Cost Evolution Throughout the Construction Value Chain

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ABSTRACT

This study is based on the following observation: there is a significant difference between the initial budget forecast and the final budget of construction project. Cost differences in construction projects between the first estimate made by the engagement committee and the actual construction cost at the end of the project are highlighted. Our study therefore focuses on indicators that track the overall cost of a construction project from the client's perspective, in this case the real estate development company. The objectives are as follow: Highlight cost variances in construction projects and analyze the gaps between the initial cost design by customer and final construction. The waste between the "design", "marketing" and "construction" phases is discussed. The paper also quantifies waste in terms of cost between the phases. The analysis reveal that the overall cost evolution is 2.59%, with 0.89% coming from the Construction phase and 1.72% from the Marketing phase, and 0.09% from the Design phase. The results could be of interest to a wide range of researchers working on the interface between the design and construction phases.

KEYWORDS

Cost evolution; design and construction; construction value chain; cost overrun

INTRODUCTION

Lack of productivity (Abdel-Wahab and Vogl 2011) and waste (Hussin et al. 2013) throughout the construction value chain; this is the stipulation by many researchers and professionals of construction. A study on cost and time overrun by (Rahman et al. 2012) in Malaysia indicated that the Malaysian construction industry is characterized by poor performance leading to failure in achieving effective time and cost performance. The findings of this study revealed that 92% of construction projects were overrun and only 8% of project could achieve completion within contract duration. In terms of cost performance only 11% of respondents mentioned that normally their projects are finished within budgeted cost while 89% of respondents agreed that their projects were facing the problem of time and cost overrun in the range of 5-10% of contract.

Another study by (Endut et al. 2005) in Malaysia on the other hand concluded that only 46.8% and 37.2% of public sector and private sector projects respectively are completed within the budget. The study by (Jong et al. 2004 (Jong et al. 2004) also contends the same idea: 9 out of 10 transportation infrastructure projects costs are underestimated and that for all project types, the actual costs are on average 28% higher than estimated costs. The situation seems to be worse in India where studies on construction projects, found that more than 60% of projects experienced up to 200% time overrun and 750% cost overrun (Rwakarehe and Mfinanga 2014).

Causes of Cost overrun are multiples (Baloyi and Bekker 2011; Mukuka et al. 2014): fluctuations in material, labor and plant costs", "construction delays" and "inadequate pre-planning…In this paper, we identify where cost evolution occurs in Construction projects and quantify this evolution (gap from the initial commitment) throughout the value chain.

THE CONTEXT OF THE RESEARCH

The research project is part of a restructuring process at a real estate company .Currently, a revolution in the construction sector is under way to become: more organized and controlled in terms of cost, quality, delivery times and also the introduction of new techniques and organizational processes in the field of construction (Bock 2015). The project uses indicators and process mapping to identify the value chain of costs. Finally, the project proposes a tool to mitigate the risks of skidding the costs of a building construction project.

The real estate company develops expertise in commercial and residential real estate. It is specialized in the acquisition, development and management of residential properties (+70% of its activity concerns residential real estate management). The company is present in all regions of France with a strong concentration of activity in the north and the Paris region.

The company mainly develops residential "programs" which are then put out to tender for construction companies. The real estate company is therefore considered as a customer for construction companies.

Standard structure of a real estate development company

The real estate developer takes the initiative for the realization of the property and assumes responsibility for the coordination of operations involved in the study, execution and procurement of construction programs to users. The real estate developer is responsible for monitoring the design and implementation of real estate programs. This includes the choice of land, the definition of the program,

the composition of the project management team (responsible for carrying out the projects and controlling the execution of the works), the award of Construction contracts, the monitoring of the construction and the sale of the property.
There are two main types of real estate development: housing and commercial real estate (companies, offices, warehouses). For each real estate operation, tasks can be divided into three departments: land development, program manager and technical manager.

Scientific contribution and research objective

The waste between the "design" and "construction" phases is discussed in the literature in the form of case studies and feedback from professionals (Kalsaas et al. 2016). This research highlights the quantified waste in terms of cost between the initial design of the project (initial budget put on the table by the customer) and the actual (final) budget. Quantified proof is thus introduced thanks to this research work. Thus, the research objective is to identify where increase in the construction chain costs and to quantify the gap.

Originality

This study takes into account the cost difference in the overall construction act (a macro view of the construction chain). This overall perspective allows for some objectivity in the analysis to provide the triggers of cost increase throughout the construction value chain. The originality lies on quantifying the waste between the different phases of the construction project, a work that will help in the transition from theory to scientific proof.

