bekker, 2014; Davies *et al.*, 2018; Lovallo *et al.*, 2023), particularly about large projects (Engelhart *et al.*, 2023), whose greater complexity and duration – in comparison to small ones – make them more subject to unexpected events undermining their effective conclusion (Rezvani and Khosravi, 2018; Lovallo *et al.*, 2023).

This study aims to extend the research on project governance by investigating how the time factor affects the use of governance mechanisms to pursue the success of large projects.

To pursue its aim, the study adopts a historical perspective (e.g. Parker, 1999; Carnegie, 2014) to provide several data that, organized over the short, medium and long periods, could be interpreted according to the hard and soft mechanisms of project governance. Moreover, according to Tennent (2021, p. 91), "the study of projects as the unit of analysis forces the researcher to use sources from multiple archives, creating the diversity of perspective and new opportunities for understandings of organisational phenomena."

This study specifically focuses on the project aimed at the construction of the "Bottino maestro di Fontegaia" that was realized within the peculiar old water system of Siena (Italy) by the so-called "Governo dei Nove" approximately between 1334 and 1356. Based on the findings of this historical case study, this article argues the different importance assumed over time by hard and soft governance mechanisms of large projects, with the former having greater relevance in the short and medium periods and the latter usually emerging in the medium period and, subsequently, playing a growing role for the project success in the long period. In so doing, the study supports both scholars and practitioners engaged in understanding large projects by specifically contributing to inspecting how the governance mechanisms of these projects evolve over time and how a different combination of hard and soft governance mechanisms affects the realization of large projects in the short, medium, and long period.

The article is structured as follows: Section 2 provides a brief literature review of the main characteristics and challenges associated with the success of projects and large projects, emphasizing the role played by project governance mechanisms in this context; Sections 3 and 4 respectively depict the research design and the historical setting under investigation; Section 5 provides the findings emerging from the analysis of the case study, which are then discussed in Section 6; finally, Section 7 summarizes the conclusions of the study, besides indicating its limitations and some ideas for further research.

2. Literature review

2.1 Large projects and critical factors for project success

To understand projects, extant literature suggests several criteria for their classifications, for instance referred to projects type (differentiating construction, maintenance and upgrade projects – Winch, 2009), application (as for the distinction between software development and product development projects – Cerpa and Verner, 2009), actors (e.g. recognizing private, public and private-public projects – Dalsgaard, 2012) and complexity (for instance, considering the number of units involved or the size, thereby distinguishing small projects from large, or even mega projects – e.g. Rowe, 2020; Flyvbjerg, 2014; Rezvani and Khosravi, 2018 and 2019; Procter and Kozak-Holland, 2019; Lovallo *et al.*, 2023). This study concerns large-scale projects (e.g. Flyvbjerg, 2017), which are usually characterized by a few main features, such as (Sanderson, 2012) delivering substantial pieces of physical infrastructure or capital assets with a life expectancy of decades, having a government or public sector organizations as main client, and with the main contractor (or consortium of contractors) being usually privately-owned and financed.

Projects are overall challenging to plan and manage and critically depend on project conditions and the ability of project managers to design, execute and control properly all the needed tasks (Flyvbjerg, 2007; Rezvani and Khosravi, 2018). In addition, project conditions may change over time (Sterman, 2000), quite frequently as a result of feedback responses, time delays and accumulations of project progress and resources (Flyvbjerg, *et al.*, 2003; Lyneis and Ford, 2007), thereby leading to project revisions, extensions or, even, failure (Friedrich *et al.*, 1987).

Extant literature has provided several examples and classifications of the factors that might induce projects to fail, as shown by Pinto and Mantel (1990) in spotting causes of failures by project managers or parent organizations, or by Cerpa and Verner (2009) that identified practices affecting negatively software project outcome. Other works have instead explored how key factors act in the context of public and governmental projects, as in Damoah and Akwei (2017) about Ghana. In addition, when examining cases in the field of project management, previous studies have searched for the critical factors favoring a successful conclusion (e.g. Ika, 2009; Alias *et al.*, 2014), specifically pointing at the so-called "hard" and "soft" factors (Crawford and Pollack, 2004).

Such a dichotomization has characterized project management for a long time, leading to several classifications, starting from differentiating hard and soft projects (Atkinson *et al.*, 2006) to continue applying such distinction to any characteristic of the project and project management activities – e.g. in terms of the approaches, structures, skills, and processes put in place during all the phases of a project management intervention (Gustavsson and Hallin, 2014). In summary, hard and soft are used to distinguish projects (Atkinson *et al.*, 2006) on the hard end of the spectrum – i.e. projects with clearly defined goals that value technical performance and efficiency, which are managed by monitoring and control, and where success is measured only in quantitative terms –, or on the soft end of it – i.e. projects with ambiguously defined goals that value relationships, culture and meaning, which are managed by negotiation and discussion, and where success is measured in qualitative measures only (Crawford and Pollack, 2004).

Notably, when investigating the determinants of project failure (or success), it is crucial to consider at least three additional aspects, which can be summarized as follows.

First, the factors and biases generating project changes, revisions and delays (Flyvbjerg, 2021) may also produce side effects and adverse dynamics (Sterman, 2000), as well as concern both project-related activities (such as ripple effects; Lyneis and Ford, 2007) and human-related consequences (such as negative emotions and demotivation for the people involved; Shepherd *et al.*, 2013).

Second, path dependency may emerge within the lifecycle of a project, especially considering the microlevel of decision-making (Zerjav, 2015). In detail, decisions taken in the past about the project and its activities do not only tend to limit its scope, but also collide with present and future decisions (Sterman, 2000).

Third, the factors determining the failure or success of a project are usually not operating in isolation but jointly and, subsequently, require an overall and systematic consideration and analysis (Gupta *et al.*, 2019), as embedded in the concept of "project governance" detailed in the following section.

2.2 Project governance for success: concept, dimensions and effectiveness

Within the literature on project success, "project governance" is a key concept, although it is differently outlined (see Ahola *et al.*, 2014, for a review of the term and its origins). For example, Pinto (2014, p. 383) defines project governance as "the use of systems, structures of authority, and processes to allocate resources and coordinate or control activity in a project" whereas the Project Management Institute (PMI) defines it as "an oversight function that is aligned with the organization's governance model and that encompasses the project lifecycle [. . .] [as well as] provides a comprehensive, consistent method of controlling the project and ensuring its success" (PMI, 2013, p. 34).

Overall, project governance is a multilevel concept (Biesenthal and Wilden, 2014) that requires considering several dimensions of decision-making related to all the phases of a project, from its design to the allocation of the resources, the implementation of all the necessary phases and the ongoing activities of controlling the progress and monitoring actions and results. Extant literature has witnessed that this concept has steadily acquired relevance (Biesenthal and Wilden, 2014), and three principal "schools of thought" can be identified (Ruuska *et al.*, 2011; Bekker, 2014) based on the variety and level of actors' involvement: a) the "single-firm school" refers to a situation where a single organization is the ultimate decision-making authority, thereby having complete control over policies, processes and activities of projects; b) the "multifirm school" addresses the governance principles concerned with two or more organizations participating on a contractual basis in the same project; c) the "large capital school" considers projects as temporary organizations, forming their entity and establishing governance principles at an institutional level. By adopting the latter approach, projects can be even seen as hybrid or network-like structures (Provan and Kenis, 2008) involving multiple interconnected actors under the guidance of one supreme hierarchical authority.

Project governance can be analysed according to additional criteria such as the one proposed by Morris and Geraldi (2011, pp. 20–23) who identified three functional levels of governance mechanisms: Level 1 – Technical (operational and delivery-oriented); Level 2 – Strategic (considering projects as organizational holistic entities with a concern for value and effectiveness); Level 3 – Institutional (acting on the institutional environment by creating the context and support for projects to flourish). Based on this criterion, the design and implementation of projects at the operational and technical levels should be necessarily complemented, supported, and even enhanced at strategic and institutional levels (Klakegg and Artto, 2008; Bekker, 2014).

Project governance mechanisms subsequently entail technical actions strictly related to how the project is designed and carried out, as well as managerial decisions at the level of the organization, thereby involving additional actors and functions (such as the board of directors or middle managers). In these terms, the governance of projects necessarily coexists and is aligned with the corporate governance framework of the organization(s) involved (Müller, 2009; Joslin and Müller, 2016), i.e. there is a bidirectional relationship between project governance and corporate governance (Joslin and Müller, 2015). According to Müller (2009, p. 17), the main goal

of project governance is indeed: "the alignment of the objectives at the different management levels of the organization to allow for most effective and efficient project planning and execution, within the boundaries of corporate governance".

The pursuit of this goal is influenced by the coexistence of several factors, which are related not only to the project itself (such as its size or type) but also to the organization governing the project, such as its stakeholder complexity (Ruuska *et al.*, 2011), or the functional positioning of the project within the organization's activities (Bekker, 2014). Moreover, embracing the concept of project governance entails deepening the analysis beyond the consideration of day-to-day technical and supporting activities to consider the relationships, values, motivations, interests, and even personal agendas of the actors responsible for the project and the organizational activities (Sanderson, 2012).

