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CONTENTS

Editorial: Construction history research on-line	i
Bill Addis and Hermann Schlimme	
Placing the keystone of the vault over the presbytery in Tortosa Cathedral, Spain (1428-40)	1
Josep Lluís i Ginovart, Agustí Costa Jover and Sergio Coll Pla	
Late-medieval construction site management at the Monastery of Jerónimos in Lisbon	23
Arnaldo Sousa Melo and Maria do Carmo Ribeiro	
How Thomas Nevile built Trinity College, Cambridge	39
Robert Neild	
The use of 'false vaults' in 18th century buildings of Sicily	53
Marco Rosario Nobile and Maria Mercedes Bares	
Patent slipways of Bakumatsu and Meiji Japan: 1861-1900s	71
Susumu Mizuta	
Hollow concrete blocks in New Zealand 1904-10	93
Nigel Isaacs	
Marcel Breuer and Jean Baretts in Bayonne (1964-68): the use of architectural precast concrete panels in large public housing schemes	109
Lauren Etxepare, Eneko J. Uranga and Naiara Zuazua-Guisasola	
The Construction History Society	127

Late-medieval construction site management at the Monastery of Jerónimos in Lisbon

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Abstract

Through the analysis of the exceptional accounting documents of 1517 related to the construction of the Monastery of Jerónimos (Lisbon), this paper discusses the main characteristics of a new model of construction site organization. In the later Middle Ages we can find, among others, two main models of constructing site organization. One, older and more widespread, consisted in a centralized and pyramidal management model. The other, apparently more recent, was based in the existence of several autonomous teams working simultaneously, each one responsible for building a specific part or section of the building. This paper describes and discusses this new organizational model as it was adopted and implemented by João de Castilho (1470–1552) for the construction of the Monastery of Jerónimos in 1517, probably for the first time in Portugal, but with some parallels in other places in Europe.

Keywords

Monastery of Jerónimos (Lisbon, Portugal); construction site organization; João de Castilho, later Middle Ages; early Modern; labour and building activity.

Introduction

The purpose of this paper is to contribute to the discussion about organizational models of major Portuguese construction sites in the fifteenth and sixteenth centuries, through a case study analysis of the building of the Mosteiro de Santa Maria de Belém, widely known as the Monastery of Jerónimos, in Lisbon.

The organization of construction sites constitutes a major theme in construction history, although it remains a subject needing further research in Portugal. As a matter of fact, there are only a few Portuguese studies on this theme. Among them, one should highlight the studies, developed over the last decades,¹ about the construction of the Monastery of Batalha (near Leiria, Portugal) from the late 14th to early 16th century, that were developed due to the survival of exceptional documentary sources. We should also mention other studies about major construction sites, such as the Royal Palace of Sintra, and other urban building activities.² Nevertheless, such studies remain rare, in spite of the existence of some important documents, still preserved, concerning other major Portuguese construction sites, such as the Monastery of Jerónimos.

The Monastery of Jerónimos has been thoroughly studied from the art history and architectural point of view, which has focused mainly on stylistic and artistic aspects. Nevertheless, the analysis of its construction process, which is a central dimension of the Construction History field, remains to be done in a more detailed way. It should be stressed that exceptional sources exist, in the Portuguese context,

about the construction of this monument, such as complete accounting records, albeit spanning only a few years, which has made this kind of research possible. The importance of studying the building process of Jerónimos also derived from the fact that it adopted a new organizational model from 1517, which was quite different from the models found in most other Portuguese construction sites.

Until the late fifteenth century, the dominant organizational model of construction activity in Portugal seems to have been the centralized management of labour, acquisition of materials and construction techniques. Among the most important examples of this model we should highlight the Monastery of Batalha whose construction began in the late-fourteenth century and continued for more than 100 years. This construction was one of the most emblematic of Portuguese Gothic buildings, and was commissioned by the royal power. Another example of this model, although with some particularities, was applied in the construction of the new customs building of Funchal (Madeira island), in the early sixteenth century, that was also supported by the king. This type of centralized management of construction sites was also found in the Jerónimos project before 1517, but from then on, it adopted a new model of organizing the construction, apparently for the first time in Portugal. It is this new model that we analyse in detail.

This new model, attested in some other parts of Europe³ as well, represents a major change in the organization and site management which we will discuss in this paper, based on the analysis of a set of accounting documents. This new model consists in a site management structure based on several simultaneously independent working teams, from the same craft, including masons and stonecutters.

