

Study and analysis of the reasons for the lack of competitiveness of Portuguese construction industry: implemented research surveys

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Abstract—The lack of accomplishment of the main management functions in construction projects had been reported worldwide. The symptoms are well recognized, like cost and time overruns, deficient quality and lack of safety. To help clarifying the reasons for this evidence, several surveys were carried to Portuguese construction stakeholders by a team research of construction management of University of Minho. The PhD survey results to confirm the original list of causes for delays of the study namely poor productivity, procurement system, and frequent change orders during construction and so on. In order to correct the above problems and improve construction competitiveness should be implemented a national database with the quantity works list for different construction projects, a more appropriate and efficient organizational systems within design teams and a need for greater care on the part of the owners when they prepare their schedules and preliminary programs. On the other hand, it was clear that despite the apparent advantages of Internet survey approach, traditional methods like fax, phone calls and interviews appear to be most successful and still are preferred by respondents.

Index Terms—“construction delays”; “cost overruns”; “deficient quality and lack of safety”; “Portuguese construction competitiveness”; “survey”

1. INTRODUCTION

THE last few years have confirmed what was mostly feared: Portuguese construction industry suffers from a chronic disease - the lack of competitiveness. Symptoms have long been recognised in several construction projects: frequent delays, cost overruns, deficient safety, absent quality. However, such evidences have systematically been lessened for a number of explanations: the specifics of the industry, the production structure, the phased development of construction projects, the lack of adequate labour training, the weather conditions, etc.

However, these does not explain why Portuguese construction evidences the above symptoms, while is seem to be more efficient in other European countries, therefore more competitive in international market, hence more healthy. The author is integrated into a researcher team that has been

carrying out a several research activities whose mains aims are clarifying reasons for the lack in competitiveness on the four aspects above mentioned. These are in fact more closely related to the symptoms of this chronic disease (we hope will be eradicated one day). Basically, the aim is to provide answers to the following questions: questions:

1. Why are construction projects systematically delayed?
2. Why are there budget overruns in practically every single project?
3. Why is safety still badly overlooked in Portuguese construction?
4. Why isn't quality satisfactory yet, even in recent projects?
5. How do promoters and contractors to deal with growing environmental demands?

The main objective of this paper is firstly to divulge the main research activities that the team has been carrying out on lack of competitiveness of Portuguese construction industry and after that to divulge the main reasons and background reasons for the lack of competitiveness of the Portuguese construction industry concerning construction delays. Thereafter, the paper will seek what could possibly be done and from which parties, in order to correct the above problem and improve construction competitiveness.

2. CHARACTERIZATION OF RESEARCH ACTIVITIES

2.1 Training in the area of construction management

The consequences of the lack of competitiveness are reflected in the industry outputs, the price of which is eventually charged to final users. For the owners, delays and cost overruns represent fewer revenues for the money invested; for contractors, low profits arising from competitive bidding and biased risk distribution are not enough to cover costs incurred with accidents and defect liability; and for users, the economic value of the constructed facility too often fails to compensate project delays and consequent investment cost increase. This common concern reflects the need for further training in the area of construction management. The subject of management training is currently addressed in a European research project in which the University of Minho is presently involved (Recognition of needs and creation of the professional training in the area of preparation and management of infrastructure construction projects financed by the European Union, project number PL/04/B/P/PP/-174 417).

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2.2 Internet Inquiry

In order to evaluate the present situation, clarify the reasons for the problem and indicate possible solutions for it, a research project has been conducted, named as “*Reasons for lack of accomplishment of schedule, costs and safety objectives in construction*”, financed by FCT (Science and Technology Foundation, in Portuguese) [1] [2] [3].

It has the following components:

1. To inquire to Portuguese construction stakeholders on the causes and background reasons for project delays, cost overruns, deficient safety and absent quality following from their experience in recent projects
2. To collect information from former studies on the subject
3. To compare previous results with international information available from other similar projects;
4. To establish a common set of causes and background reasons for the problem
5. To find diagnosis for delays
6. To establish possible paths to solve the problem.