Whereas previous research has already investigated some of these factors in various domains (e.g. the IT industry, Wang and Chen, 2006), in connection with different topics (e.g. the optimization of the management of projects – Too and Weaver, 2014), or analyzing their impacts on project success (e.g. Joslin and Müller, 2016), some areas of research are yet to be explored or deepened.

For example, Bekker (2014, p. 22) emphasized how it is "evident that further research is required to incorporate other governance variables and related theories [. . .]. The development of project governance frameworks should also consider the complexity of projects". In addition, Song *et al.* (2022) underlined that several scholars have introduced novel lenses and metaphors from multiple disciplines (Geraldi *et al.*, 2021), for example including organization studies (Clegg *et al.*, 2002), public administration (Song *et al.*, 2022), urban development (Valverde and Moore, 2019) and environmental management (Sparrevik *et al.*, 2018), thereby opening spaces for further research about the contexts in which governance activities take place.

Overall, this is coherent with the recent calls for interdisciplinary research approaches unveiling the complex realities of project governance (Davies *et al.*, 2018) whose analysis can reflect the cited dichotomization between the "hard" and the "soft" dimensions of projects (Gustavsson and Hallin, 2014). By adopting the distinction between these dimensions – that is traditionally accepted in the project management literature (Crawford and Pollack, 2004) – the hard governance mechanisms specifically reflect the rational and technical side of projects, whereas the soft ones can be associated with the human side of projects (Gustavsson and Hallin, 2014). Stated differently, if hard governance relies on structures and processes, soft governance is focused on people and social aspects such as behaviors and collaborations (Smits and van Hillegersberg, 2018).

However, useful insights for this distinction can also derive from the literature on the governing mechanisms of governments (e.g. Howlett, 2009; Zamanifard *et al.*, 2018), which extensively adopts a similar criterion to distinguish hard mechanisms, usually associated with legislation and other kinds of mandatory regulations, from soft mechanisms, corresponding to nonbinding tools such as recommendations and guidelines (e.g. Abbott and Snidal, 2000; Brandsen *et al.*, 2006). In this literature, the classification of these mechanisms can rely on additional characteristics, such as the provision of a related sanctioning system, the precision in contents, the flexibility or availability to adaptation, and the authoritative instead of participatory logic underlying their definition (Blomqvist, 2022, p. 287). Even if formulated according to the aforementioned dichotomization, these characteristics can give rise to different combinations of governing mechanisms, with hardness (rather than softness) representing the main (instead of exclusive) dimension, which can be adapted to extend theories and knowledge on project governance as advocated by the literature (e.g. Bekker, 2014; Song *et al.*, 2022).

Within this context, we particularly agree with Engelhart *et al.* (2023, pp. 218–219) when they call for further research addressing the many still open questions on the governance of large projects because the several actors involved with their different governance constructs, or the variety of contextual conditions, temporal factors and dynamics influencing the control and coordination of these projects. Indeed, several calls for more research specifically underline a research gap about the role played by governance mechanisms in ensuring the correct design and deployment of a project (e.g. Joslin and Müller, 2016), for instance, through the balanced consideration of the various actors (Song *et al.*, 2022), or levels here involved (Bekker, 2014). Specifically, the time factor (Engelhart *et al.*, 2023) assumes great relevance for this research since the duration of large projects – which is longer in comparison to small ones – makes them more subject to uncertainty and the occurrence of conditions changes along their development (Sterman, 2000).

The considerations above provide the main justifications for this study, which aims to contribute to the cited research gap on project governance by investigating how the time factor affects the use of governance mechanisms to pursue the success of large projects.

3. Research design

This study relies on the theoretical insights on large projects applied to the analysis of a case study (Yin, 2009) by adopting a historical perspective, as extensively applied to investigate contemporary organizational issues and suggest management developments (e.g. Safari and Parker, 2017; Sargiacomo *et al.*, 2023; Giorgino, 2024). Indeed, the critical evaluation of the past allows "rediscovering narrative" (Parker, 1999, p. 21) and formulating different interpretations of historical data by developing business-related theories or suggesting interdisciplinary viewpoints (Parker, 1999; Carnegie, 2014). Moreover, although studying projects supports the development of new perspectives to understand organizational phenomena (Tennent, 2021), the reference to a historical case specifically allows us to develop the analysis according to the time factor, as required by the aim of this study.

The time under investigation covers the period in which Siena was ruled by the so-called "Governo dei Nove" (Government of the Nine) – i.e. 1287–1355 – and specifically the years related to the realization of the ambitious project of expansion of the peculiar water system of Siena (i.e. its old aqueduct) through the construction of the so-called "Bottino maestro di Fontegaia". This project, aimed at bringing the water to the city center, was launched in 1334 and mostly completed by 1356.

As for the motivation for this choice, it is to stress that all historical records (e.g. Cipolla *et al.*, 1987; Catoni, 2008) identify the years between the end of the XIII century and the first half of the XIV century as the period of maximum development and growth for Siena, specifically pointing to the role played by the Government of the Nine at the head of the Municipality. The period under this Government is widely recognized as one of great political and economic splendor for Siena (e.g. Bowsky and Bowsky, 1981), which gradually expanded throughout the southern part of Tuscany to become one of the major powers of the High Middle Ages, as well as a primary center for commercial, financial and artistic activities for the whole Europe (Catoni, 2008). During its tenure, the Government of the Nine promoted some of the most relevant and impressive construction projects of Siena (Giorgi and Moscadelli, 2005; Causarano, 2009; Hub, 2012), such as the Palazzo Pubblico (City Hall, 1297–1325), the Torre del Mangia (1325–1348) and the expansion of the Cathedral (1284–1311). At this time, great artists such as Duccio di Buoninsegna, Ambrogio Lorenzetti, and Simone Martini were active in the city (Cateni and Mazzieri, 2003).

In the same period, the project of expansion of the water system represented a main innovation for the city of Siena, and it entailed the investment of relevant financial resources

as well as the employment of various categories of employees and the involvement of several stakeholders (Balestracci, 1990, 2006). In these terms, it represents a historical hypothesis of a large project, as we will better explain subsequently.

The books held by the "Consiglio Generale della Campana" ("General Council of the Bell") and the "Magistrato della Biccherna" (or, only, the "Biccherna") served as our primary sources. Notably, the General Council was a representative body of the Sienese governments of the time, whereas the Biccherna was the most important and oldest financial office of the Municipality of Siena (Bowsky and Bowsky, 1981; Minnucci, 2002). As described by Giorgi *et al.* (2019, p. 32): "during the Government of the Nine (1287–1355), the Biccherna was the central administrative body of the city, in charge of all payments to officials and citizens working for the Comune [i.e. Municipality]. All main incoming funds from the collection of taxes passed through the Biccherna, either directly or by way of other offices." These sources are nowadays stored at the State Archive of Siena, whose heritage includes the Biccherna's books for the years 1226–1786 and the deliberations of the General Council from 1248 to 1808. For the period covered by this study, these sources are almost complete, with only a few pages missing (as for the Biccherna's book n. 186 of 1336, in which the last sheets are missing) or torn (as for the Biccherna's book n. 228 of 1351, containing some sheets gnawed by mice). However, to facilitate their conservation, the Archive is promoting the digitalization of these documents so that the deliberations of the General Council can now only be consulted in digital format.

Table 1 reports the complete list of the primary sources consulted for this study.

Notably, the citation of these primary sources will be completed by the page of reference, indicated with the letter "f" (which stands for "folio"), and eventually with the addition of the letter "v" (i.e. "verso") after the Roman number to denote the back of the page.

Documents	Volume no. and data
Books of the General Council of the Bell (Cons. Gen. Delib.)	• Vol. 116, 16 December 1334 • Vol. 120, 28 April 1337 • Vol. 125, 15 December 1339 • Vol. 134, 19 March 1343 • Vol. 140, 13 April 1347 • Vol. 145, 26 November 1349
Books of the Biccherna (Bicch.)	• Vol. 186, 18 December 1336 • Vol. 209, 31 December 1341 • Vol. 213, 28 November 1343 • Vol. 219, 20 May 1346 • Vol. 223, 30 April 1348 • Vol. 227, 30 June 1351
Books of the Concistorio (Concist. Delib.)	• Vol. 8, 18 January 1356

Source: Table by the authors

Table 1. List of the primary sources used in this study

Several secondary sources were also used, specifically to describe the main characteristics of the historical period chosen for this study (e.g. Bowsky and Bowsky, 1981; Douglas, 2000; Minnucci, 2002; Kucher, 2005; Catoni, 2008; Hub, 2012) and to collect additional information about the construction of the bottini composing the peculiar water system of Siena and, more specifically, the project that is analyzed in this research (e.g. Bargagli Petrucci, 1906; Balestracci, 1990; Balestracci, 2006; Boschi, 2007).