We have applied a methodology crossing different types of sources, - the archival documents themselves as well as art-historical studies of the Jerónimos, and also the observation and analysis of the building still existing today. One of the main sources is a set of accounting books from the construction of the monastery dating from the years between 1515 and 1518.⁴ These accounting books contain regular records of construction-related expenses, namely the wages of the members of different working teams. Nevertheless, in the present study we have only used the data from the book of the year 1517, because this was the first year when the new method of site management was implemented. A portion of the information it contains is summarized in Tables 1 and 2 (below).

We begin by presenting the two different site management models used in the construction of Jerónimos, one used before 1517 and the other from 1517 and the next years. We focus particularly on it's the innovative and the conservative characteristics of the new model, as well as the main protagonists and the team's composition.

This paper presents the first results of a wider project about the construction of the Monastery of Jerónimos, currently under way, during which the other accounting books will be analysed, and more thorough and complete analysis of data will be undertaken.

The Monastery of Jerónimos: historical context

The Monastery of Jerónimos in Lisbon was established in a location away from the city walls and the urban centre, in a new area that the king wanted to develop near the Tagus River, west of the city. Its construction was started by King Manuel I, in the early years of the sixteenth century, and the main stages of its construction were developed in the first half of the sixteenth century, although it experienced other interventions in later years. Today it remains one of the most prestigious Portuguese national monuments, with great symbolic value, presenting itself as an outstanding architectural complex.⁵ (Figs 1 & 2)

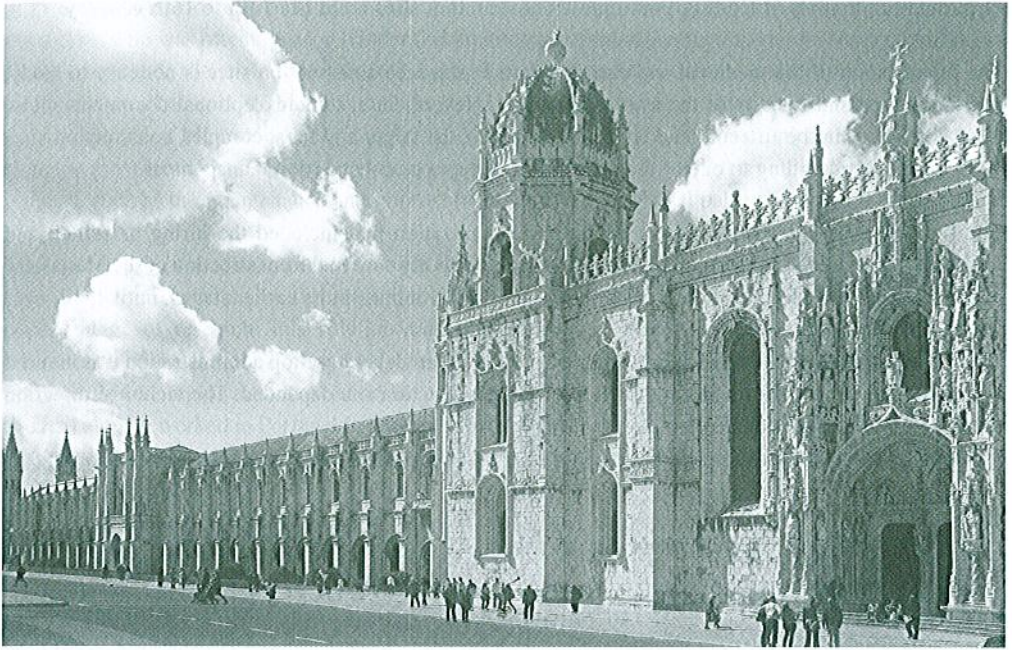


Figure 1. Monastery of Jerónimos, Lisbon, Portugal. Architects: João de Castilho and others, 1501-1580. General view of south side. (Authors' picture.)

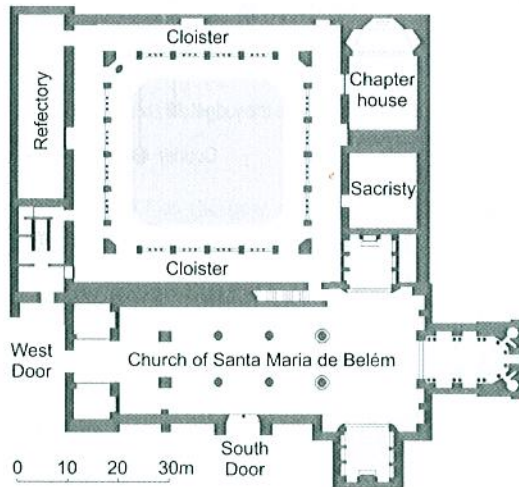


Figure 2. Monastery of Jerónimos, Lisbon. Plan.