2.3 PhD survey

A PhD thesis named “Construction delays” has been developed by author João Pedro Couto. The main program task was a survey carried to Portuguese construction stakeholders. It has the following main components [1]:

1. To research and analysis bibliography and establish a common set of causes and background reasons for the problem
2. To inquire to Portuguese construction stakeholders on the causes and background reasons for project delays following from their experience in recent projects
3. To establish possible paths to solve the problem

3. BIBLIOGRAPHIC RESEARCH NOTES

The consequences of a **time overrun** are almost always serious and hard to resolve. Failure to meet deadlines represents financial losses to the users and, more often than not, it has a negative impact on the profitability of the project for the promoters. However, understanding the causes may help in curbing the problem and contribute to an improvement in management and productivity, inevitably making the sector a more productive one. In Portugal there are no known studies of any relevance on the causes for time overruns, although their consequences are often discussed [1]. There are however some studies about lack of quality, coordination problems and errors in project. The importance of the problem *per se* constitutes enough grounds for the development on Portuguese construction a specific research focuses on this topic. The goal here is to make information available that will help develop and deploy attenuating measures as well as strategies and techniques geared specifically towards the management, prediction and control of the causes for delays.

Causes for **cost overruns** in construction projects have been extensively researched worldwide and reported in

scientific literature, public reports and in the media in general. For instance, analyzing the risk for a construction project to suffer cost overruns, Marcos study concluded that the causes are vast and can be classified as deviations from original scope, defective performance of management and organizational functions, inadequate procurement system, external factors and limitations of the methods used for cost estimation [4]. Other researcher [5], focused on infrastructure rehabilitation projects, concluded that the main factors affecting cost overruns were design and cardinal changes, different site conditions, management inexperience, deficient hierarchic chain and inadequate supervision.

The Portuguese national accounting court of law, published some reports on public projects concluded in the last years.

Following, some conclusions are presented [6]:

- In the 26 major motorway projects concluded from 1985 to 1997, the average cost overrun rate attained 39%, due to incomplete design at the procurement phase, deficient contract documents, capital changes due to the change of scope, direct changes, different site conditions and problems with delivery construction site
- In underground projects launched between 1985 and 2000, cost overruns averaged 311% due to contracting without concurrence (direct award), insufficient data to use design/build contracting system; direct and scope changes and design omissions
- The Expo98 projects report divulged that cost overruns averaged was 41%, due to design errors, omissions and inappropriate options, inadequate contract systems (unit price and direct awarding), premium clauses, late site disposal and direct and cardinal changes

Usually associated with cost overruns, **time overruns** also occur frequently, and influences not only construction industry, but the country’s economy as a whole.

In a research conducted in Portugal, it was concluded that in 29 railway recent construction projects, with an average initial contract value of 21.000.000 € the average time overruns reached 85 %, meaning 912 days more of the initial estimate of 536 days [7]. Causes for time overruns have not been surveyed, because the main objective was the type of construction claims presented on those projects.

Cost and time overruns, as well as safety related indicators, are the most well known consequences of the lack of accomplishment of management functions in construction, because they produce immediate effects on stakeholders [7].

Nevertheless, the **lack of quality** in construction projects is reflected along its life cycle, and begins at the initial stage of the design phase. As the prevention of this is always crash, the results are the user endemic (and systematic) claim for repairing defects. Repair costs may be as high as 12% of the project total cost [8], and are mainly due to changes in the

design phase, variations in the construction phase and design errors. These causes appear to contribute to, at least, 92% of rework costs, but this rate may be even higher, as delay costs, claim costs and other intangible expenditures, are not usually included [9].

Lack of safety in the construction industry is not Portuguese specific, although the rates are higher, when compared to the rest of European Community countries. In fact, construction workers have 3 times more chances of dying, and 2 times of getting injured than any worker of other economic activity. During 2004, 197 fatalities occurred in all Portuguese economic activities, not considering the transportation accidents to or from the work place, from which, 101 (51%) were in the construction industry. This represents an average of 25 deaths per 100.000 workers, twice as much the European rate, and the same happens with injuries (above 50.000/year) [10] [7].