4. The historical context

A city of Etruscan-Roman origins (Catoni, 2008), Siena experienced consistent growth after the year 1000 (Boschi, 2007) because of its organization as a Republic (in 1125) and the construction of the Via Francigena, a vital link between Rome and northern Europe (Kucher, 2005).

As mentioned (e.g. Cipolla *et al.*, 1987; Catoni, 2008), the period under the Government of the Nine (1287–1355) is considered as the one of maximum economic and civil development of Siena (Balestracci, 1990), also for the realization of numerous and impressive construction projects that contributed to confer the epithet of "good" (i.e. the "Buon Governo") to this Government, as represented in the well-known fresco by Ambrogio Lorenzetti.

Considering the economic wealth of Siena, it is remarkable the role played by the bankers and the merchants of the city (Cipolla *et al.*, 1987) and the many industries that were significant at the time, such as wool merchants, leather makers and dyers (Boschi, 2007). These businesses not only were progressively replacing the old economy based on agricultural activities (Pulselli *et al.*, 2010) but also "allowed the city to grow to nearly fifty thousand inhabitants by the 1320 s [a figure even said to be around 80,000, for Rugani *et al.*, 2011] — only half that of Florence-a figure that was not attained again until the twentieth century" (Kucher, 2005, p. 3) and comparable, or even higher than, what Paris and London had at the time (Douglas, 2000, p. 102).

Notably, the growth of Siena was also evident in an expanded control of the surrounding geographical areas, as Bowsky and Bowsky (1981, p. 4) emphasized: "at the height of its territorial expansion for the entire regime of the Nine, Siena claimed general rule and supervision over an area of roughly thirty miles in radius from the city."

Several secondary sources (Bargagli Petrucci, 1906; Balestracci, 1990; Kucher, 2005; Minnucci, 2002; Boschi, 2007; Catoni, 2008) witness that within this context of development new needs were emerging: the expansion of the city beyond its original nucleus required new urban solutions (houses, streets, buildings, etc.) and, also, water in abundance to support the lives of Sienese citizens and the business activities operating in the city. Indeed, water represented a fundamental good for craft activities (e.g. for grinding grain and washing leather) and for farmers (e.g. processing their crops and livestock) but also to satisfy drinking and household needs, and guarantee the safety of the city, being used to extinguishing the fires that frequently spread in the crowded streets and menaced people, houses and business units (Balestracci, 1990; Douglas, 2000; Minnucci, 2002; Boschi, 2007).

Unfortunately, Siena suffered from a severe shortage of water, unlike neighboring cities such as Florence and Pisa, thereby justifying the interest and effort of its governments since the establishment of the Republic (Boschi, 2007). Indeed, already in the XIII Century, Siena's governments had explored ways and launched projects to bring water to the city from distant rivers (Balestracci, 2006). These projects were mainly based on the construction of some tunnels running underneath the city and named "bottini" for their resemblance to a "botte" (i.e. a barrel), which were devoted to capturing the rainwater filtering underground (Bargagli Petrucci, 1906; Balestracci, 1990 – see Figure 1).

Source: Figure courtesy of "La Diana" Association

Figure 1.
Examples of Siena's bottini

Each "bottino" was specifically dug underground in between two different layers of sand that characterize the Sienese hills: an upper one with yellow sand (Pliocene sandstone), porous and permeable, which filters rainwater, and the other one, in the area below, made of compact and impermeable blue clay, that collects the water (Baldi, 2006). The bottino had to be dug with a calculated slope using the so-called "archipendolo." The water collected by percolation was then transported through the bottino by using a small channel ("gorello") excavated in it, to the city and its fonts (Pulselli *et al.*, 2010). To ensure the water purification, the slope given to the bottino was minimal (1 / 1000, to let water deposit impurities), and several settling tanks ("vasche di decantazione") were built to make the limestone in the water deposit (Rugani *et al.*, 2011).

Within this context, the Government of the Nine looked for a durable solution to the city's issue of water availability by promoting some exceptional intervention projects to widen the water system. This study specifically focuses on the project that was launched in 1334 to build the "Bottino maestro di Fontegaia" that became one of the most relevant bottini of Siena in addition to the already existing and older "Bottino maestro di Fontebranda" (Balestracci, 2006; Boschi, 2007).

5. Findings

5.1 Preliminary information

The analysis of our sources demonstrated that the expansion of the water system of Siena under the Government of the Nine was facilitated by the decisions and activities of the numerous authorities and officials having jurisdiction over water matters.

These authorities first included the General Council, which had legislative functions and was called upon to discuss all the relevant matters for the Municipality of Siena (Bargagli Petrucci, 1906). The Biccherna was instead in charge of the main transactions, just like any organizational and financial-related matter about the water system, such as the Operai's selection and payment. The Operai were usually required to comprehensively manage all the activities on the bottini, including technical direction and continuous vigilance, thereby acting as officials on behalf of the Municipality (Bargagli Petrucci, 1906, pp. 90–91): specifically, they could receive funding for commissioned work in advance, but more frequently they provided for the payment of wages to the workers and subsequently

transmitted monthly the expense notes to the Biccherna, which refunded the expenses incurred.

If, initially, the Operai acted like mere supervisors and no other authorities were involved in the works on the bottini, this situation radically changed when, in 1334, the ambitious project regarding the "Bottino maestro di Fontegaia" was approved.

This project aimed at bringing water to Piazza del Campo. This square, placed in the center of Siena, was the most important square of the city for several political, economic and social reasons: it hosted the Palazzo Pubblico (City Hall), constituted the center of Siena's businesses (since the market took place there and it was where lenders and money changers carried out their activities), and the most powerful Sienese families lived nearby it (Balestracci, 2006). Based on these reasons, as well as in consideration of the difficulties in bringing water from the north of Siena to its heart (Balestracci, 1990), the construction of this bottino with the associated font had "a history of its own, different from that of the other Sienese fonts" (Bargagli Petrucci, 1906, p. 209), as reconstructed below.

5.2 Conditions and first phase of the "Bottino maestro di Fontegaia" project

The role of designer and person in charge of the project was assigned to master Iacopo "di" (i.e. son of) Vanni di Ugolino (Balestracci, 2006), who had to act not as an official for the Municipality but as an "impresario" or contractor. Indeed, he assumed the benefits and burdens of this "new project based on the risk" (Bargagli Petrucci, 1906, p. 91), as it had never happened for previous works related to the water system of Siena. The terms of the agreement – regarding both duties and compensations – were accurately defined in the contract signed by master Iacopo, reporting that "for the price of six thousand gold florins master Iacopo promises [. . .] to bring [. . .] as much [. . .] water as that which derives and arrives at the Branda font to the Piazza del Campo of the Municipality and the city of Siena" [A1] (Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxvij^{v}-lxviij) (Appendix).

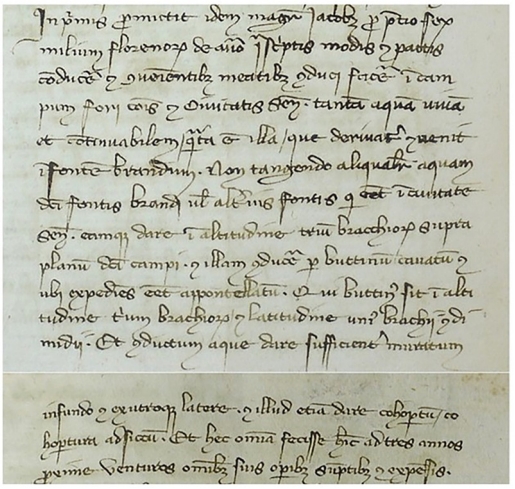
The contract defined the project goals in terms of costs (i.e. 6,000 golden florins), size of the bottino (3 arms in height and 1.5 arms in width), type of coating for its walls, and deadlines (three years), with master Iacopo's commitment to assume all the expenses related to the project realization (see Figure 2). Notably, in that period, a golden florin corresponded to 2.3 "lire" representing the main currency of the monetary system in adoption.

These expenses were, first of all, related to the salaries and, sometimes, meals of the various categories of workers that directly participated in the excavation (i.e. skilled and unskilled diggers) and contributed to reinforcing the bottino walls or were responsible for transporting the materials produced by the excavations (carriers), as well as to the tools to be used in the works (e.g. shovels, hoes, and picks) (Balestracci, 2006).

According to the contract, the compensation had to be paid by the Biccherna to master Iacopo gradually, with the transfer of "300 gold florins from here [i.e. December 1334] until the entire following month of July, for each request of the same master Iacopo to be spent continuously on the said project" [A2 (Appendix)] (see Figure 3). For his part, master Iacopo had to promise an appropriate deposit and put some assets as a guarantee, committing jointly himself and his family members to the project success [A3 (Appendix)] (see Figure 3).

Further specifications were added regarding inconveniences that could impact the works and deriving, for example, from the risk of landslides during excavations, thereby requiring additional interventions of "propping up" of the bottini with strong armors at master Iacopo's expenses [A4] (see Figure 2).