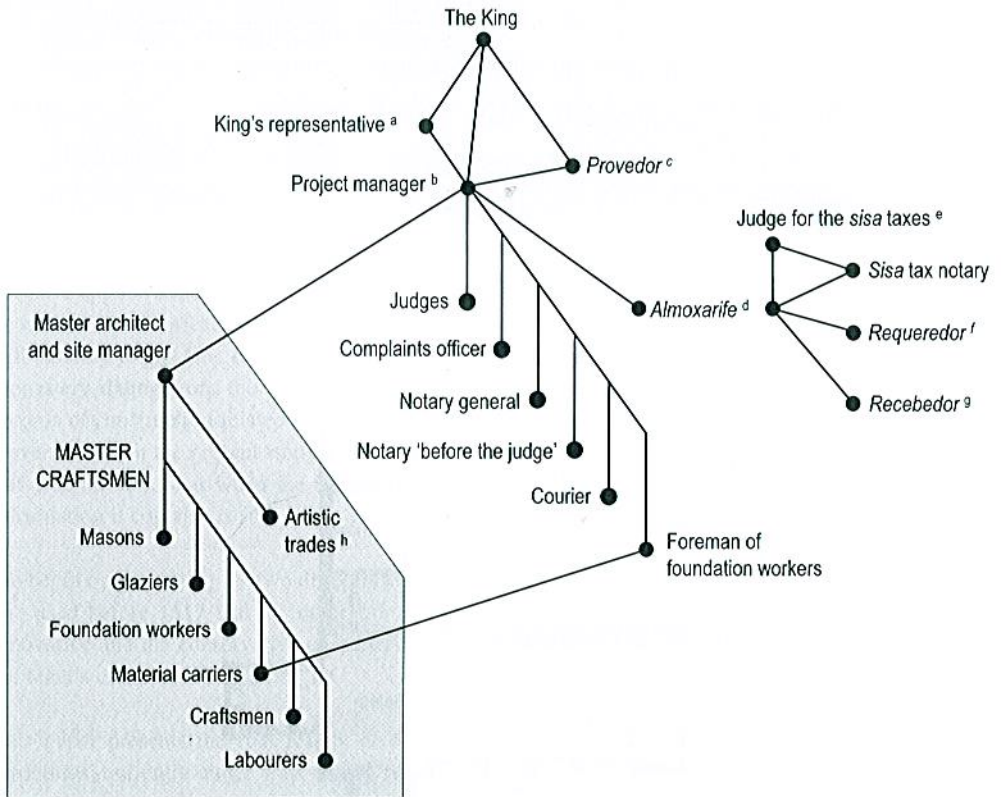
This monastery was funded by the royal power through income derived mostly from revenues and taxes on maritime trade with India, namely the *Vintena da especiaria*.⁶ Its function was to symbolize the king's power and the prestige of the kingdom. To accomplish its construction the monarch used extraordinary resources, as well as a team of experts comprising architects, artists and builders of national and international origins, and with high reputations. In those days, with huge revenues from the Portuguese maritime expansion, the monarch could bring together a very diverse and considerable set of funding sources for the large and most important royal buildings.⁷

Organization models at leading Portuguese construction sites from the 14th to 16th century

The organization of the medieval and early modern Portuguese construction sites is not easy to study, due to the type and scarcity of the available sources. Nevertheless, some exceptional documents allow us to know that, in the fifteenth and sixteenth centuries, the larger and most complex construction sites were organized according to one of the following two types of construction management.

The first one was characterized by a centralized organization that included the hiring of skilled and unskilled labour by the top management of the site; this was the case in the construction of the Monastery of Batalha, and for the construction of the Monastery of Jerónimos in its earlier stages, until 1517.

