

Causes of Construction Projects Cost Overrun in Brazil

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Abstract

This paper presents a survey on construction projects cost performance in Brazil with an analysis of cost overrun causes of the works based on the contractors' point of view. After a literature review and field research, several causes were identified and evaluated by frequency, severity, and importance through a questionnaire. The field survey conducted included 11 directors, 17 project managers and 19 area managers of different construction companies. Eighty-five causes of cost overrun were identified and classified in 11 departments with internal and external influences. The research shows that 71% of the 238 contracts of the study have their costs exceeded, being 82% in amounts up to 25% of the initial agreement and 18% above 25%. The most striking causes identified by the three parties were the change of scope, lack of design detail during budgeting, and high indirect cost in a period of low productivity.

Keywords: *Construction projects, Cost overrun causes, Brazilian construction*

1.0 Introduction

The main objective of contractors is to complete their projects within appropriate planned cost and time, but mainly profitability. However, it is not what reflects most of the works contracts in Brazil. Through the presentation and analysis of a series of cases, studies show that construction projects have a common characteristic of non-compliance with the initial agreed costs, affecting the financial and economic performance of the works. It is important to explain that when analyzing through the contractor's view if the cost increase is linked to the additive scope combined with increased revenue while maintaining final profitability, this is no longer the subject of discussion in this study.

However, the construction projects are subject to several external and internal factors that directly affect the cost of a work. Those factors are environmental factors; political factors; market factors; customer behavior; factors related to the performance and directives of the management and contract management; factors related to the performance of the work departments such as commercial and contractual administration, engineering and consulting, budgeting, planning and cost control, production, quality, environment and health. The relation of causes to each of these factors is of extreme importance to identify which department most influence cost increase of a work.

2.0 Objectives of the Study

The study aims to identify the main causes of cost overrun, the loss of profitability of a construction project, in works of the public, private and mixed contracts types in Brazil, as well as the main factors related to them. The focus of this case study is the budget analysis in the view of the contractor rather than client. For that, we interviewed professionals from the area of 27 different

companies, who underwent works in 16 states of the country and who have great experience in the construction projects.

The paper covers three important hierarchical levels point of view within construction companies. First, directors, which have a strategic view of all projects and responds directly to shareholders regarding the profitability of the contracts. Then, project managers who are the highest level within a work, responsible for managing and ensuring the interaction between the departments and the profitability of the contract through the effective performance of management in all areas. Finally, the area managers who are the ones who create the budgets, execute the works, carry out the acquisitions, control and monitor cost and planning.

With the analysis through these three hierarchical levels, one can obtain an internal view of the company in the identification and analysis of the main causes of the increase of cost through 3 different points of view, but of great relevance in the five phases of the life cycle of a project.

3.0 Literature Review

Studies presented in various articles indicate that the problem of cost increase is common to several countries and that the causes are recurrent. The poor performance of public works in relation to cost increases and delivery times, compared to expected values, has been recurrent in Brazil and other emerging countries (Santos et al., 2015).

Santos et al. (2015) [1] in a study on the causes of cost increases and deadlines in municipal public building works in Belo Horizonte concluded that 72% of the 145 works evaluated presented a cost increase, very similar with this present study in which 71% of 238 contracts under study showed a cost increase. Santos et al. still present in their study that the two most important causes regarding the delay of the works are related to the lack of compatibility of the projects and error in the quantitative survey. In this present study, these causes were also pointed out as of great importance in the view of area managers.

Senouci et al. (2016) [8] in his study on the increase of term and cost in 122 construction contracts in Qatari shows that 54% had their costs increased and 72% their deadlines increased.

Niazi and Painting (2016) [2] present corruption, late payment by the client and financial difficulties on the part of the construction companies as the three main causes of the increase in construction costs in Afghanistan. But, among the ten most important causes present the delay in the approval of the projects, which in this present study is among the most important causes in common agreement of all the interviewees.

Azhar et al. (2008) [3] in a study on causes of cost increase in works in Pakistan show that the main causes are related to variation in materials prices, high equipment costs. However, the top 10 are also related to the lack of cost control, which in this present study is evaluated as one of the causes of greater impact in the project managers' view.

