TECHNICAL NOTE

Success Evaluation Factors in Construction Project Management - Some Evidence from Medium and Large Portuguese Companies

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Abstract

The construction industry plays a very important role in the Portuguese economy. In 2009, it was among the top five economic sectors, representing 13% of total employment. Nevertheless, project failures are still frequent mainly due to inadequate management practices and to the intrinsic characteristics of projects of the construction industry. Even though Portuguese construction has improved in recent years, cost and schedule overruns, low productivity and final product quality problems are still common. In this context, project management is a crucial tool for improving construction operations and for the overall success of projects. The aim of this article is to contribute to the discussion on success evaluation factors in a field where little has been written – the construction industry. Through a survey of 40 medium and large Portuguese companies several factors were identified which are currently considered in the evaluation of project success, as found in the literature review. The results show that the traditional factors, often referred to as the "Atkinson elements triangle" (cost, time and quality), are still the most relevant for evaluating the success of a project, but others, such as customer involvement and acceptance, have gained importance in recent years.

Keywords: *construction industry, success factors, project management, portuguese companies, manager profile*

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1. Introduction

Construction companies need to constantly adapt to new market requirements, increase competition and technological innovation (KPMG, 2012). They must, therefore, use efficient management tools to meet these relentless new challenges. In 2009, the construction sector was the first employer in the manufacturing sector in Portugal (PORDATA, 2012). However, construction has an inherent set of characteristics which makes the implementation of efficient management systems more difficult.

Every construction project is site-specific and executed with the involvement of several stakeholders. Compared with other industries, construction is much less predictable as it involves a lot more complexity, which can lead to inefficiencies at various levels. By their very nature, normal construction site activities are highly heterogeneous (Chau, 2004). Therefore, today's complex projects require more effective planning and communication (Wang *et al.*, 2004), and more advanced tools (Cao *et al.*, 2002; Chau *et al.*, 2003). For instance, Chau *et al.* (2003) propose a

computing system for facilitating the planning process, aimed at enhancing the quality of site management.

The construction sector is often criticized because of delays, budget overruns, low productivity or product quality problems. This reflects inefficiency in the use of project management tools. According to Pires *et al.* (2007), construction companies in Portugal with projects above 10 million Euros had, on average, a 40 percent delay in expected delivery times, a 14 percent budget overrun and significant non-compliance issues related to quality.

In a field where little work has been done in Portugal, this article aims to contribute to the discussion on success evaluation factors for construction projects as currently embraced by the literature, especially testing those that are considered to be more traditional and exploring whether other factors are becoming more relevant. It presents the results of a survey conducted with the participation of forty managers from medium and large Portuguese construction companies, with the objective of identifying the most relevant factors for the definition and characterization of construction project management

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success. Additionally, it discusses the relationship between company dimension and the factors considered.

The next section discusses the current main factors for success characterization in construction project management based on a literature review. Following that, the methodology is presented and the main results are discussed. Lastly, some conclusions are drawn.

2. Background

According to various authors (Munns and Bjeirmi, 1996; PMI, 2008; Roldão, 2007; Lewis, 2007; Navas, 2008) a project can be defined as a unique effort or undertaking with well-defined starting and ending dates. It aims at meeting predefined objectives related to schedules, cost and specifications. This is achieved through a set of non-repetitive activities, following a plan and requiring specific resources.

Project management involves the use of several processes to optimize resources and methods, based on an integrated system of actions designed to achieve specific objectives (TSO, 2009). The use of project management tools has been spreading throughout the industrial and services sectors, and is used by more and more companies in all fields, including the construction sector (Kerzner, 2009).

The construction sector presents a particular set of characteristics (FIEC and EFBWW, 2008) related to the diversity of production processes and market segments (e.g., roads, bridges and buildings), which makes the implementation of project management procedures more difficult. The efficiency of project management depends on knowledge and adaptation of success factors. Measuring the success of construction projects and their management is difficult, not only because of the increasing complexity of projects themselves but also because of the involvement of several stakeholders in the construction process (Yang, 2011). In fact, as projects become larger in size nowadays (Chau, 2004), they involve more and more parties in a multi-disciplinary collaboration (Singh *et al.*, 2011). As such, a more stringent standard on planning and communication is required (Chau *et al.*, 2003).

In the literature, success factors for project management are often related to the traditional Atkinson (1999) triangle elements (cost, time and quality).

Munns and Bjeirmi (1996) outline several factors for project management success, namely completion on budget, meeting the schedule, adequate quality standards and goals, good conception and planning, project manager competence, good communication flow, adaptability and team member involvement and motivation.