This corresponds to a structured and centralized pyramidal model, whose top administration was assured by a *Vedor*, on whom the technical direction of the construction site depended. The technical direction



- a The *promotor* or *requeredor* responsible for leading the project on behalf of the King.
- b A royal officer responsible for managing the whole project and also acted as judge within the construction site.
- c 'Fiscal' or representative of the Dominican friars who would occupy the monastery when complete.
- d Treasurer - a regional Royal officer with fiscal and financial powers on behalf of the king with several royal officers in his service.
- e The *sisa* tax was a royal tax collected in the kingdom, part of which, in this project, was used to fund the construction of the Batalha monastery.
- f Collector of the *sisa* taxes.
- g Receiver of the *sisa* taxes.
- h Sculptors, stained glass workers, painters and other decorative trades.

Figure 3. Organizational chart of the construction yard of Monastery of Batalha (Leiria, Portugal) in late 14th-15th centuries, from A. S. Gomes 2011 (see note 8), pp. 177.

in its turn was also organised by a construction master, with ultimate responsibility for the execution of the works, who was often a mason. Under the supervision of this construction site master, and under his direct command, there were specialized craft masters including masons, carpenters, sculptors and painters, as well as unskilled labour, such as *braceiros* or servants, as we can see from the organization chart of the site of Monastery of Batalha.⁸ (Fig. 3) Having in mind the known examples this model seems to be the most prevalent from the late fourteenth century onwards, if not before, at least in the large royal projects, such as the maintenance and improvement works of the Royal palace of Sintra in 1507-1510.⁹

The second type of construction management represents a division of work between some large teams and each one was responsible for the execution of different parts of the building. As far as we know at the current stage of research, this solution was implemented in Portugal for the first time during the construction of the Jeronimos Monastery, from 1517, by João de Castilho (1470–1552), a master builder from the Basque region who worked on the cathedrals of Burgos and Seville in Spain early in his career, and had already worked in Portugal in previous years.¹⁰ This new site organisation represents a significant change, with the creation of several teams responsible for different areas of the building construction.

The first of these two models was the older one and most widespread in Europe as far as large and monumental buildings construction were concerned; the second model, called in Portuguese *empreitadas*, became increasingly common in the fifteenth and sixteenth centuries, especially in Italy.¹¹ In Portugal, there are some clues that suggest the possibility of this second organisation model being used in the 12th and 13th centuries, for example for the construction of the Romanesque church of San Pedro de Ferreira, in northern Portugal. In this construction site, Manuel Real, from an architectural and artistic analysis, proposes the existence of three independent teams, each one with its own master, but working together under a general direction that ensured consistency of the whole building.¹² However, it must be stressed that, for this example, no detailed written sources survive, comparable to those for the Monastery of Jerónimos, that would allow us to analyse San Pedro de Ferreira in further detail.

The organizational model for the construction of Jerónimos Monastery from 1517

The project director, João de Castilho

João de Castilho was appointed in 1517 as the new general master of the whole construction site by Manuel, the King of Portugal. He replaced Diogo de Boytac (c.1460–1528), who had begun the project in January 1501, and assumed the architectural direction of the entire project. João de Castilho was a Biscayan builder who had arrived in Portugal in the early 16th century with several compatriots, working first on several construction sites in the northern part of the kingdom, including the Cathedral of Braga (1509-11) and the church of Vila do Conde (1511). Later, João de Castilho and his Basque colleagues eventually moved south to other parts of Portugal and we find them working on the cathedral in Viseu, on the Monastery of Batalha in Tomar, on several large royal buildings in Lisbon, and in the Portuguese cities of northern Africa, including Arzila and Mazagão (in present day Morocco), among others.¹³

Organisation of the workforce

Implementing his new management system, João de Castilho divided the construction work into separate *empreitadas*, each of which were assigned to a specific team, with its own master and its own specific contract.¹⁴ Details of the actual contracts and their contents are unfortunately not known, as the documents no longer exist. We know of their existence from references in other written sources and from the accounting books.

Salaries

Each builder had a daily salary defined and each month he would be paid according to the number of days he had worked in that month, as was registered in the accounting books. The daily rates could be different for different workers. The master of each team had a higher daily salary than the other builders, and the specialized workers, such as masons, could also have some salary differences between them. The labourers had, of course, lesser payments. In this paper we present only a broad picture of this site organization, so we provide only the total amounts paid to each team in average terms, throughout the year. We also present an individual salary mean for each team according to the number of its workers, regardless the salary differences that might exist between them, in order to help us understand the global characteristics of this organizational model. A more detailed study of the salaries and their differences will be the subject of a later paper.