4. INTERNET INQUIRY

Against the background of previous paragraphs, it was decided to launch a research project focused on the reasons for the lack of achievement of the main management construction functions, and use project results to recommend actual measures to increase competitiveness of the Portuguese construction industry. The research is focused on the largest projects through an inquiry to the most relevant clients of the industry and the biggest contractors. Results will be disseminated both national and internationally, in form of reports, papers, articles and other publications, that may influence stakeholders to adopt proposed measures, including construction legislation review. In order to characterize the present situation in Portugal, the first step of the research was to develop an Internet based inquiry to collect information on past projects. Internet inquiries appears to have several advantages over traditional ones, because they allow to reduce postal and administration costs, overcome sparse geographic locations, minimize respondent errors, save time inputting collected data, increase speed in getting results, etc. It is well reported [11] that the accuracy of information and the ability to manage it efficiently are two decisive factors for achieving success in the global economy [7].

The link to the Internet based inquiry was addressed by emailing clients and contractors involved in the main construction projects concluded in Portugal in the last years. The questionnaire focuses on the characteristics of each project and on specific evidence about the lack of achievement of the four management functions mentioned above.

4.1 Characterization of project, clients and contractors

Projects inquired were completed after 1998, with an initial contract value greater than < 10.000.000 € in order to ensure the participation of the largest Portuguese companies. Although the objective is to collect information from a large scope of projects (public and private, building and civil engineering, new construction and repairing), the inquiry started with the public ones, because references to the

procurement phase of these projects are easy to find in official journals. So, whenever further references are made, public projects are meant. A total of 493 public construction projects were found accomplishing the above conditions, distributed by type of work, as follows:

- Motorway /Road: 173
- Railway / Underground /Airport: 87
- Buildings: 79
- Environment (Water, Drainage, Waste): 86
- Maritime / Hydraulic: 44
- Others: 24

The projects identified above have been promoted by 109 different clients, and awarded by 108 contractors, either standing alone or in association.

Then respondents were asked to **quantify** the lack of fulfillment of each management function, by indicating the final cost of the project, the final project duration, the number of accidents, the number of workers involved, the work hours, the lost days and the number of non-compliances or claims due to quality problems.

The **qualitative** evaluation of each project was done by pointing up several possible causes retrieved from scientific literature, for the lack of fulfillment of each management variable, and asking respondents to graduate them in a scale of 1 (less important) to 4 (most important). It was also given the possibility to indicate other causes, not previously identified:

4.2 Internet inquiry results

Six months after sending the email (June – December 2005), only four clients managed to fill up the data sheet, for seven projects they promoted. This corresponds to a very low answering rate of only 1.4%, 3.7% and 0%, taking on account the total number of projects, clients and contractors, respectively.

Reasons for this despicable participation were directly asked to the companies inquired in order to gather them into different types, and take some actions to help solving the problem. In fact, an informal inquiry was made to clients and contractors, with a sole single question: *What reasons does construction industry have not to answer to inquiries about past projects?* The importance of knowing the answers to the above question was to help finding adequate measures to overcome receptiveness of the inquiry, and mitigate the lack of information received. The reasons presented by the industry, and the measures taken, are described afterwards:

- Too busy to answer
- Lack of treated data or hard to get it
- Lost email
- Field personnel left the company
- Afraid of getting data used against the company

- Confidential data (does not want to provide)
- Excuses (continue to avoid answer)
- All reasons

5. PHD SURVEY

5.1 Main survey aims

The previous sections have shown that it is important to scale up anti-delay controls, which will certainly help improve the performance of everyone involved in the construction process. It is this study's goal to look into and evaluate the aspects pertaining to causes for delays that have an impact on the output of construction companies. To this end, the literature available was analyzed. By and large, one can say this analysis/research was undertaken bearing in mind the following aims [1] [2]

- To catalogue and analyze the factors, reasons and motives for delays discussed in extant bibliography
- To glean information on classification of, as well as methodologies to evaluate, delays, claims and related issues
- To understand, compare and draw out the specific traits of the causes specific to our sector and contrast what is found in international data

To make this possible, not only did we collect bibliographical information and proceed with the analysis of the traits found in the national construction sector but we also asked a number of people for their opinions. These people were promoters, company owners, construction owners, public institutions, contractors, designers and other relevant construction personnel. They were asked to provide a data set that would validate our current concern and allow for a more realistic insight into the problem, and increase our knowledge and understanding of the reasons behind overruns. A nation-wide survey was administered.