RESEARCH METHOD

The methodology consists of two steps.

(1) Step 1: Identify the phase of the increase in the construction chain costs

The first is to identify where costs increase in the construction value chain from the perspective of the real estate developer. To do this, once the cost of the operation has been set by the commitment committee, we monitored the evolution of this cost during the "Design" phase. This can be done by analyzing the "Architects, design offices and other indicators" fees. Then, i.n the "Marketing" phase and finally the evolution of the cost in the "Construction" phase as shown in Figure 1.

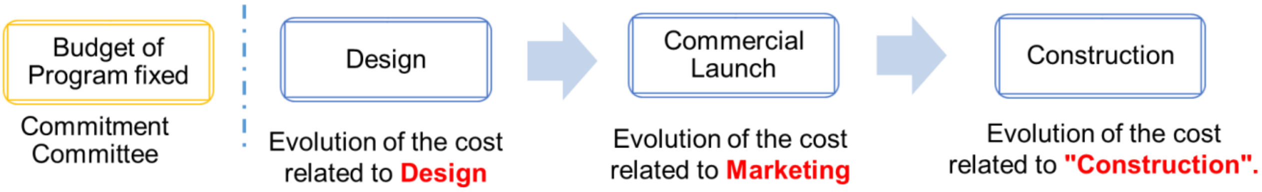

Figure 1. Construction phases with the potential cost variation

The increase in construction cost is linked "financial transactions" in the construction value chain.

(2) Step 2: Quantify this gap

The second step is to quantify this cost evolution in the 3 phases. Data were collected from 56 housing programs and the overall analysis of the sample was carried out, as well as an analysis of the sample:

- By Region: West-South-East (OSE) – North – IDF (Île-de-France).
- By number of trades:

  0-32 lots --> 20 projects, 33-51 during --> 17 projects, 52 and + --> 19 projects

56 housing programs from the real estate developer's database concern this study.

(3) Indicator calculation

The difference in cost (%) is made between the balance sheet established at the Commitment Committee (EC) and the Actual balance sheet at the end of the Construction divided by the Turnover of the operation (CA). The formula for the cost difference is calculated according to the following equation:

$$\Delta = \frac{B_r - B_{ce}}{CA} \quad (1a$$

Where:

Δ : difference in project cost (%).

B_r : Actual project cost (€).

B_{ce} : Balance sheet established at the EC (cost of the initial operation).

CA: Turnover of the operation.

RESULTS AND DISCUSSION

(1) Cost variation as a function of the construction phases

Figure 2 shows the cost evolution curve (in percentage) for the 3 phases, namely, "Design", "Marketing", and "Construction". The overall analysis of the 56 projects reveals that Design generates an evolution of about 0.6%, the "Marketing" phase a cost evolution of 1.65% and the Construction phase "0.9%".

The translation of the percentages into real figures makes the waste clearer: Marketing resulted in a waste of 10M euros compared to 5 Meuros of additional costs for the Construction phase.