Recently, some authors such as Chan and Chan (2004) have added health and safety conditions to these factors as very important items to be taken into account. Another investigation carried out in Chile (Ramirez *et al.*, 2004) shows that loss control management is strongly related to companies having superior planning and control, quality management, cost control,

which give importance to the traditional elements of project management success.

Although Belout and Gauvreau (2004) question the relevance of human factors in project success (depending on the life cycle and on the type of organization), great emphasis is given to human factors in several of the papers reviewed. White and Fortune (2002) cite, for example, the importance of senior management support in a large range of sectors. The results of a survey conducted in large Vietnamese construction companies and related organizations by Nguyen *et al.* (2004) show that the success management factors under the main categories of competence, commitment and communication are much more related to human aspects than technical ones. In this field, as in other sectors, the type and the level of competence of the professionals involved is essential (Palacios *et al.*, 2010), particularly their capacity to make adequate decisions for good development of a project (Crespo *et al.*, 2010).

Research done, in Australia, presents a more recent perspective of construction project management (Doloi and Lim, 2007). Several critical factors for success are identified: detailed planning of the project budget and cost control, project time planning and schedule control, human resources management (including support and communication), project quality control, ability of team members to perform the required tasks, information and specification available, project complexity, personnel with construction industry experience, project contingencies, well-defined and detailed breakdowns of project structures and project milestones. As it is possible to see, Doloi and Lim (2007) focus on technical and human resources management success factors.

The Construction Industry Institute of the University of Texas (CII, 2011) proposes a set of 14 areas of knowledge deriving from extensive research and benchmarking processes which should be mastered in order to guarantee project management success in the construction sector. These areas of knowledge also address technical and management factors: project planning, design optimization, materials procurement and management, construction start-up and operations, human resources management, project organization management, business and project processes, project control, risk management, safety and health, environmental protection, information and technology systems management, globalization issues and security.

Beyond internal management, Carú *et al.* (2004) also shows that the successful outcome of a project highly depends on the management of client relationships during the project cycle.

In Portugal, little research has been done in this field. One of the few examples is presented by Pires *et al.* (2007), which shows how construction projects often have time and cost overruns and quality issues. This paper aims at contributing to filling this gap, presenting the results of survey-based research carried out combining traditional success factors (Atkinson, 1999) used in the literature with others such as client satisfaction and human resources management.

3. Methodology

This study is focused on medium and large companies because their projects have complexity and dimensions which require a more comprehensive set of project management tools.

To support the methodology used in this research a survey was sent to 750 project managers of construction companies with a construction licence level (habilitation class) equal to five or higher, as conferred by the INCI (Instituto Nacional da Construção e Imobiliário), the Portuguese National Institute of Construction and Real Estate. The habilitation class defines the maximum value of a construction project that a company is qualified to perform, according to its economic and technical resources. In this case, a habilitation class equal or superior to five means that the value of a company's construction projects are mostly above 2.656.000 euros.

To gather the empirical data, a questionnaire was administered (see appendix). It was pre-tested by six project managers in order to improve its readability. The questionnaire focused on a list of factors in project management success. These factors were retrieved from a questionnaire used in previous research on project management (Varajão *et al.*, 2008), and their relevance was confirmed in the literature review. Ranging from technical factors to the human resources aspects related to the project manager and the project team going through client involvement, they all appear to contribute to the overall success of a project. These include the traditional set of factors (see Fig. 1) proposed by Atkinson (1999), namely cost, schedule and requirements, and others (Doloi and Lim, 2007; Nguyen *et al.*, 2004; Carú *et al.*, 2004; Belout and Gauvreau, 2004; Chan and Chan, 2004; White and Fortune, 2002; Munns and Bjeirmi, 1996) related to client satisfaction, and to human resources management.

The questionnaire was edited and sent through an online platform (LimeSurvey). A briefing letter regarding the scope and goals of the study was sent by email to the project managers, including a link to the Internet home page, which allowed for completion of the questionnaire online.

The survey was carried out from January to June 2009. Forty usable questionnaires were received after three rounds, concluding the data gathering process. This corresponds to a response rate of 5.3%, which is sufficient for obtaining useful insights and an initial understanding of the reality of medium and large construction companies in Portugal.