5.2 General research method deployed

In this section we outline the research methodology employed with a view to achieving the aims of this study. For us to reach our goal, we need a research methodology that will set off the fundamental stages of our investigative procedures:

1. Bibliographical research and analysis
2. Discussion with relevant professionals and construction management specialists
3. Implementing a questionnaire
4. Analysis of the data gathered

5.3 Drafting and implementation of the nation-wide survey

Having studied the bibliography and complemented, double-checked and contrasted the data therein against a number of opinions published by several relevant parties in the sector, and following an intuitive analysis by the researchers, drafted a map that breaks down causes for delay in Portugal into 12 origin-related categories (see Table I).

Table I. Categories of contemplated causes for delay

Categories of Causes for Delay	
MT: Material-related	DT: Design Team-related
EQ: Equipment-related	PM&I: Project Manager and Inspection-related
LB: Labour-related	CCR: Contract and Contractual Relationships-related
CM: Contractor Management-related	IR: Institutional Relationships-related
FMP: Financial Management of Project-related	PS: Project Specificity-related
OW: Owner-related	OF: Outside Factors-related

Then were consulted a few national specialists, consultants and researchers in construction management about the adequacy of this cause map that we'd drafted, and then elicited opinions from national and specialists about the importance and meaning of studies of this kind to the delay control and competitiveness in the construction sector. This cooperative effort was important. It helped us adjust the cause map to the actual characteristics of the national construction sector. It would be apposite to say that the whole process evolved as we conducted our survey.

Once defined the cause map, we drafted a questionnaire based on it. The map now featured an analysis of the relationship between delays and accidents in the workplace, as well as an analysis of the legal framework for delays in construction projects in Portugal.

A hundred questionnaires were sent out to contractors, 85 to consultants and project designers and 100 to construction owners. On stage two, we contacted the respondents who did not get back to us within the prearranged response time, proposing an interview as an alternative. The latter suggestion was gladly accepted by these respondents. During our interviews we spoke openly about the problem and related areas. The main intent was to ask questions that would clarify the causes mentioned in the survey and observe procedures so as to resolve them;

The answers were provided by administrative personnel or technical staff in management positions then working with construction companies, as well as public owners, consultancy and engineering firms, design firms, management directors, project directors and managers and senior engineers.

The answers collected were 59 by contractors, 26 by designers/consultants and 79 by owners answered to questionnaire. The above-mentioned number of answers is included 8 interviewers to contractors, 8 to designers, 18 to public owners and 5 to private owners.

5.4 Structure of the questionnaire

Taking into account what prior studies recommended as we drafted the questionnaire. It was shared in five sections. In section A, the goal is to obtain general information on the institution or company that is taking the survey. In section B was present a list of possible causes for delays, built according to the results of our investigation and our own experience. The list was divided by categories. The respondents were asked to attribute to each cause degrees of frequency, impact on workflow and the types of construction project where they are most likely to occur. The aim is to establish a classification and consequently rank the several causes. Section C will serve the purpose of identifying the indicators that may best evaluate and assess potential delay-causing problems. With section D the intent is to clarify the relationship between work-related accidents and pressure resulting from the race to meet construction deadlines. Finally, in section E we intended to gather a set of complementary data relating to construction delays, especially where current Portuguese law is concerned and the administrative procedures observed by the entities involved in this sector [1].

5.5 Survey results

The results have revealed that responsibility for delay can be ascribed to all parties involved. The statistical and mathematical analysis is still under way, but we can now publish some of our more evident conclusions from the data gathered.