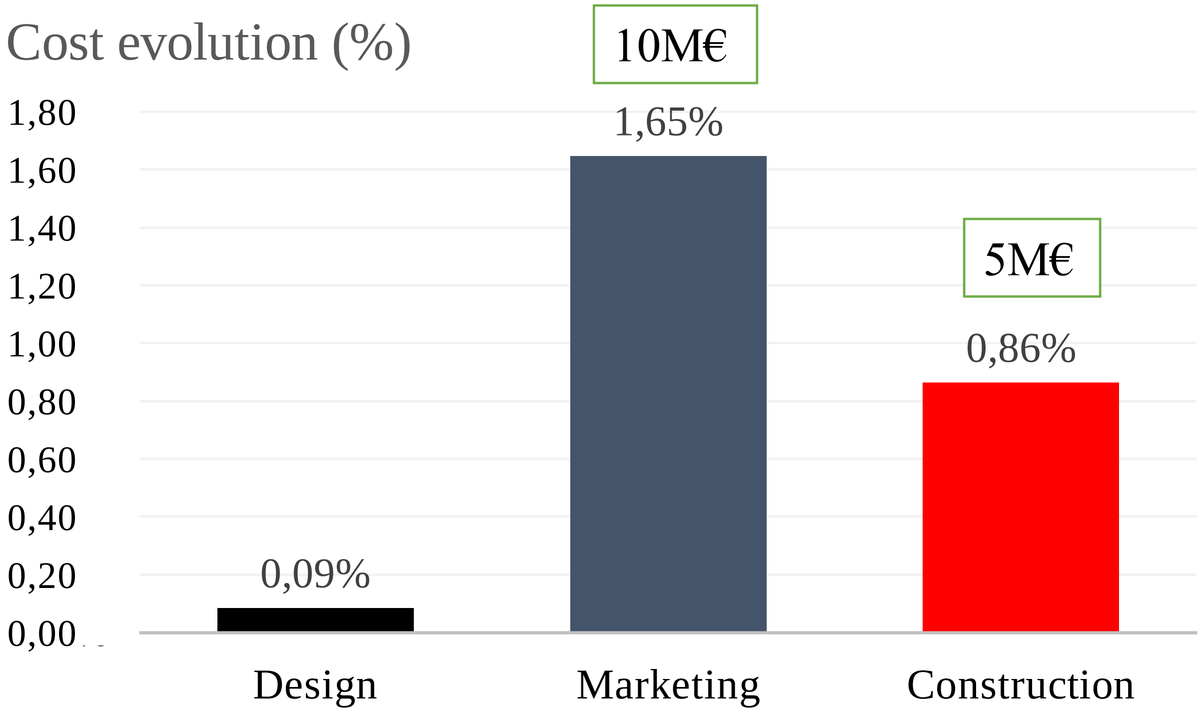

Figure 2. Evolution of the project cost according to the construction phases

(2) Cost variation as a function of the region

Figure 3 expresses the evolution of cost by regions: West-South-East (OSE), IDF (Ile-de France) and North of France. The results show that the OSE region is the one that generates most cost overruns. There is also a disparity in the evolution according to the different regions. This means that practices are not the same in the regions while the company is the same.

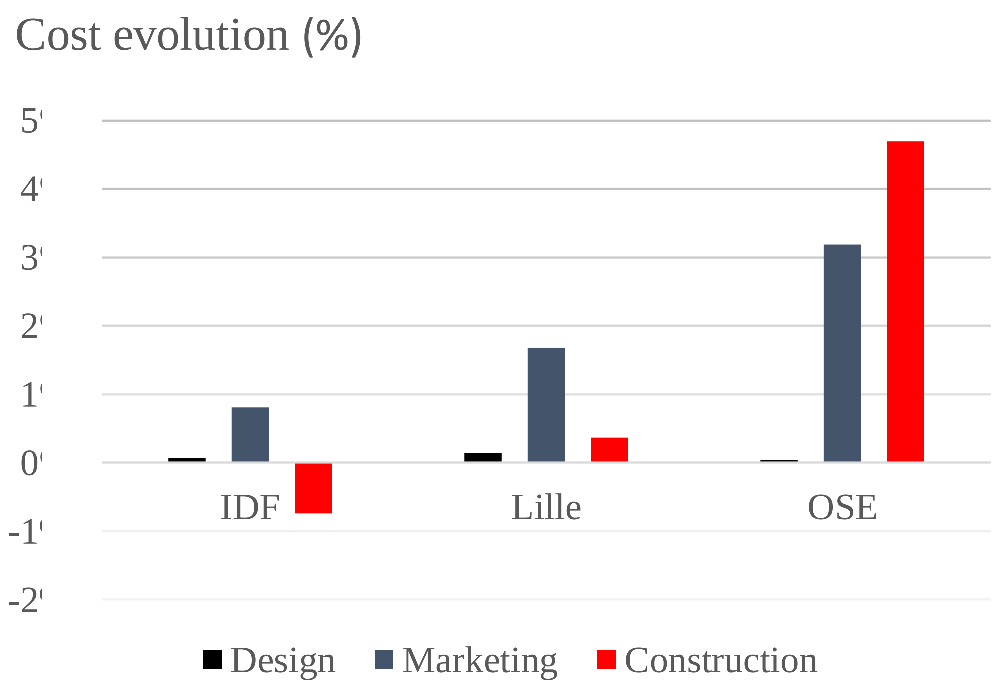

Figure 3. Difference in project cost by region

(3) Cost variation as a function of the number of construction trades

The last analysis focuses on the evolution of cost according to the number of trades (Figure 4). The more trades involved in the construction project, the bigger is the project size. For projects between 0 and 32 trades, the cost evolution is moderately pronounced. Projects between 33 and 56 trades experience the most positive evolution of cost. For large projects, the evolution of costs is relatively less, sometimes even negative, which means cost reduction from the initial client engagement.