Organisation of the work packages

João de Castilho was responsible for the overall site and project management and he divided the construction workforce into 7 teams (*empreitadas*) each led by a different master. (Fig. 4)

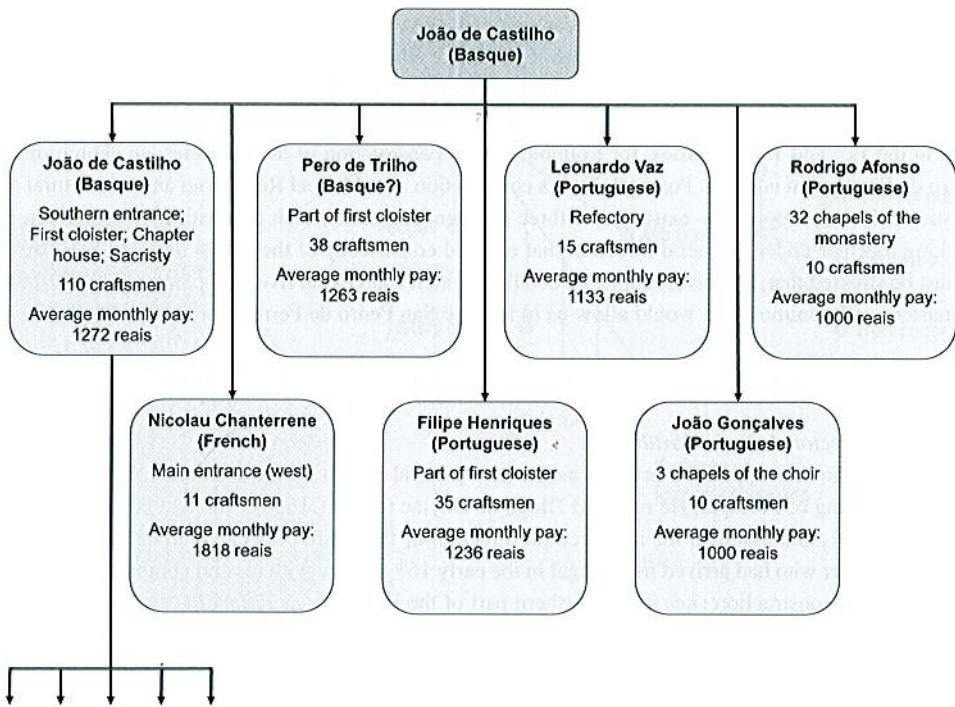


Figure 4. Organizational chart of the construction yard of Monastery of Jerónimos in 1517, divided in 7 teams or *empreitadas*, when João de Castilho became the general master.

João de Castilho himself led the largest of the *empreitadas* which was responsible for five separate work packages – the building of the famous south entrance of Jerónimos’ Church, and construction of parts of the first cloister, the chapter house and the sacristy. This *empreitada* was composed of 110 skilled workers, plus the labourers. 68 of those 110 workers worked on the first cloister and the southern door, while the other 41 workers were building the chapter house and the sacristy. This team of 110 men was paid a total 140,000 reais per month in 1517, which represents an average monthly salary of 1,272 reais per man. (Table 1)

Table 1. Site organisation for the construction of the Monastery of Jerónimos: the 7 main teams (*empreitadas*) in 1517 (Source: ANTT, Arquivo Nacional da Torre do Tombo (Portuguese National archives), Lisbon, Portugal, Núcleo Antigo - Despesas das obras do Mosteiro de Belém, Livro 813, fls. 1-51v.)

Master name	Tasks	Number of men	Payment
1 st <i>empreitada</i> : João de Castilho (Biscayan) Divided into 5 specific teams	- Southern entrance - First cloister - Chapter house - Sacristy	110 craftsmen (<i>oficiais</i>), comprising: - 68 craftsmen in first cloister and south entrance; - 41 craftsmen in chapter house and sacristy, plus labourers	140,000 <i>reais</i> /month (90,000 for first cloister and south entrance; 50,000 for chapter house and sacristy) (average: 1272 <i>reais</i> per man)
2 nd <i>empreitada</i> : Master Nicolau Chanterrene (French)	Main entrance (west)	11 craftsmen (<i>oficiais</i>), the majority French	20,000 <i>reais</i> /month (average: 1818 <i>reais</i> per man)
3 rd <i>empreitada</i> : Pero de Trilho (Biscayan?)	Part of first cloister	38 craftsmen (<i>oficiais</i>), the majority Portuguese	48,000 <i>reais</i> /month (average: 1263 <i>reais</i> per man)
4 th <i>empreitada</i> : Filipe Henriques (Portuguese)	Part of first cloister	55 craftsmen (<i>oficiais</i>), the majority Portuguese	68,000 <i>reais</i> /month (average: 1236 <i>reais</i> per man)
5 th <i>empreitada</i> : Leonardo Vaz (Portuguese)	Dining hall	15 craftsmen (<i>oficiais</i>)	17,000 <i>reais</i> /month. (average: 1133 <i>reais</i> per man)
6 th <i>empreitada</i> : João Gonçalves (Portuguese)	3 chapels of the choir	10 craftsmen (<i>oficiais</i>)	10,000 <i>reais</i> /month. (average: 1000 <i>reais</i> per man)
7 th <i>empreitada</i> : Rodrigo Afonso (Portuguese)	32 chapels of the monastery	10 craftsmen (<i>oficiais</i>)	10,000 <i>reais</i> /month. (average: 1000 <i>reais</i> per man)