Similar to the studies cited above, Aziz et al. (2013) [4] in their study in works in Malaysia, have as main causes the variation of materials prices, cash flow and financial difficulties on the part of the constructors. Although in the present study these causes are pointed out, they are not among the ten most relevant. Enshassi et al. (2009) [5] also presents as the main cause of the cost increase the variation of the price of the materials.

Sawalhi (2015) [6] conducts an evaluation of indirect costs in construction projects in the Gaza Strip and presents the impact and importance of these costs on a construction site. The high indirect cost in periods of low productivity is the third most important cause among the 85 presented in the present study.

Assaf and Al-Hejji (2006) [7] in research on causes of the increase of the term in construction projects in Saudi Arabia interview 23 contractors whose results of the most relevant causes in their visions are delay in payment by the client, delay in review and approval of the projects and

modification of the execution sequence of the work. These causes directly impact the cost of the works as can be observed in the present study.

Kaming et al. (1997) [9] in a study of construction projects in two cities in Indonesia show that the increase in the price of materials due to inflation, the error in the estimation of materials and the complexity of the projects are the main causes of the cost increase. Arditi et al. (1985) [10] presents a similar result in his study in Turkey.

Cheng (2014) [11] presents a research result in which change in scope and cost control are the most relevant causes. Already Polat et al. (2014) [12] identified project changes and delays in project approval as more critical factors. These two studies present very similar results with the present study.

Based on this literature review, the causes of cost overrun in construction projects in Brazil were analyzed and listed based on the evaluation of several professionals in the industry. Their experiences contributed to other causes until reaching the 85 introduced in the present study.

4.0 Research Methodology

The research methodology consisted in the identification of 85 causes of cost increase through the literature review and field research with professionals in the area. Subsequently, these causes were distributed in 11 departments. Following a questionnaire was elaborated being divided into two stages: the first one with the objective to qualify the interviewed ones by obtaining information on the career and data of the works lived by them. The second, focused on the evaluation of the frequency and severity of the causes listed. Subsequently, an analysis of the data collected in the second stage was carried out through frequency, severity and importance indexes.

The interview includes 47 professionals, such as 11 directors, 17 project managers and 19 area managers with experience in 27 different construction companies. The answers were based on the experience of 238 small, medium and large works.

5.0 Questionnaire Design

In order to prepare a questionnaire, it was necessary, in the first stage, to obtain the data related to the interviewees' profile, such as the position held, the number of years of experience, the number of works done, the types of work, the types of contract and the percentage of cost increase on those projects.

The second part of the questionnaire is related to the evaluation of the causes of cost overruns. The Likert scale was evaluated from 1 to 5 for frequency and severity. The frequency of the cause event was characterized as: does not occur, low frequency, medium frequency, high frequency and extreme frequency. The severity follows a similar category being: no severity, low severity, medium severity, high severity and extreme severity. The collected data were then compiled according to the approach described below.

6.0 Data Analysis Approach

For the analysis of the data, the following statistical formulas were applied:

(FI) Frequency Index: This formula is used to list the causes identified according to their frequency from the evaluation of each interviewee.

$$FI (\%) = \sum \frac{Af}{A \times N} \quad (1)$$

Where:

$\sum Af$ = sum of the weight of the frequency reported by each interviewee from 1 to 5 for the presented cause;

A = highest weight, which in this case is equal to 5, highest category of the Likert scale adopted in this study; and

N = total number of responses to that cause;

This formula must be applied for each cause.

(RII) Index of Relative Importance or (SI) Severity Index: This formula is used to list the causes identified according to their severity or impact based on the evaluation of each interviewee.

$$RII=SI=\sum_{A \times N} \frac{W}{A \times N} \quad (2)$$

Where:

$\sum W$ = sum of the impact weight reported by each interviewee from 1 to 5 for the cause presented;

A = highest weight, which in this case is equal to 5, highest category of the Likert scale adopted in this study; and

N = total number of responses to that cause;

This formula must be applied for each cause.