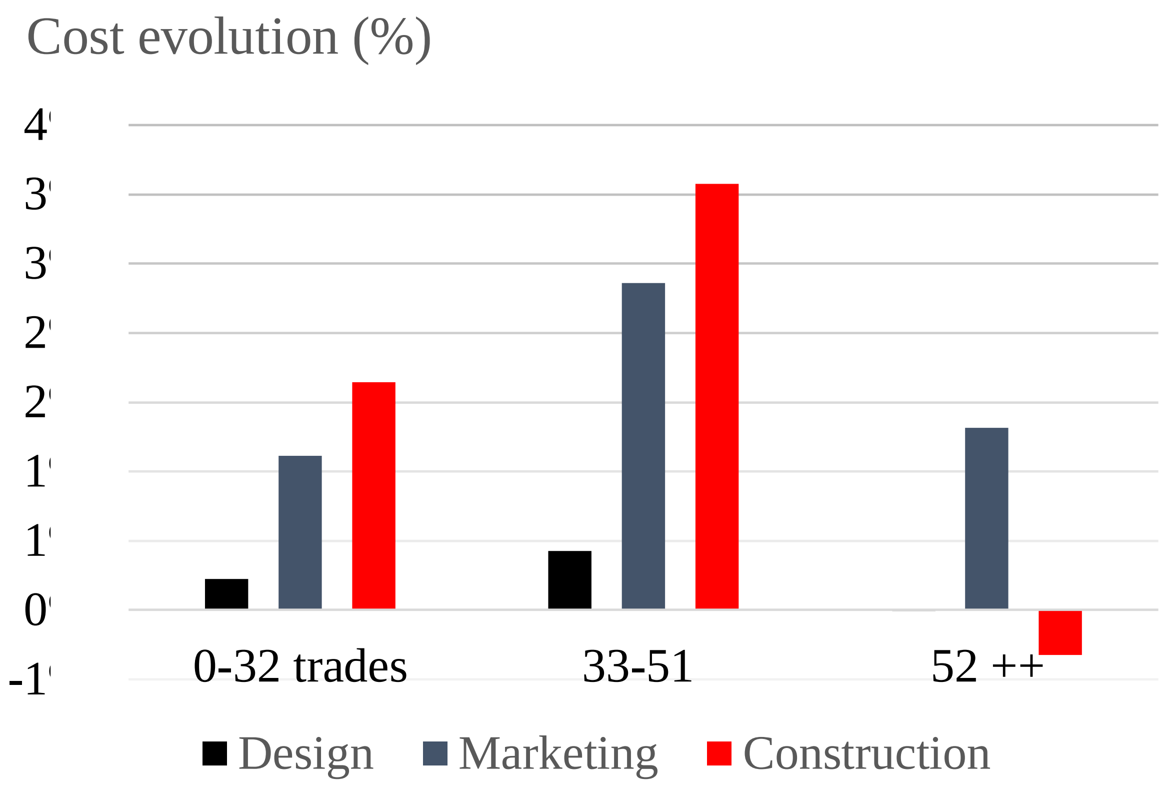

Figure 4. Evolution of project cost according to the number of construction trades

CONCLUSION

The idea of this paper emerged from the observations that (1) many construction project experience cost overruns and the (2) waste in project interfaces (mainly design and construction). We therefore identified the elements that could be at the root of these gaps, and then quantified them through our study of 56 housing development projects at a real estate company in France. Following this, we proposed a set of statistics and analysis in order to explain the cost evolution in three construction value chain phases: Design, marketing, and construction.

The analysis of 56 projects shows that the overall cost difference is 2.59%, with 0.89% coming from the Construction phase and 1.72% from the Marketing phase. Overall, the design generates an extra cost of €0.5M, the marketing phase €10M, and the Construction phase €5M. The "OSE" region (West-South-East) has the largest gap (7.92%) compared to the North (2.3%) and the Ile-de-France (0.13%). The second insight is that mid-sized projects (between 33 to 51 trades (5.86%) generate more cost while large projects experience the most cost variability throughout the construction value chain.

The representation of the number of project trades (size) as a function of the gap illustrates that the cost evolution concern mainly mid-sized projects (lot between 33 to 51 (5.86%) generate more cost while large projects experience the most cost variability throughout the construction chain.

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