The second large *empreitada*, led by Master Nicolau Chanterrene, French, was undertaken construction of the Main Gate at the west side of the building. (Fig. 5) This team was composed of 11 specialized workers, mostly French; this team was paid 20,000 *reais* per month, a monthly average of 1,818 *reais* per man. The third *empreitada*, led by Pero de Trilho, probably Biscayan, worked on the construction of another part of the first cloister with 38 men, mostly Portuguese. They received 48,000 *reais* per month, a monthly average of 1,263 *reais* per man. The fourth *empreitada*, led by the Portuguese master Filipe Henriques was responsible for another part of the first cloister. Composed of 55 mostly Portuguese men, this team received 68,000 *reais* per month, a monthly average of 1,236 *reais* per man. The fifth *empreitada*, directed by Leonardo Vaz, Portuguese, undertook the construction of the dining hall (*refeitório*) received 17,000 *reais* per month and was composed of 15 builders who earned a monthly average of 1,133 *reais* per man. The sixth *empreitada*, led by João Gonçalves, a Portuguese, built three chapels of the choir; it was composed of 10 men who received 10,000 *reais* a month, an average of 1,000 *reais* per man, monthly.

The largest of the main *empreitada* teams, led by João de Castilho himself, was, in its turn, divided into five teams, due to the great complexity and amount of work to be done. Each these five teams was responsible for a more specific work package of the construction and was led by a Biscayan *master*. (Fig. 6, Table 2)

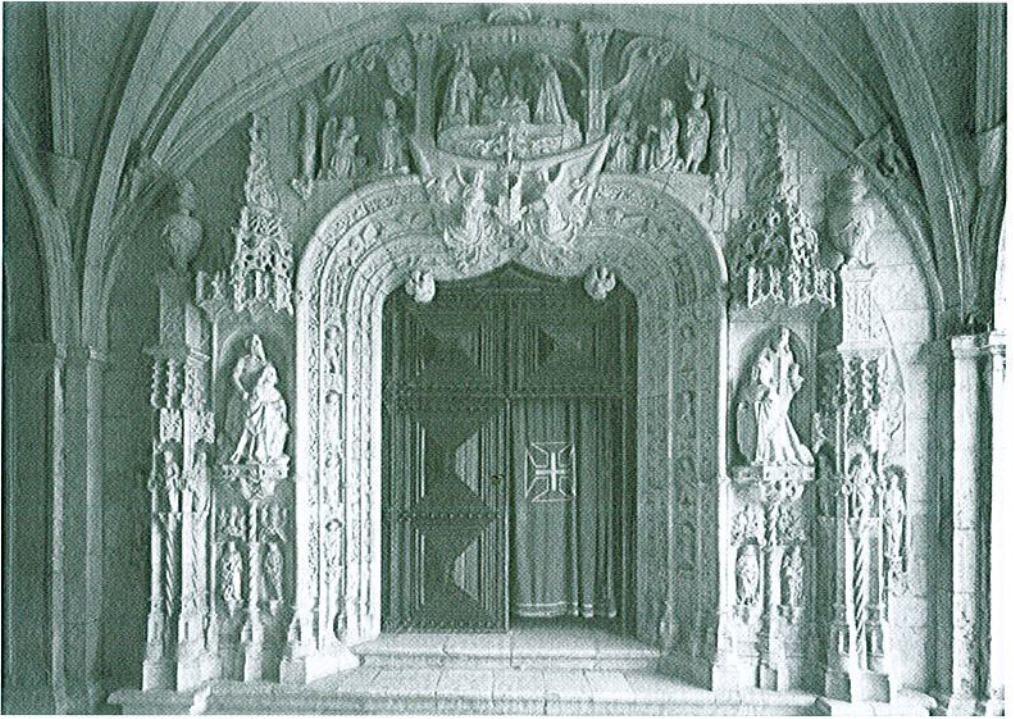


Figure 5. Monastery of Jerónimos. Main entrance (west). (Authors' picture.)