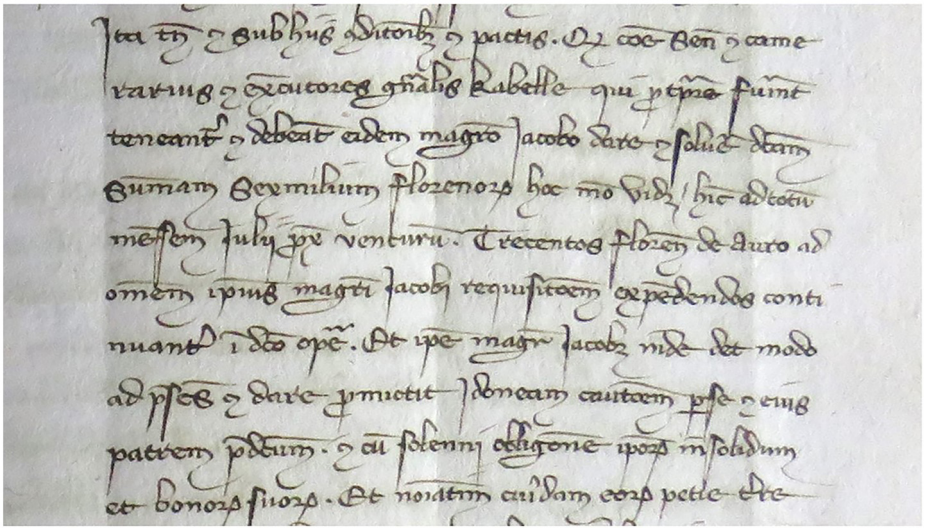
Additional issues for the excavations could result from the presence of big stones along the bottino trajectory, therefore requiring additional investments of time, effort, and money (for workers and equipment), specifically to drill a hole in the stones with the simple tools



"In primis promictit idem magister Iacobus pro pretio sex milium florenorum de auro, infrascriptis modis et pactis, conducere et convenientibus meatibus conduci facere in Campum Fori Comunis et civitatis Senarum tantam aquam vivam et continuabilem, quanta est illa que derivatur et venit in fontem Brandum, non tangendo aliqualiter aquam dicti fontis Brandi, vel alterius fontis qui esset in civitate Senarum, eamque dare in altitudine trium bracchiorum super planum dicti Campi et illam conducere per buttinum cavatum et ubi expediens esset, appontellatum. Qui buttinus sit in altitudine trium brachiorum et latitudine unius brachii et dimidii, et conductum aque dare sufficienter muratum in fundo et ex utroque latere et illud etiam dare cohopertum, cohopertura ad siccum. Et hec omnia fecisse hinc ad tres annos proxime venturos omnibus suis operibus, sunptibus et expensis"

Source: Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxvij^{v}-lxviij (figure courtesy of the State Archive of Siena, Prot. 693-A/2024 – further reproductions of this material are expressly prohibited)

Figure 2.
Conditions and goals of the contract signed by master Iacopo



Source: Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij (figure courtesy of the State Archive of Siena, Prot. 694-A/2024 – further reproductions of this material are expressly prohibited)

Figure 3.
Financial details and guarantees of the contract signed by master Iacopo

available at the time (e.g. shovels, hoes, and picks). In this case, it was established that the financial support of the Municipality would not be lacking: "if a stone is found in digging in the aforesaid bottino, the Municipality of Siena, at its own expense, would make it to be excavated and carefully hauled and raised, after the said master Iacopo calculates the quantity of the said stone due to him in proportion to [the realization of] another bottino without stones" [A5] (see Figure 4). Similarly, repairing any damage caused by master Iacopo's works would have remained the responsibility of the Municipality of Siena [A6] (see Figure 4).

According to secondary sources (e.g. Bargagli Petrucci, 1906, and Balestracci, 2006), the expected speed of the works, which had to be completed in just three years, was likely because of the adoption of an original digging technique that was different from the simpler one used for the previous bottini. The old method, which entailed starting from a single access point to the underground, was very slow because the restricted size of the tunnels did not allow more than one man at a time to work. Having to comply with the deadline set in the contract, master Iacopo instead proposed to carry out the excavation starting from at least two different points, namely with two tunnels proceeding in opposite directions to meet subsequently at an intermediate point. Along the route of the bottino, some wells ("smiragli" or "sboccatori") were built to facilitate the disposal of the excavated debris and the burial of the construction material, as well as to verify and, possibly, correct the direction of the tunnels (Balestracci, 2006). Their presence arises by the accounting records reporting the payment made by the Biccherna in favor of the citizens who had suffered damage to their properties because of the construction of these wells (e.g. "2 lire to Baldino Neri, to compensate for the damage that was caused to him in the district of Vico to make the smiragli for the water reaching [Piazza del] Campo, as it was estimated by the officials appointed to evaluate such damage" [A7] (Biccherna, Vol. 223, 30 April 1348, f. cxxxiij).

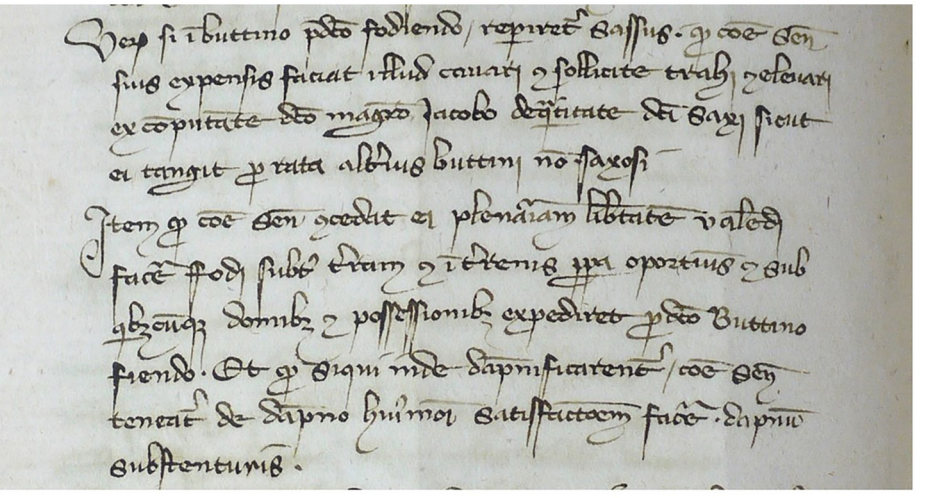


Figure 4.
Additional financial responsibilities of the Municipality of Siena in the contract with master Iacopo

Source: Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij^{v} (figure courtesy of the State Archive of Siena, Prot. 694-A/2024 – further reproductions of this material are expressly prohibited)

5.3 Progression and second phase of the project

Unfortunately, the project history differed from the initial plan, both in technical and economic terms. The difficulties encountered in the excavations slowed down the progress of master Iacopo's work and caused more damage than expected, to the point that, in 1336, even a road was demolished because of the construction works (Bargagli Petrucci, 1906). As agreed, the Municipality had to pay the damages, but this expense probably led to the rescission of the contract with master Iacopo, based on the past tense ("dovea menare", i.e. "*had* to bring") used in the accounting record reporting this payment (of 10 lire) [A8] (Biccherna, Vol. 186, 18 December 1336, f. xlvj^{v}).

Notably, our primary sources do not explicitly confirm this rescission, but the contract certainly could not have ended well if, in 1337, master Iacopo presented a plea to the General Council (Bargagli Petrucci, 1906). In this circumstance, although reaffirming his confidence in the project, he also complained about the inadequacy of municipal funding and that he "was not able to properly respect the promise because he could not put in the perfect effort that he should give [for the project realization], even if he had put [in the project] all his possessions, so much so that, for the same reason, he was reduced to poverty" [A9] (Cons. Gen. Delib. Vol. 120, 28 April 1337, f. xlvij^{v}-xlviij). Underlining the amount of expenses already incurred by the Municipality, master Iacopo also emphasized how it would have been inconvenient for everyone if the project of bringing water to Piazza del Campo remained unfinished [A10]: he consequently begged that the continuation of the work had to be financed to himself, who had already invested all of his money in the project or, alternatively, that the Municipality decided "to free master Iacopo from all obligations and promises made" [A11] (see Figure 5).

The General Council accepted the plea of Master Iacopo, who was granted further funding to continue the project, even though under the supervision of a new authority, as testified by successive primary sources (Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij). Specifically, "some" ("aliquos") "good and lawful men" ("bonos homines et legales") were appointed with "the power and authority" ("balia et potestate") to supervise the project of "bringing water to Piazza del Campo" ("conducende aque in Campum Fori") (Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij – see Figure 6, left side up). The appointment of these men acting as government officials could not last more than one year [A12], during which they could have the "power, authority and bailiwick" to carry out their duties [A13] (Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij^{v} in Figure 6, right side). Moreover, they were also assigned a camerlengo to report on the use of the funds.