(IMPI) Importance Index: This formula is used to list the identified causes according to their importance from the evaluation of each interviewee and is obtained by multiplying the IF index by the SI.

$$IMPI (\%) = FI \times SI \quad (3)$$

Finally, was calculated the Spearman correlation coefficient (r_s) which is a non-parametric test whose result varies from -1 to +1, with +1 signifying a total agreement between the candidate groups and -1 total disagreement [7]. Closer to 1 the result means a good correlation of the analyzed groups. This coefficient was applied to the results of the 3 possible combinations: Directors with Project managers; Directors with Area Managers and Area Managers with Project managers, using the following formula:

$$r_s = 1 - \frac{6 \sum d^2}{n(n^2-1)} \quad (4)$$

Where:

d = difference between the classifications of the 2 groups analyzed; and n

= number of analyzed data.

The results obtained with the application of these statistical formulas will be presented in several tables that will be exposed in the following item.

7.0 Results and Discussions

Data were collected based on 238 contracts distributed in 16 states of the country as shown in Figure 1.



Figure 1: Country states involved in the case study. Source: (Author, 2017)

In the first stage of the questionnaire, data were collected regarding the characteristics of the respondents and their different experiences, as can be observed in Table 1 and Figure 2.

Table 1: Characteristics of respondents

Parameters	Quantity	Percentage (%)	Cumulative (%)
Respondent's Position			
Director	11	23%	23%
Project manager	17	36%	60%
Area Managers	19	40%	100%
Experience (years)			
Director	28	38%	38%
Project manager	17	35%	74%
Area Managers	11	26%	100%
Types of Projects			
Buildings	71	30%	30%
Infrastructure	125	53%	82%
Industrial Projects	38	16%	98%
Offshore and onshore oil platform	4	2%	100%
Contract Types			
Public	120	50%	50%
Private	105	44%	95%
Public Private	13	5%	100%
Size of Projects			
0 - 35 Million (USD)	109	46%	46%
35 - 100 Million (USD)	61	26%	71%
100 - 350 Million (USD)	47	20%	91%

More than 350 Million (USD)	21	9%	100%
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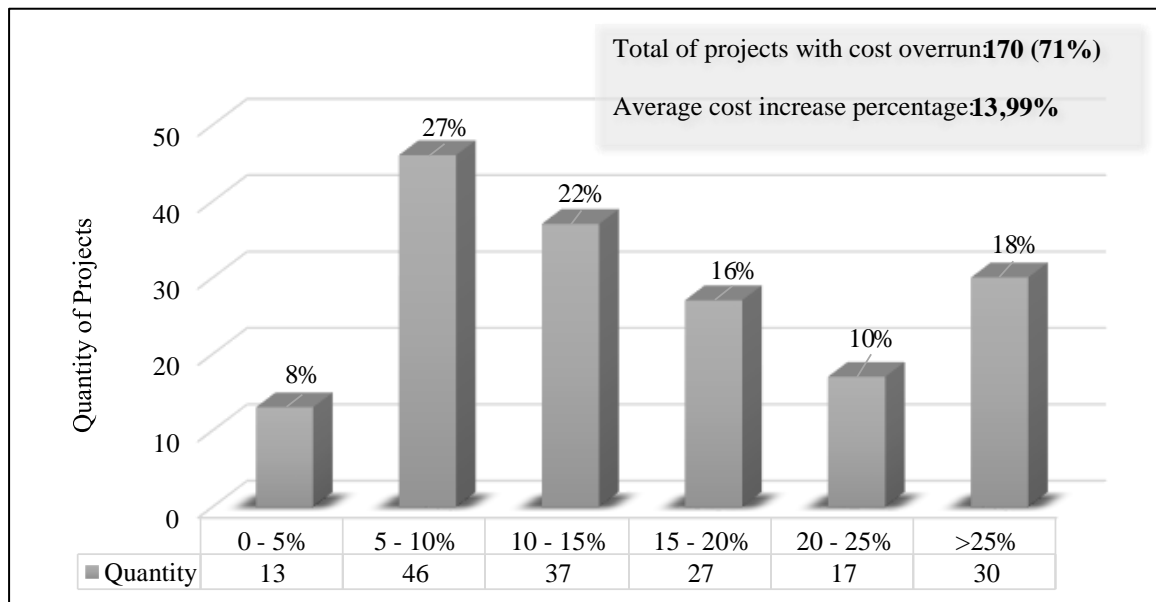


Figure 2: Percentage of Cost Overrun in Projects. Source: (Author, 2017)

Subsequently, the second stage of the questionnaire consisted in the evaluation of the 85 causes of cost increase classified by each department, identified in Table 2.

