

# WHY CAN'T MAIN PROJECT MANAGEMENT FUNCTIONS BE ACHIEVED IN MOST CONSTRUCTION PROJECTS?

H. P. Moura<sup>1</sup>, J. C. Teixeira<sup>2</sup>

<sup>1</sup> Civil Engineer, Estradas de Portugal, EPE, Almada, Portugal

<sup>2</sup> Associated Prof., Minho University, Guimarães, Portugal

**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, a survey was carried to Portuguese construction stakeholders, based on an Internet inquiry, aimed to characterize past projects. While time for the answers is still running, the main important conclusion retrieved from the survey is that industry practitioners do not have, or do not want to provide, quantitative information about past projects. This, in fact, may be signalled as the first reason for the lack of competitiveness of the construction industry in Portugal.

**Keywords:** project management functions, Internet inquiry, quantitative information, cost overruns, time overruns, quality, safety

## 1 - INTRODUCTION

Construction industry in the open European Market ought to be competitive and efficient, in order to return value to the stakeholders. Presently construction represents one of the most relevant sectors of the European economy, worthing more than 900 billions euros a year, which is 10% of GDP, and employing about 13 million workers.

In Portugal, percentage figures are roughly the same, as construction industry represents 13.5% of the GDP, and employs 11 % of the active population [1].

However, the Portuguese construction industry lacks competitiveness, which can be viewed as a chronic disease. Symptoms are recognized in many construction projects: frequent delays, cost overruns, deficient quality and insufficient safety. Accordingly, stockholders' expectations may be partially frustrated, because the achievement of these management functions is frequently viewed as a major criterion for project success.

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)

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).

## 2 – CONSTRUCTION MANAGEMENT FUNCTIONS

After the contract is awarded, the main concern for the contractor is the management of **cost**, **time** and **quality**. The interaction of these functions is typically represented by a triangle as the one depicted in Figure 1 [2], showing that every project should be positioned inside it, and that there is a balance between the three factors, with or without similar relevance (point P):

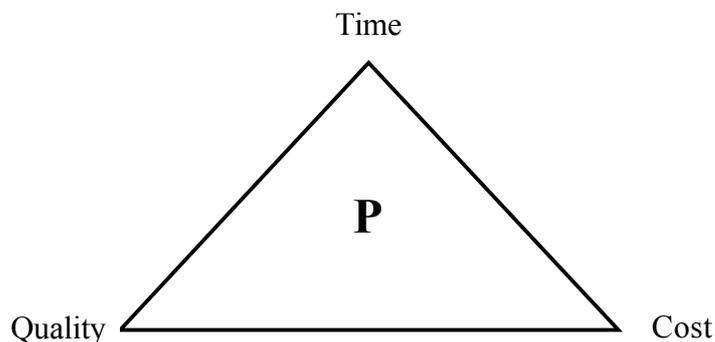


FIGURE 1 – Interaction of Cost, Quality and Time

In the last years, **safety** has also been playing an important role, because deficient safety performance on site reduces the project economic revenues. Moreover, accidents have some intangible liability effects in the projects participants, namely contractors, owners, project managers and designers.

The lack of fulfilment of the main management functions in construction projects has been reported in Portugal and internationally. Causes pointed in Portugal tend to be general and chiefly backed by specific characteristics of the construction industry, e.g: the specific production structure, the phased project development, the inadequate labour training, the dependence on the weather conditions, and so on. Nevertheless, some reports have been increasingly quantifying project failures due to the pressure of the public opinion and the need for public fund control.

Moreover, survey to international literature reveals that some relevant causes have already been identified.

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, analysing the risk for a construction project to suffer cost overruns, a 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 [3]. Other researcher [4], 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.

In Portugal, the national accounting court of law, published some reports on public projects concluded in the last years. Conclusions are as follows [5]:

- In the 26 major motorway projects concluded from 1985 to 1997, the average cost overrun rate reached 39%, due to incomplete design at the procurement phase, deficient contract documents, cardinal changes due to the change of scope, direct changes, different site conditions and delayed site disposal.
- 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 revealed that cost overruns averaged as much as 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. The causes pointed for this evidence are various and well documented in international literature.

In a research conducted in Portugal, the authors 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 [6]. 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 fulfilment of management functions in construction, because they produce immediate effects on stakeholders.

However, 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 miscarried, 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 [7], 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 [8].

**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) [9].

### **3 – 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 characterise 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, minimise respondent errors, save time inputting collected data, increase speed in getting results, etc. It is well reported [10] that the accuracy of information and the ability to manage it efficiently are two decisive factors for achieving success in the global economy.