Master Iacopo's works on the project then continued, but not without issues and resistances (Minnucci, 2002), such as the one advanced in 1338 by the wool makers ("lanaioli") to push the Municipality of Siena to approve a further expansion of the water system in the northern area of the city. Consequently, at the end of 1339, the project was still far from its completion, and some experts were appointed to decide if the works should continue or not [A14] (Cons. Gen. Delib. Vol. 125, 15 December 1339, f. lxiiij). Secondary sources (e.g. Bargagli Petrucci, 1906, p. 216) report that the experts' opinion was favorable and master Iacopo was able to continue the project even if no longer alone: he had to collaborate with two other masters (i.e. Lando di Pietro and Agostino di Giovanni), who had direct responsibility for the additional funds. Successive primary sources testify that, in the same period (December 1339), the General Council became convinced of the need to finance the project more massively and established that "all taxes and revenues coming, or which would have come from the city of Grosseto" had to be devoted "to this project until it was completed" [A15] (see Figure 6, left side down).

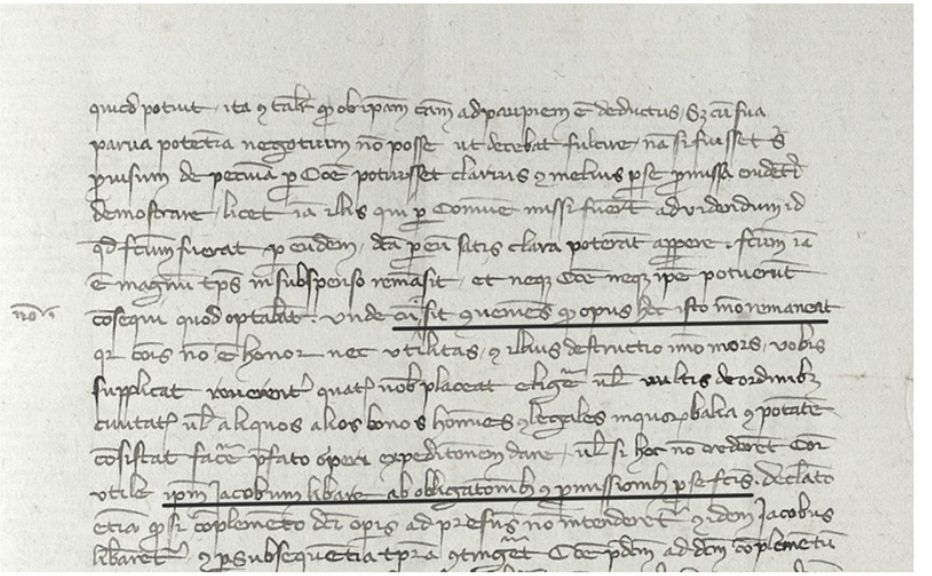


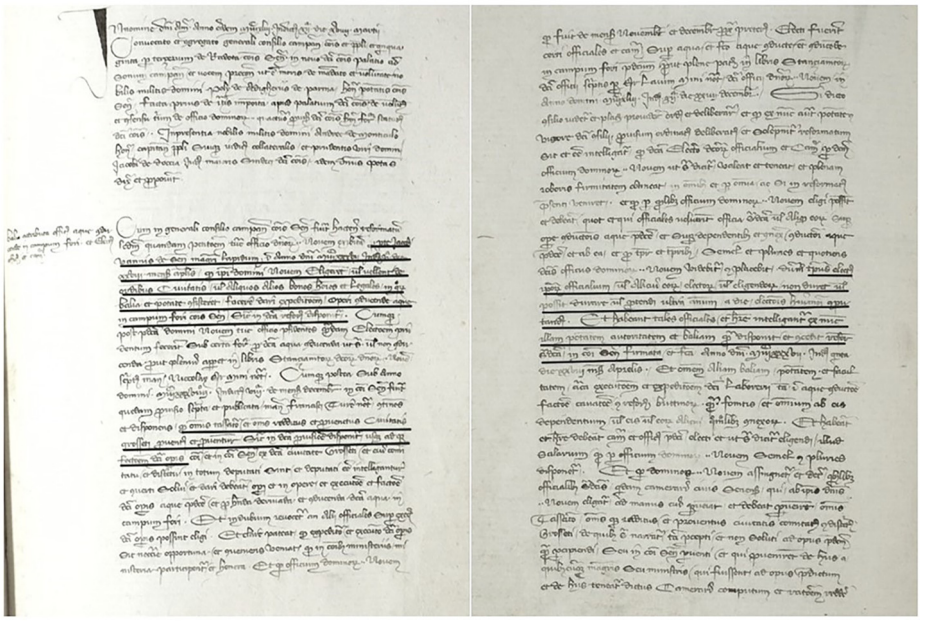
Figure 5.
Excerpt of master Iacopo's plea to the General Council

Source: Cons. Gen. Delib. Vol. 120, 28 April 1337, f. lxviij (figure courtesy of the State Archive of Siena, Prot. 694-A/2024 – further reproductions of this material are expressly prohibited)

Yet, in 1341, water had not yet reached Piazza del Campo, and three officials assumed the charge of the project, as highlighted by the Biccherna's record reporting their payment [A16] (Biccherna, Vol. 209, 31 December 1341, f. lv). Under their direction, the first water finally arrived in Piazza del Campo, and in 1343, the construction of a small and simplified font (precursor of the subsequent and monumental Fonte Gaia that would be placed there by Jacopo della Quercia in the early 1400s – see Balestracci, 2006 and Figure 7) started, at the expense of the Municipality, as testified by the Biccherna's records reporting the refunding of these expenses to Operai and guerchi (e.g. "to Figarino [i.e. a worker], for a lira of a tow for the font of Piazza del Campo" [A17], Biccherna, Vol. 213, 28 November 1343, f. lv).

However, some doubts remain about the origin of this water, which was still insufficient for the citizens' needs. The works on the project consequently continued under the direction of the successive officials who were entrusted, and thanks to the further funds provided by the Municipality. As usual, the payments are reported by the Biccherna's books, as in the case of the accounting record indicating the payment of 1,000 lire "to Scotto di Tino, Niccolò di Mino Vincenti, and Agnolo di Sir Conte, officials over the water of the Campo [in this period], to be expended and converted in their office", [A18] (Biccherna, Vol. 219, 20 May 1346, f. cxxxviiij^{v}).

These funds became even more significant in 1347 when it was clear that "the works for the water supply to the Piazza del Campo of the Municipality of Siena did not proceed with as much fervor as the Sienese citizens hoped and as it could have proceeded, not because of the fault or negligence of workers and officials, but above all because of the small amount of money assigned to them in the business" [A19] (Cons. Gen. Delib. Vol. 140, 13 April 1347, f. xxvij). Notably, an additional amount of 5,000 florins deriving from the taxes for the



Source: Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij-xxiiij^{v} (figure courtesy of the State Archive of Siena, Prot. 694-A/2024 – further reproductions of this material are expressly prohibited)

Figure 6.
Additional authority and conditions for the progression of master Iacopo's works on the project

Source: Picture taken by the authors

Figure 7.
A glimpse of current Fonte Gaia in Piazza del Campo reproducing the monumental font of Jacopo della Quercia of the early 1400s, nowadays saved at the "Santa Maria della Scala" museum

slaughtered meat sold in the city and nearby was allocated to the project to be completed in the following two years.

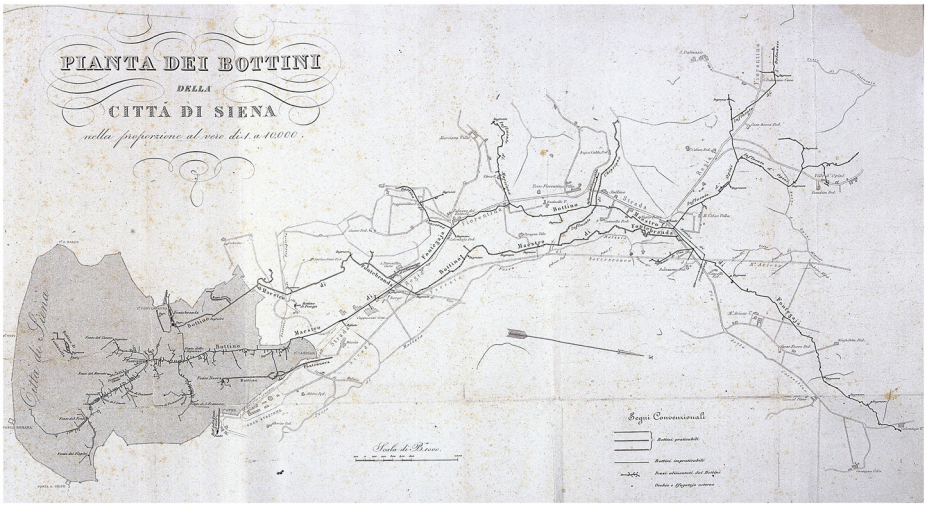
5.4 Third phase and conclusion of the project

Fifteen years after the start of the project, the "Bottino maestro di Fontegaia" had reached 3,600 meters in length, but it was necessary to look for further waterways that could compensate for the limited water flow of the bottino because of its shallow depth and construction on a layer of soil that was not perfectly impermeable (Bargagli Petrucci, 1906, pp. 38–40). In the same period, unfortunately, master Iacopo died, leaving his family in a condition of extreme poverty. Evidence of this is the plea that in 1349 master Iacopo's son (Giovanni) made to the General Council to emphasize his father's merit of having led "to discovering the fruitful and fortunate gift of the font Gaia" and also to complain about how, because of "slanders" ("malitia"), "the same master [i.e. Iacopo] had been ousted with his entire family" from this project [A20] (Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij). Moreover, Giovanni highlighted how he had "always assisted [his father] in the research and discovery of this water, dedicating all his work and study to this project," and his greatest desire was to contribute "so that the desired goal of the good citizens was achieved" [A21] (Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij).