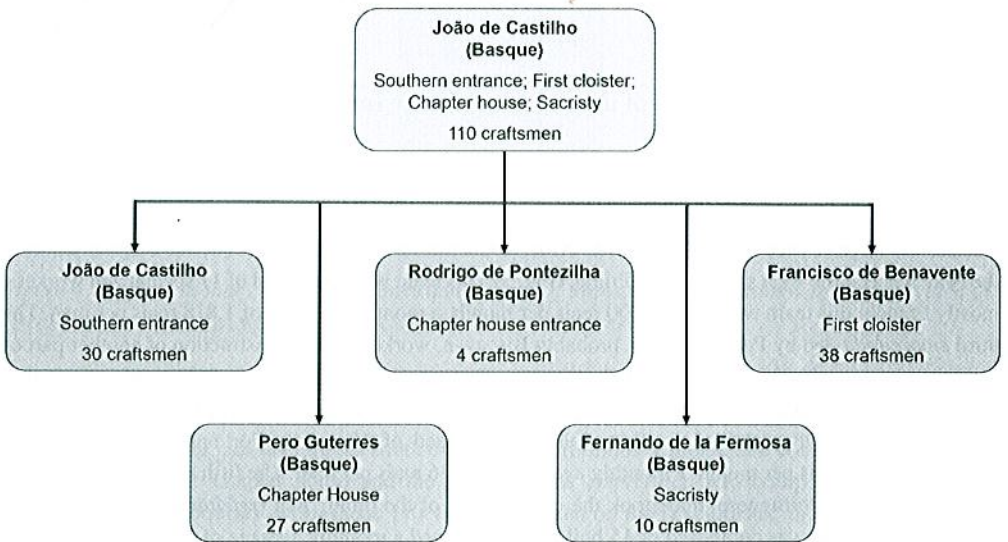


Figure 6. João de Castilho's *empreitada* of Monastery of Jerónimos in 1517 divided into 5 specialist teams.

The first of these specialist teams was led by João de Castilho himself and was responsible for the construction of the southern entrance of the Jerónimos Monastery. (Fig. 7) It was composed of 30 builders (*oficiais*), half of whom were French and the other half Biscayans and Portuguese. The second team comprised 27 men, most of them Biscayans, and was led by Pero Guterres, another Biscayan worker, who was called the *aparelhador* (the worker that puts the stones in place) of the chapter house. (Fig. 8) The third team, composed of 4 men, was led by Rodrigo de Pontezilha, called *aparelhador* of the chapter house door. The fourth team of 10 builders was directed by Fernando de la Fermosa, *aparelhador* of the sacristy. Finally, the fifth team, with 38 men, was the one led by Francisco de Benavente, *aparelhador* of the first cloister. (Figs 9 & 10)



Figure 7. Monastery of Jerónimos. Southern entrance. (Authors' picture.)

Another feature of this organization model for the construction site of the Monastery of Jerónimos was that some *empreitadas* worked simultaneously in the same parts of the building. This was the case, for example, for the first, third and fourth *empreitadas* which simultaneously worked on different portions of the first cloister.

During 1517, then, approximately 250 builders plus the labourers, divided among the different *empreitadas*, were working simultaneously on the Jerónimos Monastery construction site.¹⁵ João de Castilho demonstrated that he was an outstanding construction site manager, with the ability to lead a major project and building site that had a very complex organization.

Size of the teams

From the analysis of the work of these different *empreitadas* we can conclude that the size and complexity of the tasks of each one were quite different. The size of the teams also varied a lot, depending on the size and complexity of the work assigned to each team. The seven *empreitadas* ranged in size from 110 men to only 10, while the sizes of the five teams within the first and largest *empreitada* (which was the only one to be subdivided into smaller teams) ranged from 38 men to only 4.