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.

#### **3.1 Characterization of the projects**

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:

<b>Motorway /Road</b>	<b>173</b>	<b>35%</b>
<b>Railway / Underground /Airport</b>	<b>87</b>	<b>18%</b>
<b>Buildings</b>	<b>79</b>	<b>16%</b>
<b>Environment (Water, Drainage, Waste) Treatment</b>	<b>86</b>	<b>17%</b>
<b>Maritime / Hydraulic/ Dam</b>	<b>44</b>	<b>9%</b>
<b>Others</b>	<b>24</b>	<b>5%</b>

**TOTAL 493 100%**

**TABLE 1 – Project distribution by type of work**

### 3.2 Characterisation of clients and contractors

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

The clients may be characterized either by the number of projects promoted, or by their main activity. Table 2 shows that barely 9 clients have promoted 65 % of all projects (324):

<b>Estradas de Portugal, EPE</b>	<b>154</b>	<b>31%</b>
<b>Refer</b>	<b>48</b>	<b>10%</b>
<b>Sec. Reg. Equi. Transp. Mad</b>	<b>41</b>	<b>8%</b>
<b>Brisa, SA</b>	<b>30</b>	<b>6%</b>
<b>Metropolitano de Lisboa</b>	<b>14</b>	<b>3%</b>
<b>EPAL</b>	<b>13</b>	<b>3%</b>
<b>CM Lisboa</b>	<b>12</b>	<b>2%</b>
<b>Instit. Desenv. Rural Hidral.</b>	<b>12</b>	<b>2%</b>

**TOTAL (projects) 324 65%**

<b>Local city authorities</b>	<b>40</b>	<b>33%</b>
<b>Water / Sewer /Waste</b>	<b>24</b>	<b>20%</b>
<b>Transportation</b>	<b>19</b>	<b>16%</b>
<b>Sports / Leisure</b>	<b>11</b>	<b>9%</b>
<b>Government Departments</b>	<b>10</b>	<b>8%</b>
<b>Gas/Energy distribution</b>	<b>6</b>	<b>4%</b>
<b>Education</b>	<b>6</b>	<b>4%</b>
<b>Others</b>	<b>4</b>	<b>3%</b>

**TOTAL (owners) 109 100%**

**TABLE 2 – Client distribution by projects and activity**

In the same way, contractors may be identified, either by the number of construction projects they participated in, by turnover or by their workforce. In this case, Table 4 shows that the main 9 contractors participated in 49 % of all projects x contractors (719):

<b>Mota-Engil</b>	<b>73</b>	<b>10%</b>
<b>Construtora do Tâmega</b>	<b>59</b>	<b>8%</b>
<b>Ramalho Rosa - Cobetar</b>	<b>45</b>	<b>6%</b>
<b>Somague</b>	<b>43</b>	<b>6%</b>
<b>Soares da Costa</b>	<b>40</b>	<b>6%</b>
<b>Teixeira Duarte</b>	<b>37</b>	<b>5%</b>
<b>Zagope</b>	<b>34</b>	<b>5%</b>
<b>BPC</b>	<b>24</b>	<b>3%</b>

**TOTAL (projects x contractors) 355 49%**

#### 2004 ANNUAL TURNOVER (Millions of € )

<b>&gt; 250.000 M€</b>	<b>16</b>	<b>15%</b>
<b>100.000 M€ – 250.000 M€</b>	<b>10</b>	<b>9%</b>
<b>50.000 M€ - 100.000 M€</b>	<b>28</b>	<b>26%</b>
<b>25.000 M€ - 50.000 M€</b>	<b>19</b>	<b>17%</b>
<b>&lt; 10.000 M€</b>	<b>35</b>	<b>33%</b>

**TOTAL (contractors) 108 100%**

**TABLE 3 – Contractors distribution by projects and annual turnover**

### 3.3 Characterization of the inquiry

The **general** data surveyed about past construction projects, was the following:

- Project name, client and contractor name;
- Initial contract value and type of contract according to the Portuguese public project regulations (unit-priced, lump sum, cost percentage, design/build);
- Starting date and initially schedule duration.