The General Council responded to this request positively by establishing that Giovanni would have had "in perpetuity, every year, 150 lire of money from the Municipality of Siena", taking, for his part, the obligation "to do and carry out everything that his father master Iacopo had been required to do" [A22] (Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij). The Biccherna's books report the payments related to this perpetual income, divided into 75 lire per semester (e.g. Biccherna, Vol. 227, 30 June 1351, f. cxij^{v}). These payments lasted until the end of the Government of the Nine (1355), but after Giovanni's death, the new government (the so-called "Government of the Twelve") received the request to proceed with the project by Giovanni's sons (and master Iacopo's grandchildren) Domenico and Iacopo. Secondary sources report that this request was also accepted, and the new government granted the two young men an income of 12 gold florins a year for ten years (Bargagli Petrucci, 1906; Della Valle, 1785). However, because of Domenico's and Iacopo's young age, the responsibility of the task was attributed to master Cecco di Vanni, who continued the works with master Iacopo's grandchildren (Concist. Delib. Vol. 8, 18 January 1356, f. vij). At this step, the initial aims of the Government of the Nine and master Iacopo can be intended as reached, even if, in the following years, several other masters and many Sienese governments contributed to expanding the initial project of the "Bottino maestro di Fontegaia" to further enrich the water supply of Piazza del Campo with new branches of this bottino (Bargagli Petrucci, 1906). Figure 8, while portraying the complexity of the system of bottini that supplied water to the city of Siena (i.e. the grey area of the map), highlights the impressive length reached over time by the "Bottino maestro di Fontegaia," whose representation develops starting from the bottom right side of the picture.

6. Discussion

Our findings on the project of the "Bottino maestro of Fontegaia", while allowing us to reconstruct the amount of funding (overall, several thousands of golden florins), long time (around twenty-two years), and many actors (starting from master Iacopo and his many employees) required for its completion, confirm its high complexity and appraisal as a large-scale project (Flyvbjerg, 2017; Rezvani and Khosravi, 2018; Lovallo *et al.*, 2023). Moreover, the project satisfies all the main features identified by Sanderson (2012) to recognize large-scale projects since it aimed at delivering a physical infrastructure (the bottino) through the



Source: Ms D 59, c. 547 (figure courtesy of the State Archive of Siena, Prot. 694-A/2024 – further reproductions of this material are expressly prohibited)

Figure 8.
Map of the bottini underneath the city of Siena, dated around the mid-19th century

commitment of private citizens (mainly master Iacopo and his relatives) and involving a public organization (the Municipality of Siena) as the main client.

Based on the aim of bringing water to Piazza del Campo, the project of the "Bottino maestro of Fontegaia" can be considered a successful one, even though during its realization, multiple inconveniences jeopardized the final success. These inconveniences specifically led to some revisions and extensions of the project (e.g. Friedrich *et al.*, 1987) as well as several reworks and changes (Lyneis and Ford, 2007), eventually impacting the actual completion times, which were much longer than the three years mentioned in the 1334 original contract (see Figure 2). During the many necessary years, various governance mechanisms were needed to sustain the realization of the project, and their analysis can help to understand how to solve some major challenges of governing large-scale projects (Procter and Kozak-Holland, 2019).

This analysis is proposed below by organizing its contents according to the three phases of the project lifecycle we previously outlined.

About the first phase (1334–1337), it is noteworthy to remember that the governance of a project includes the different "systems, structures of authority, and processes" (Pinto, 2014, p. 383) aimed at "controlling the project and ensuring its success" (PMI, 2013, p. 34). For the "Bottino maestro of Fontegaia" project, the governance mechanisms initially relied on the procedure followed for its approval (Balestracci, 1990) that, under the Government of the Nine, firstly required a specific deliberation of the General Council (Bargagli Petrucci, 1906). The procedure was completed by the contract that, based on this deliberation, was signed by master Iacopo to establish the conditions of the project in terms of expected times, costs, and results with the overall aim of bringing water to Piazza del Campo ("conduci facere in Campum Fori Comunis et civitatis Senarum tantam aquam vivam et continuabilem", as displayed in Figure 2). Moreover, since master Iacopo received the benefits and bore the burden of realizing this "new project based on the risk" (Bargagli Petrucci, 1906, p. 91) by acting on a contractual basis as an independent "impresario," his involvement by the

Government of the Nine is coherent with the governance perspective of the "multifirm school" (Ruuska *et al.*, 2011; Bekker, 2014).

Throughout the article, we mentioned that extant literature (e.g. Bekker, 2014; Biesenthal and Wilden, 2014; Song *et al.*, 2022) has defined project governance as a concept with multiple dimensions. By specifically referring to the functional levels identified by Morris and Geraldi (2011), it is now possible to state that all three levels (i.e. technical, strategic and institutional) supported the construction of the "Bottino maestro of Fontegaia," although with different modalities over time. Initially, the upper level of the project governance corresponded to the institutional procedures followed by the Government of the Nine for the official approval of the project. As highlighted, these procedures mainly included the deliberations of the General Council, which was, in that period, the leading Sienese authority in water matters (Bargagli Petrucci, 1906). At the intermediate level, some additional governance mechanisms (corresponding to the main elements of the contract signed by master Iacopo) defined the strategic effectiveness of the project (i.e. its expected results and the value of bringing water to the center of Siena as already happened in other strategic points of the city – see [A1]). Finally, at the lower level of the project governance, additional mechanisms defined the technical details about the bottino to be realized (e.g. its size and propping up, as reported in Figure 1 and [A4]), as well as the division of responsibility between master Iacopo and the Municipality of Siena (e.g. the former's promise of a guarantee – see [A3] – or the latter's intervention in case of stones or damages emerged during the excavations – [A5] and [A6]).

In addition, all these governance mechanisms can be also analyzed according to the dichotomization between the "hard" and "soft" aspects suggested by Gustavsson and Hallin (2014, p. 568) "to distinguish between various dimensions and features of projects". Particularly, while legally binding master Iacopo's action through the contract signed, these mechanisms were also precise in content (i.e. times, costs, and results of the project) and related to a defined sanctioning system (i.e. the loss of the deposit and assets given by master Iacopo as guarantee), thereby unveiling their "hardness" even without reflecting a formalized hierarchical structure (Blomqvist, 2022, p. 287; Abbott and Snidal, 2000). In these terms, it is possible to state that, at the beginning of the project of the "Bottino maestro of Fontegaia", therefore over the short period, the governance mechanisms in use were mainly the hard ones based on formally defined procedures structuring the agreement and the processes to be followed (Smits and van Hillegersberg, 2018) – e.g. government deliberations and contract conditions – instead of the soft elements or values guiding the project. Interestingly, this confirms the findings and insights of other studies that have looked at the key role that might be played by a few hard factors – such as clear project objectives, effective project planning and adequate project budget – to pursue success (e.g. Abbasi *et al.*, 2014).

In the second phase of the project (years 1337–1349), the initial governance mechanisms, however, proved insufficient to face the several inconveniences that emerged and that, besides requiring reworks and changes to the original plan, also generated several side effects such as human-related consequences (Sterman, 2000; Lyneis and Ford, 2007). Therefore, in this intermediate phase, additional governance mechanisms were defined to support the progression of the project.

About them, firstly, it is to mention the high commitment to this ambitious project of both master Iacopo and the Municipality of Siena. This data emerges, for the former, from the fervent plea he made to underline his merit in initiating such a visionary and relevant project, although with insufficient municipal funds that have "reduced in poverty" him and his family (see [A10] and [A9]); for the latter, from the new deliberation assumed to allocate

additional funds for the project progression after master Iacopo's plea (Cons. Gen. Delib. Vol. 120, 28 April 1337, f. xlvij^{v}-xlviij). Actually, this commitment allowed their collaboration to continue (Smits and van Hillegersberg, 2018) even beyond the expiration of the original contract (Figure 2). However, the incentive for this further collaboration was not related to a top-down or hierarchical logic but derived from a bottom-up initiative (i.e. master Iacopo's plea) as in the network or participatory structures of soft governance mechanisms (Blomqvist, 2022). The aforementioned findings particularly unveil that, in this phase of the project, softer and more human-related or behavioral mechanisms began to play a prominent role in the project and its overall governance (Flyvbjerg, 2021). They involved the personal values, motivations, and interests of the main actors responsible for the project (e.g. Sanderson, 2012), who decided to persevere despite their unmet expectations.