4. Analysis and Discussion

After the data collection a three-step statistical analysis was carried out. The first involved the characterization of the sample. The second ranked the success factors according to their importance. The third identified any relationship between the dimension of the companies and the recognized importance of the success factors. To do this, cross tables of the factors were created to identify any links, using Chi-Square tests. To support

Table 1. Characteristics of Project Managers

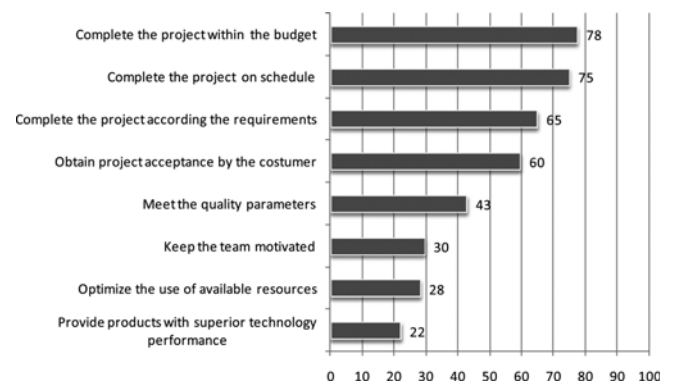|	Construction	
Sex	33	82.5
Male		
Female	7	17.5
Age		
Less than 30 years	12	30
30 to below 35	9	22.5
36 to below 40	2	5
41 to below 45	5	12.5
Greater than 45	12	30
Time working in current company		
Less than 5 years	13	32.5
5 to bellow 10 years	9	22.5
11 to bellow 15 years	6	15
Greater than 15 years	10	25
Without answer	2	5
Experience in project management		
Less than 2 years	7	17.5
2 to bellow 5 years	9	22.5
6 to bellow 10 years	9	22.5
Greater than 10 years	15	37.5

Fig. 1. Relevant Aspects for the Definition of Construction Project Management Success

the statistical analysis, the SPSS programme was used.

A brief characterization of the responding project managers shows that the majority are male (82.5%), under 36 years old (52.5%), although 40.0 per cent are over 40 years old. 55.0 per cent have been working in their current companies for less than 11 years and 25.0 per cent for more than 15 years. 85.0 per cent of the participants have a university degree, 70.0 per cent of which are in the construction field. The majority (60.0%) have more than five years of experience in project management, and 37.0 per cent have more than 10 years of experience (Table 1).

The respondents had to establish a hierarchy among the possible factors which determine the project success. The ranking of the factors considering the average of the answers is presented in Fig. 1.

The economic aspects are considered to have the most influence when judging the success of a construction project.

Accordingly, the respondents gave "complete the project within the budget" factor the highest weighting (78.0%). This is not surprising since construction is greatly influenced by unexpected external factors (the weather for example), which often entail an increase in the costs of the projects. "Finishing on schedule" is also very important (75.0%), which reinforces the previous idea, since an overrun in schedule often means an increase in costs. A definite tendency of trying to meet customer expectation of good service is also shown. "Complete the project according to the requirements" comes in third place (65.0%), which is not surprising in an industry where the requirements, even though formalized, often undergo changes during the development of the project. In the last place are "keep the team motivated", "optimize the use of available resources" and "provide products with superior technology" with weightings of less than 30.0%.

From the set of factors considered, the more traditional ones (budget, schedule and requirements accomplishment) are ranked as the most important for more than 50.0 per cent of the overall respondents. It is interesting to note that the "obtain project acceptance by the customer" factor is in the fourth position. In other words, project management success is increasingly related with customer satisfaction, which confirms what has been written in recent literature for other economic sectors. For instance, comparing these results with the ones presented in the software industry in Portugal (Paiva *et al.*, 2011), the same success factors are ranked at the top (project completion within the budget, on schedule, according to requirements, and acceptance by the customer). The difference is in the position of each aspect in the respective industry. Whereas in the software industry the most important aspect is to "complete the project according to the requirements," in the construction industry "complete the project within the budget" is in first place. On the other hand, "obtaining project acceptance by the costumer" is considered more important in the software industry than "completing the project within the budget" in the construction industry. This discrepancy might be due to the fact that in the software industry the customer is much more involved during the project cycle than in construction, where customer involvement is more frequent in the design phase. Comparing both industries, the least relevant aspects are common.

These overall results give rise to the following research question: is the relative importance of the identified factors for evaluation the success of a project dependent on the size of the company?

To answer this, the "dimension of the construction companies" variable was crossed with the "importance given to factors" variable in order to verify whether there was any relationship. Companies were split into two groups according to their habilitation class. For statistical purposes, the importance level indicators were grouped in two classes (the first from very relevant to medium (positions 1-4) and the second from medium to not relevant (positions 5-8)).