Of the 118 causes contemplated in the survey, an extract of the 15 that were most highly ranked on a scale of relevance by 4 groups involved in the construction sector (Public owners, Private owners, Contractors, Designers /Consultants) [1] is presented.

Table II. Ranking of 15 most relevant causes

No.	CAT: CAUSES FOR DELAYS IN CONSTRUCTION	Average Relevance Ranking
77	DT: Incomplete projects, ambiguities, errors, omissions, inadequate details, details inconsistent throughout special teams, inadequate design, etc.	1
102	IR: Excessive dependency on opinions and authorizations from several institutions and ruling bodies (city/town halls, IPPAR – Portuguese Institute for Architecture and Patrimony, Environment Institute, EP, etc.)	2
100	IR: Difficulties in obtaining licenses and permits from authorities	3
97	CCR: A tendency to use procurement systems with a bias toward the cheapest solutions	4
28	CM: Deficient planning, activity/material/labor and equipment management and control	5
18	OW: Shortage of skilled laborers	6
76	DT: Errors in design originating from the project designers due to a lack of knowledge of local conditions and the surroundings	7
75	DT: Delays in preparation of technical documentation by project designers while construction is in progress	8
49	CM: Neglect of critical activities	9
51	CM: Overly optimistic planning	10
62	OW: Frequent change orders during construction	11
44	CM: Deficient coordination among participants	12
26	OW: Low productivity	13
98	CCR: Non-existence of financial incentives that would encourage meeting deadlines of completing the works before the deadline	14
103	IR: Difficulty and delay in the drafting and submitting of requests for institutional opinions and authorizations	15

5.6 Recommendations and construction delays measures preventive

Based on the opinions provided by the respondents, specialists, associations and institutes involved in the construction sector, as well as prior studies conducted outside Portugal, it is our purpose to prepare a comprehensive file on preventive measures and recommendations, guided by strict criteria, which will help lessen the problems under scrutiny. The recommendations are many and target every single participant. Not meaning to establish definite hierarchies now, we can however single out the following [1]:

1. The need to implement a national database with the quantity works list for different construction projects - this project is now under way

2. Implementing more appropriate and efficient organizational systems within design teams
3. A need for greater care on the part of the owners when they prepare their schedules and preliminary programs
4. A need for greater precision when preparing viability studies
5. Raising awareness with those involved about the risks inherent to construction
6. A need to optimize management with a basis on qualification and the use of more adequate techniques;
7. A need to update some inadequate legislation so as to clearly define and segregate responsibility and liability, and so on

6. CONCLUSIONS

As it was afore-mentioned the lack of accomplishment of the main management functions in construction projects had been reported worldwide, because their consequences are reflected in the industry outputs. The main objective of this paper was firstly to divulge the main researcher activities that the team has been carrying out on lack of competitiveness of Portuguese construction industry and after that to divulge the main reasons and background reasons for the lack of competitiveness of the Portuguese construction industry. The mains reasons to time overruns are related with designer problems, poor productivity, procurement system, overly optimistic planning, and frequent change orders during construction and so on. Thereafter, it was presented what could possibly be done and from stakeholders in order to correct the above problems and improve construction competitiveness. The most highly ranked on a scale of relevance by stakeholders were implementation a national database with the quantity works list for different construction projects, a more appropriate and efficient organizational systems within design teams and a need for greater care on the part of the owners when they prepare their schedules and preliminary programs.

Another important conclusion is that, in fact, the stakeholders (clients and contractors) do not respond freely to Internet inquires, for many reasons that make it hard to research construction management practices. Accordingly, alternative approach measures needed to be introduced in order to increase the participation in the inquiry. Results so far, confirm that despite the apparent advantages of Internet approach, traditional methods like fax, phone calls and interviews appear to be most successful. This may be due to the conservative attitude behavior of the industry, the fear that data, in some way, be used against respondents, or the lack of relevant data to report. And this must be notable, in fact, as the first reason for the lack of competitiveness of Portuguese construction industry [7].

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