Secondly, it is to underline that, given these further funds granted using public money (Bargagli Petrucci, 1906), the Municipality of Siena felt the need to search for additional governance mechanisms that could "allow for most effective and efficient project planning and execution" (Müller, 2009, p. 17). To ensure the success of the intervention and bring the project to its completion, the Municipality thus started looking for additional skills and competencies that could support and integrate those of master Iacopo, thereby supporting the alignment between the project governance and the overall governance of the city (Joslin and Müller, 2015 and 2016). As an example, it was in this period that the Municipality appointed some officials ("good and lawful men") and even a camerlengo as a means to facilitate, but also keep under control, master Iacopo's activities and decisions (see Figure 6, [A12] and [A13]). These appointments represented additional hard governance mechanisms since, whereas concerning the structure steering the project (Smits and van Hillegersberg, 2018), they extended the hierarchical power logic to be followed for success (Blomqvist, 2022). Moreover, in this phase, many other officials and funds (even all the taxes coming from the city of Grosseto, as testified by [A15]) were allocated to the project by diverting them from other purposes until the first water reached Piazza del Campo, in 1343 (see Balestracci, 2006 and [A17]). Overall, the precision of the directives about these allocations as for the other conditions included in the new deliberation of the General Council (see Figure 6) emphasizes the main character of "hardness" (Blomqvist, 2022, p. 287) of these additional mechanisms guiding the progression of master Iacopo's action.

In brief, during the second phase of the project, the emergence of soft governance mechanisms was associated with a strengthening of the initial hard governance mechanisms, mainly within the upper or institutional level of project governance (Morris and Geraldi, 2011). At this step, the reinforced interconnections of activities between master Iacopo and the Government of the Nine's officials also allow us to interpret the governance model adopted for the project as more correspondent to the perspective of the "large capital school" (Ruuska *et al.*, 2011; Bekker, 2014), with master Iacopo operating under the supreme authority of the Government of the Nine as in a network-like structure (Provan and Kenis, 2008).

However, not even the adoption of this governance model led to the complete success of the project since, at master Iacopo's death, the water brought to Piazza del Campo was still insufficient for the citizens' needs (see [A19]). Therefore, in the subsequent and final phase of the project (years 1349–1356), additional governance mechanisms gradually emerged as the key factors to face problems and pursue success (Flyvbjerg, 2007).

Firstly, in this period, new actors were involved in the project governance: master Iacopo's son (Giovanni) from 1349 to 1356 and grandchildren (Domenico and Iacopo) for the remaining part (Bargagli Petrucci, 1906). Even if in different moments, they appeared in front of the General Council with new pleas in which, while complaining about the state of

extreme poverty into which they had been reduced by the project, emphasized master Iacopo's merit of having provided Piazza del Campo with "the fruitful and fortunate gift of the font Gaia", in addition to the experience and competence that they had acquired by assisting their ancestor's work (see [A20]). Also in this case, the initiative to persevere with the project derived from a "bottom-up" proposal, i.e. from master Iacopo's son and grandchildren, who asked for acting "as 'partners'" in the pursuit of success (Blomqvist, 2022, pp. 286–287).

Secondly, the General Council, while recognizing the competence of master Iacopo's relatives and deliberating their involvement in the project, also recognized more deeply the value that water had for the city of Siena and embraced "the desired goal of the good [Sienese] citizens" of enriching the water supply of Piazza del Campo (see [A21]). Indeed, as we recalled in this article, the availability of water for Siena was meant to serve various purposes since it represented a fundamental raw material for wool makers, dyers and also farmers (Kucher, 2005; Boschi, 2007), as well as a relevant commodity for citizens, eager to have drinkable water within the city center and in their houses (e.g. Balestracci, 1990; Minnucci, 2002). Moreover, bringing water directly to Piazza del Campo had the additional value of an intangible asset: as aforementioned, the Piazza represented the center of the main political, economic, and social affairs of Siena (Balestracci, 2006), and the availability of water in this place, besides being a symbol of wealth for the whole city, was recognized likewise a real status symbol (e.g. Balestracci, 1990; Boschi, 2007). The commitment of the Municipality of Siena to this project is, therefore, to be seen not only towards master Iacopo's relatives and the many workers and actors involved in the project but also, and above all, towards the city of Siena and its citizens, whose needs incentivized more in-depth collaboration (Smits and van Hillegersberg, 2018). Interestingly, this commitment was so strong that the General Council authorized and bore expenses and completion times that were extraordinarily higher and longer than expected (e.g. Balestracci, 2006). Moreover, the Council recognized to master Iacopo's relatives a perpetual income (see, for instance, [A22]) as implicit recognition of the merit and value of having satisfied the promise made to the Sienese citizens to bring water in the heart of the city to elevate their economic, social, and political lives (Minnucci, 2002; Boschi, 2007).

Based on extant literature (e.g. Crawford and Pollack, 2004; Gustavsson and Hallin, 2014), it is possible to state that all the aforementioned aspects concern the soft side of project governance, which can be analyzed by referring to its human dimensions as competences, motivations, culture and values. Stated differently, about the last phase of the project, our findings revealed the relevant role played by soft mechanisms in triggering and enabling the governance of a large project by relying on social aspects such as actors' behavior and collaboration (Smits and van Hillegersberg, 2018). Moreover, these soft mechanisms are related to the path dependency of the project (Zerjav, 2015), whose successive activities are conditioned by the decisions taken in the past (Sterman, 2000), as for the involvement of master Iacopo's relatives.

All the considerations and information we provided above about the three phases of the project are summarized in Table 2, which particularly emphasizes the different relevance of hard and soft governance mechanisms throughout the project lifecycle. In the table, we respectively associated these phases and the related time periods with the brief, medium and long periods of the project.

7. Conclusions

Based on the analysis of the large project of the "Bottino maestro of Fontegaia" in Siena, it is possible to formulate our conclusions about how the time factor affects the use of governance mechanisms to pursue the success of large projects.

Table 2. Elements of the project governance in the three phases

Period	*Main governance actors*	*Hard governance mechanisms*	*Soft governance mechanisms*	*Results and consequences*
Short period: 1334–1337	1. General council 2. Master Iacopo	1. Deliberation of the general council 2. Contract signed by master Iacopo	None	1. Cost and time overruns 2. Master Iacopo and his family reduced to poverty 3. No water in Piazza del Campo
Medium period: 1337–1349	1. General council 2. Government officials 3. Master Iacopo	1. Deliberation of the general council 2. Extension of the contract signed by master Iacopo 3. Appointment of government officials and additional controls	1. Master Iacopo's plea 2. Government of the nine's motivation to persist in the project (due to the huge resources already invested)	1. Allocation of additional public funds to the project 2. First (insufficient) water in Piazza del Campo 3. Dissatisfaction of Siena's citizens
Long period: 1349–1356	1. General council 2. Master Iacopo's relatives (son and grandchildren) 3. Government officials 4. Sienese citizens	1. Deliberation of the general council 2. Appointment of government officials 3. Recognition of a perpetual income to master Iacopo's relatives	1. Pleas of master Iacopo's relatives 2. Government of the nine's motivation to persist in the project (huge resources already invested) 3. Recognition of the multiple values of water for Siena's citizens (social pressure)	1. Financial support for master Iacopo's relatives 2. Further allocation of public funds to the project 3. More abundant water supply in Piazza del Campo, in line with the initial aim of the project

Source: Table by the authors

Specifically, the results of our analysis suggest that, in the short period, large projects are essentially supported by hard governance mechanisms that, in terms of formally defined procedures such as hierarchical authorities' decisions or law-regulated contracts (e.g. Crawford and Pollack, 2004; Gustavsson and Hallin, 2014), are able to sustain the project planning and beginning. These mechanisms, even when including soft elements such as agreements with private organizations, unveil their prevalent hardness dimension being usually legally binding, precise in content, and associated with a defined sanctioning system (Blomqvist, 2022; Abbott and Snidal, 2000).

In the medium period, when the occurrence of significant inconveniences may hinder the progression of large projects, additional hard governance mechanisms are required to strengthen the formal structure steering the project (Smits and van Hillegersberg, 2018), but "bottom-up" initiatives are pivotal in persevering with the project aims (Blomqvist, 2022). Indeed, it is a combination of reinforced hard governance mechanisms with soft governance mechanisms that supports the alignment between the project and the corporate governance (Joslin and Müller, 2015 and 2016), thereby developing networking among the different actors involved (e.g. Provan and Kenis, 2008).

Finally, in the long period, when the emergence of additional inconveniences is further aggravated by both the amount of resources already invested and the end-user discontent, social aspects such as behaviors and collaborations assume even greater importance (Smits and van Hillegersberg, 2018). At this step of a large project, soft governance mechanisms, besides emphasizing the relevance of human-side factors such as culture and values in pursuing success (e.g. Crawford and Pollack, 2004; Gustavsson and Hallin, 2014), are associated with the path dependency characterizing the project decisions and activities over time (Sterman, 2000; Zerjav, 2015).