Composition of the teams

It is noteworthy that the geographical origin of the master and most of the craftsmen in his team were usually the same. For example, most of the men who worked with Nicolau Chanterrene, a Frenchman, were also French, while in the team of Filipe Henriques, Portuguese, most builders were also Portuguese. This was probably due to the shared language and also previous professional experience.

On the other hand, the largest team, led by João de Castilho, Biscayan, combined French workers, who



Figure 11. View of the Monastery and Beach of Belém, Lisbon (1657), Filipe Lobo, Museu Nacional de Arte Antiga, Lisboa, Portugal. (Source: [http://commons.wikimedia.org/wiki/File:Vista_do_Mosteiro_e_Praia_de_Bel%C3%A9m_\(Filipe_Lobo\).jpg](http://commons.wikimedia.org/wiki/File:Vista_do_Mosteiro_e_Praia_de_Bel%C3%A9m_(Filipe_Lobo).jpg) photo in the Public domain.)

made up about half the team, and Biscayans and Portuguese, who made up the other half. This is probably explained by the professional career of João de Castilho who had worked on several Portuguese and Iberian construction sites and therefore must have developed relationships with many builders from different regions. One of the most important architectural and artistic features of the Jerónimos Monastery is the famous southern entrance which was designed and constructed by the sub-team of the first *empreitada* directed personally by João de Castilho. (Figs 7 & 11) This work was probably concluded in a short time by João de Castillo and his trusted team of workers – including Juan de la Faya, André Pilarte and the Flemish Mestre Machim who is known to have worked on construction sites in the city of Braga in 1510, and later in Coimbra – with whom João de Castillo had previously worked on many other buildings in northern Portugal.¹⁶

Conclusion

In the later Middle Ages Portuguese construction sites were organized using two main models, which is similar to what can be observed in some other parts of Europe, such as Italy. One of these models has a centralized (single) and pyramidal (hierarchical) organization, with an administrative and technical management that directly controlled the entire site. The other model was characterized by having a single high-level management of the whole site, but having a sub-division of work and tasks among several main teams (*empreitadas*). The building under construction was divided into several segments, each one being allocated to a specific team that was responsible for its construction. Each *empreitada* had its own master, a specific working team who worked under a specific contract related to the task to be accomplished. It was, thus, a more decentralized organizational model.

From our current knowledge, it seems that this model was first introduced into Portugal at the construction site of the Monastery of Jerónimos in Lisbon, from 1517 onwards, when João de Castilho became general master of the construction site. At present we can only speculate whether the initiative to introduce this new model came from the administration of Manuel, the King of Portugal, perhaps because the project had not been successful enough under the previous project director, Diogo de Boytac, or from the new project director João de Castilho after he had been appointed.

Other examples of this organisational model are unknown in Portugal at this time, at least in such a comprehensive form. Both models for site organization can be found in different regions of Europe from the fifteenth century, but it is unclear whether the second one, the *empreitadas* model, was used widely, or only in a small number of cases. The first model, with a single centralized management, seems to have been the most common in the great royal construction sites of the stronger centralized monarchies, such as France and Spain in the sixteenth century. Among other examples, the attempt to introduce the system of *empreitadas* by The architect Juan Bautista de Toledo (c. 1515–67) who had been educated and trained in Rome, attempted to introduce the system of *empreitadas* in the second half of the sixteenth century to build the Monastery of the Escorial, in Madrid, which he designed). However, his attempt failed due to opposition from the king and his agents, who wanted to continue using the traditional model, which was already in progress.¹⁷

To conclude, we can emphasize that the new organizational model was developed for the construction of the Jerónimos Monastery in Lisbon, from 1517, by João de Castilho, and signified a major change in how to organize and manage a large project. The construction of the Jerónimos Monastery, begun by King Manuel in around 1501, benefited from significant financial resources assured by the royal administration that allowed, in turn, large teams of renowned masters to be attracted from several European regions. This monastery was built to give a strong image of the king and kingdom power, and therefore assumed a rather exceptional character, that might also explain the adoption of that ‘new’

organizational model. The new model continued in 1518, as were many of builders employed whose numbers even grew. The accounting records indicate that João de Castilho himself reduced his presence on the site after the end of 1518, and from mid-1519 to 1522 the construction works seem to have slowed down. In 1522 when the new King, João III, was on the throne, and still with João de Castilho as master the construction, the project got under way again.¹⁸

From our current knowledge, we do not know if the system of *empreitadas* was used in any other constructions projects in Portugal. However, we do know that the traditional model with centralized management, was used on many more contemporary projects.

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