Then respondents were asked to **quantify** the lack of fulfilment 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 workhours, 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 fulfilment of each management variable (Table 4), 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:

	<b>Time</b>	<b>Cost</b>	<b>Safety</b>	<b>Quality</b>
<b>LACK OF ACHIEVEMENT</b>	Due to materials (delays in purchasing, run out, specification changes, poor quality and deficient scheduling)	Design errors (inadequate solutions or materials, improper measurements and document incompatibilities)	Lack of individual protection	Inadequate design solutions
	Due to equipment (break down, missing, deficient scheduling, productivity and inefficiency)	Diferent Site Conditions, due to geological and geotechnical problems	Lack of collective protections	Deficient work execution or construction errors
	Due to work labour (poor scheduling, missing, absence, unskilled, low productivity, moral and motivation)	Direct Changes, ordered by the client	Lack of workers knowledge to do the specific activity	Inactions or errors of project managers decisions and performance
	Due to contractor management (poor coordination, supervision, construction errors, technical inadequacy, late mobilization)	Cardinal changes, imposed by third parties (utility, arqueologic, environment, local or national authorities)	High risk activity	Inactions or errors in clients decisions and performance
	Money problems (payment delays to vendors or subcontractors, low cash availability, lack of financing)	External factors (weather conditions, force majeure events, legal and regulatory changes)	Lack of equipment maintenance	Inadequate materials, products, construction process performance
	Owner responsibility (payment delays, suspensions, no access to site, interference on job, unrealistic initial duration, excessive bureaucracy)		Lack of job preparation	Inadequate or deficient inspections to site conditions
	Design responsibility (error and /omissions, inadequacy, extreme complexity of the project, delay or lack of response, inexperience, norms violations)		Accident due to the fullfilment of a direct order from the client or its representative	External factors (weather conditions, force majeure events, environment, legal and regulatory changes, licences)
	Due to project manager (inexperience, incapacity, delayed actions and decisions, not available, inflexible.		Inadequacy of the equipments and/or materials selected	

Due to contract (insufficient penalties, lack of premium, low price awards)		Force majeure events, inevitable and unforeseeable	
Institutional relations (difficulties obtaining licences, patents, recommendations)			
Specificity of the project (utility reposition, traffic deviation, site restrictions, other contractors on site, difficulties to access to site)			
External factors (weather conditions, force majeure events, accidents, environment, cultural or social problems, legal and regulatory changes)			

**TABLE 4 – Previously identified causes for the lack of achievement**

At the end of each section, respondents were asked to indicate the actions that should have contributed to the mitigation of problems detected.

#### **4 – REPLY FROM INDUSTRY**

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 in Table 5:

<b>REASONS STATED</b>	<b>ACTION DECIDED</b>
Too busy to answer	Asked to fill the qualitative part of the inquiry only
Lack of treated data or hard to get it	Ask to give the opinion about other projects
Lost email	Re-send the email and fax to the company Board of Directors
Field personnel left the company	Ask to give aggregate answers for all projects
Afraid of getting data used against the company	Phone call explaining the use of data for research proposes only
Confidential data (does not want to provide)	Phone call assuming confidentiality
Excuses (continue to avoid answer)	Email and phone calls insisting and use of personal acquaintance of key staff
All reasons	Indirect motivations by diffusion of results

**TABLE 5 – Reasons invoked and measures taken**

Nearly one month after taking this measures, at this date (31 January 2006) 24 projects had been characterized, involving answers from 9 clients and 3 contractors, and every week new answers are being received. Though these data denote an increase of the answers, corresponding to rates of 4.8 %, 8.2% and 2.8%, respectively for the number of projects, clients and contractors surveyed, there is still a very low participating.

This is due to the fact that the excuses are still the most claimed reason, and the solution to engage Portuguese Construction industry on this research is the media pressure and the international diffusion of this project. The presentation of this paper, is an important step on this objective, and will allow to get opinions on the adequacy of the inquiry developed.

Further actions also include personal interviews with the most significant clients and contractors, in order to get more relevant and timely answers. The data analysis and the final recommendations on the lack of competitiveness of portuguese construction industry, will hopefully be presented in a forthcoming conference.

## **5 – CONCLUSIONS**

This paper reports a survey on construction management practices in Portugal by using an Internet based inquiry. The objective of the survey was to identify the reasons for the lack of achievement of main management functions, namely cost, time, quality and safety, in past relevant projects concluded in Portugal in the last years, in order to propose measures to overcome them.

But the few answers got so far do not allow for identifying this lack of achievements, although they had contributed to find other important problems of the industry:

- Quantitative data about past projects, adequately treated and stored, is hard to find in client and contractor organizations;
- 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 behaviour 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 signaled, in fact, as the first reason for the lack of competitiveness of portuguese construction industry.

The remaining of the survey will hopefully furnish significant information, which will eventually be used to cope with the project objectives. For the time being, the questions in the title of this paper remain unanswered!

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