Figure 9 summarizes our conclusions by highlighting, for the short, medium, and long period, the combination of hard and soft mechanisms characterizing the governance of a large project and the related consequences in terms of the project realization.

By relying on these conclusions, this study provides useful insights for both scholars and practitioners involved in the analysis and definition of the governance mechanisms

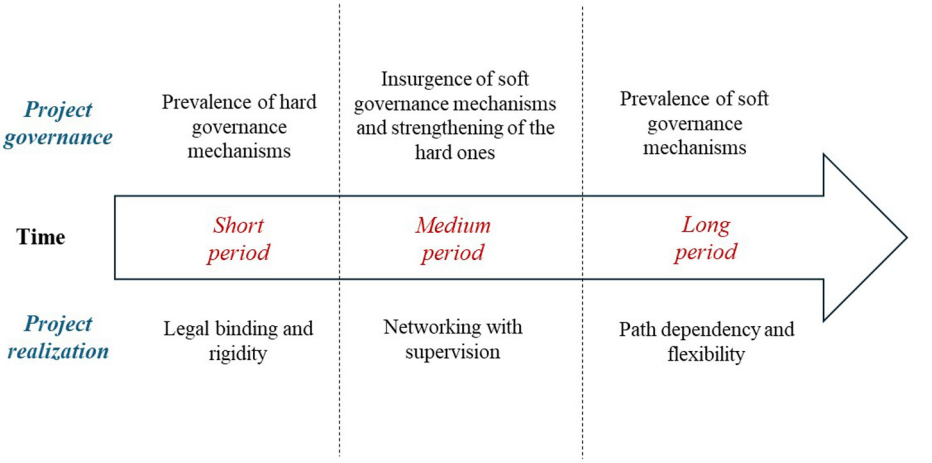


Figure 9.
Project governance development over time and consequences for the realization of large projects

Source: Figure by the authors

that can enable the success of large projects. Specifically, by emphasizing the different roles played by hard and soft governance mechanisms, on one side, this study stimulates research oriented to analyze their combination when related to large-scale projects. It particularly encourages more research on the relevance of social factors when facing the challenges associated with these projects. On the other side, this study supports practitioners in understanding which soft or hard governance mechanisms are best to focus on to achieve success in the different phases of a large project since they are the mechanisms with greater influence on the ultimate result of the project in the short, medium, and long periods.

Nonetheless, this research is not without limitations, starting from the fact that it refers to the analysis of a single project that, although significant and relevant to our aim, cannot lead to generalizations. Furthermore, the governance mechanisms of specific projects – both hard and soft ones – are certainly to be considered context-related and could generate different results and consequences if observed in other organizations and domains. Future research on this topic may therefore be directed towards the analysis of additional case studies to investigate further how the interplays of hard and soft mechanisms of project governance may impact the success of a project throughout the various stages of its life and, also, with regard to different settings and industries.

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Appendix

[A1] "promictit idem magister Iacobus pro pretio sex milium florenorum de auro [. . .] conducere [. . .] in Campum Fori Comunis et civitatis Senarum tantam aquam [. . .] quanta est illa que derivatur et venit in fontem Brandum", Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxvij^{v}-lxviij.

[A2] "eidem magistro Iacobo dare et solvere dictam summam sex milium florenorum hoc modo, videlicet, hinc ad totum mensem julii proxime venturum, trecentos florenos de auro, ad omnem ipsius magistri Iacobi requisitionem expendendos continuatim in dicto opere", Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij.

[A3] "Et ipse magister Iacobus inde det, modo ad presens, et dare promictit idoneam cautionem *per se* et eius patrem predictum et cum solenni obligatione ipsorum insolidum et bonorum suorum", Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij.

[A4] "et illam [aquam] conducere per buttinum cavatum et ubi expediens esset, appontellatum", i.e. "and to carry that [water] through a digged and, where appropriate, propped up bottino", Cons. Gen. Delib. Vol. 116, 16 December 1334, lxvij^{v}.

[A5] "si in buttino predicto fodiendo reperiretur sassus, quod Comune Senarum, suis expensis, faciat illud cavari et sollicite trahi et elevari exconputante dicto magistro lacobo de quantitate dicti saxi sicut ei tangit pro rata alterius buttini non saxosi", Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij^{v}.

[A6] "si qui inde dapnificarentur Comune Senarum teneatur de dapno huiusmodi satisfactionem facere dapnum substenturis", Cons. Gen. Delib. Vol. 116, 16 December 1334, f. lxviij^{v}.

[A7] "A Baldino Neri, per mendo del danno che li fu dato ne' la contrada di Vicho in fare gli smiragli per 1'aqua che viene nel Campo, siccome fu stimato per li ufficiali eletti a stimare e' detti danni—ij libr.", Biccherna Vol. 223, 30 April 1348, f. cxxxiij.

[A8] "Anco, a le donne di Sancta Petronella, Ser Ricovaro Chiari, Cola Cini e Baglione (di) Giovanni per ristoramento d'una loro via incinevole (*sic*) che si guastò per lo buttino che fece il maestro Iacobo Ugolini che dovea menare l'acqua nel Campo – x libr.", Biccherna Vol. 186, 18 December 1336, f. xlvj^{v}.

[A9] "promissam idem lacobus non potuit commode observare ob quia ipse non potuit dare perfectam operam quam debebat quamvis de suo posuerit quicquid potuit, ita et taliter quod ob ipsam causam ad pauperiem est deductus", Cons. Gen. Delib. Vol. 120, 28 April 1337, f. xlvij^{v}-xlviij.

[A10] "non sit conveniens quod opus hoc isto modo remaneat", Cons. Gen. Delib. Vol. 120, 28 April 1337, f. xlviij.

[A11] "ipsum lacobum liberare ab obligationibus et promissionibus *per se* factis", Cons. Gen. Delib. Vol. 120, 28 April 1337, f. xlviij.

[A12] "tempus electionis ipsorum officialium vel alicuius eorum electorum vel eligendorum non duret vel possit durare vel protendi ultra annum, a die electionis huiusmodi, computandum", Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij-xxiiij^{v}.

[A13] "Et habeant tales officiales et habere intelligantur ex nunc illam potestatem, auctoritatem et balìam quam disponit et concedit reformatione supradicta in Comuni Senarum firmata", Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij-xxiiij^{v}.

[A14] "quomodo opus aque conducende et habende in Campum Fori Senarum, iam in dicto Comuni ordinatum et inceptum, procedat et effectui demandetur", i.e. "to provide and order how the work of bringing and holding water in Piazza del Campo of Siena, already organized and begun in the said Municipality, should proceed and be demanded", Cons. Gen. Delib. Vol. 125, 15 December 1339, f. lxiiij.

[A15] "omnis tassatio et omnis redditus et proventus civitatis Grosseti perventus et perventurus [. . .] ad perfectionem dicti operis") (Cons. Gen. Delib. Vol. 134, 19 March 1343, f. xxiiij.

[A16] "Anco, a Naddo di misser Striccha, Meuccio di Neri Baldinotti, Fredi di Neri Ponzi, signori e ufficiali del aqua che dè venire nel Campo, per cinquecento libr. che 'l Comune di Grosseto pagharà", i.e. "Again, [payment of] five hundreds lire, which the Municipality of Grosseto will pay, to Naddo of sir Stricca, Meuccio of Neri Baldinotti, Fredo of Neri Ponzi, gentlemen and officers of the water that must reach [Piazza del] Campo", Biccherna Vol. 209, 31 December 1341, f. lv.

[A17] "Figarino, pro una libra stoppe pro fonte Campi Fori", Biccherna Vol. 213, 28 November 1343, f. lv.

[A18] "a Scotto di Tino, Niccolò di Mino Vincenti et Agnolo di messer Conte, ufficiali sopra a l'aqua del Campo, per spendare e convertire nel loro ufficio – m libr.", Biccherna Vol. 219, 20 May 1346, f. cxxxviiij^{v}.

[A19] “opus aque conducende in Campum Fori Comunis Senarum ferventer non procedat ut spes Senensium respicit et ut in eo posse procedi non ex culpa vel negligentia operarij et officialis dicte aque sed ex modicitate pecunie ipsi negotio deputate precipue”, Cons. Gen. Delib. Vol. 140, 13 April 1347, f. xxvij.

[A20] “ad invenitum fertile et felix donum fontis Gai” [. . .] “ipse magister cum tota familia sua fuisset deradicatus”, Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij.

[A21] “semper adstiti ad inventionem et prosecutionem aquarum predictarum, et in opere predicto omne meum opus meumque studium dedi” [. . .] “ut consequatur optatus finis bonorum civium”, Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij.

[A22] “in perpetuum, anno quolibet, cl libras denariorum a Comuni Senarum” [. . .] “facere et exequi omnia illa que magister Iacobus pater suus facere tenebatur”, Cons. Gen. Delib. Vol. 145, 26 November 1349, f. xxxvij.

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