As shown in Table 2, the dimension of a company does not

Table 2 Company Dimension and Success Factors

Success factors	Habilitation classes	Position 1-4	Position 5-8
Complete the project within on schedule	Category 1-5	12	8
Chi-square: 2.820 Asymp. Sig. (2-sided): 0.093	Category 6-9	16	3
Complete the project within the budget	Category 1-5	16	4
Chi-square: - Asymp. Sig. (2-sided): -	Category 6-9	16	3
Complete the project according the requirements	Category 1-5	11	9
Chi-square: 0.742 Asymp. Sig. (2-sided): 0.389	Category 6-9	13	6
Optimize the use of available resources	Category 1-5	9	11
Chi-square: 0.033 Asymp. Sig. (2-sided): 0.855	Category 6-9	8	11
Provide products with superior technology performance	Category 1-5	13	7
Chi-square: 4.356 Asymp. Sig. (2-sided): 0.037	Category 6-9	6	13
Obtain project acceptance by the costumer	Category 1-5	9	11
Chi-square: 0.268 Asymp. Sig. (2-sided): 0.605	Category 6-9	7	12
Keep the team motivated	Category 1-5	5	15
Chi-square: 0.208 Asymp. Sig. (2-sided): 0.648	Category 6-9	6	13
Meet the quality parameters	Category 1-5	5	15
Chi-square: 0.86 Asymp. Sig. (2-sided): 0.770	Category 6-9	4	15
Missing values: 1			

constitute a variable which interferes with the results concerning the highest priority of construction project management success factors, since in almost all of the relationships between company dimension and success factors the Chi-square test is $p > 0.05$.

It is clear that there is a difference between major companies and smaller ones in answering the "provide products with superior technology and performance" factor ($p=0.037<0.5$). Smaller companies tend to give more relevance to this factor. One interpretation of this may be that smaller companies need to compete harder in the market and are more willing to satisfy their clients through innovative solutions. They also usually have a more immediate relationship with their clients, which fosters this. These results indicate an interesting area for further in-depth research of this aspect.

5. Conclusions

This article presents the results of research which aimed at contributing to the discussion on success factors for project management in the construction industry. A survey was applied to a group of medium and large Portuguese construction companies, which enabled testing whether the traditional

success factors are still considered to be the most important ones for judging project management success. Crossing these factors with the dimension of companies enabled the testing of whether there was any relationship between them.

Results show that construction project managers in Portugal continue to consider the traditional success factors as the most important ones, with completing projects within the budget and on time at the top of the list. Meeting quality requirements and customer expectations are also in the top four spots. As to the management of human resources, the results confirm the position of the scientific community on the matter, which is not united in considering this factor as critical. This may translate that professional construction project management practice has not yet incorporated up to date methods of involving human resources. The results also show that the dimension of companies, at least in the medium and large companies in this study, does not change the level of importance given to the success factors. Knowing the primary factors which contribute to construction project success allows practitioners and training institutions to focus their attention on these processes.

Further research should be done in the areas of productivity (López *et al.*, 2011) and construction finance, which appear to be very important aspects of project success, but were not considered in this survey. Research developed in other industries (such as software) has demonstrated their importance. It would also be useful to enlarge the sample of companies surveyed in order to reinforce the obtained results.

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Appendix. Questionnaire

Profile of the respondent

Gender:
Choose only one of the following:
   Male   ☐
   Female   ☐

Age:
Choose only one of the following:
   Less than 25 years   ☐
   25 to 30 years   ☐
   31 to 35 years   ☐
   36 to 40 years   ☐
   41 to 45 years   ☐
   More than 45 years   ☐
   Do not know / No answer   ☐

How many years have you been with your current company?
Write your answer here: _____

What is your area of training?
Choose only one of the following:
   Computer Science   ☐
   Construction Engineering   ☐
   Management   ☐
   Information Systems   ☐
   Architecture   ☐
   Other Engineering Area   ☐
   Other   ☐

What is your highest academic degree?
Choose only one of the following:
   Secondary Education   ☐
   Graduation (3 years)   ☐
   Graduation (5 years)   ☐
   MBA   ☐
   Master   ☐
   PhD   ☐
   Other   ☐ _____

How many years of experience do you have in the project management area?
Choose only one of the following:
   Less than 2 years   ☐
   2 to 5 years   ☐
   6 to 10 years   ☐
   More than 10 years   ☐

Project Management – relevant aspects for the definition of project success
   Please organize the following aspects by order of importance.
   Complete the project on schedule
   Complete the project within the budget
   Complete the project according the requirements
   Optimize the use of available resources
   Provide products with superior technology and performance
   Obtain project acceptance by the costumer
   Keep the team motivated
   Meet the quality parameters