Table 2: List of causes of cost overrun categorized into eleven departments

No	Cost overrun Causes	Departments
1	Changes / additives in scope	Client
2	Undefined scope	Client
3	Political pressures to meet deadlines	Client
4	Frequent change orders during construction by client	Client
5	Delay in progress payments by client	Client
6	Delayed delivery of the site by the client	Client
7	Unrealistic contractual deadlines	Client
8	Customer contractual suspension	Client
9	Delay in decision making by the client	Client
10	Restrictions such as expropriations and interference	Client
11	Lack / inefficiency of contract administration	Commercial / Contractual Administration
12	Lack of qualification of subcontractors	Commercial / Contractual Administration
13	Constant changes of subcontractors	Commercial / Contractual Administration
14	Lack of knowledge of subcontractors	Commercial / Contractual Administration
15	Contracts poorly negotiated with subcontractors (measurement criteria, unit cost, payment term, etc.)	Commercial / Contractual Administration
16	Constant equipment failure	Commercial / Contractual Administration

17	Purchase of low quality materials	Commercial / Contractual Administration
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No	Cost overrun Causes	Departments
18	Delay in delivery of materials	Commercial / Contractual Administration
19	Financial difficulty on the part of the company causing delay in the payment of the resources mobilized	Directorship
20	Lack of interaction between directors and project managers	Directorship
21	Lack of experience of the company in the construction type	Directorship
22	Excessive internal procedures	Directorship
23	Lack of internal procedures	Directorship
24	Increase in Central Administration Fee	Directorship
25	Unrealistic initial budget assumptions	Directorship
26	Late in reviewing design documents	Engineering / Consulting
27	Complexity of project design	Engineering / Consulting
28	Lack of communication and integration between consultants/engineering sector with other parties	Engineering / Consulting
29	Slow information delivery (Ex: Technical queries)	Engineering / Consulting
30	Conflicts between consultants/engineering sector with other parties	Engineering / Consulting
31	Project design incompatibility	Engineering / Consulting
32	Mistakes in design documents	Engineering / Consulting
33	Delay in the preparation of design projects	Engineering / Consulting
34	Extreme weather factors (rains, winds, heat.)	Environmental Factors
35	Natural disasters	Environmental Factors
36	Archaeological interferences at the site	Environmental Factors
37	Interference of fauna and flora	Environmental Factors
38	Corruption	Political Factors
39	Effects of social and cultural factors	Political Factors
40	Problems with public services	Political Factors
41	Excessive bureaucracy on the part of public entities	Political Factors
42	Change of norms and laws	Political Factors
43	Change of taxes	Political Factors
44	Raise in the price of resources due to the increase in inflation	Political Factors
45	Change of national currency	Political Factors
46	Exchange variation	Political Factors
47	Variation in the price of commodities (Oil, ethanol, wheat, aluminum ..)	Political Factors
48	Permission for foreign jobs	Political Factors
49	Lack of security in the area of construction activities (robberies, shootings, etc.)	Political Factors
50	Lack of specialized labor	External
51	High labor cost	External

52	Lack of qualified labor	External
53	Shortage of building materials and equipment on the market	External
54	High market demand by raising prices of resources (materials, equipment, services, etc.)	External
55	Lack of interaction between production, engineering, planning, cost and customer measurement sectors	Contract Management
No	Cost overrun Causes	Departments
56	Lack of team motivation due to non-active leadership	Contract Management
57	Conflicts between area leaders	Contract Management
58	Delays in the mobilization of construction sites and resources	Contract Management
59	High indirect cost in periods of low productivity	Contract Management
60	Lack of safety, environment and health management	Contract Management
61	Inefficiency in identifying risks	Budget
62	Lack of knowledge of the real productivity in the elaboration of the compositions	Budget
63	Error in raising quantitative	Budget
64	Lack of design detail during budgeting	Budget
65	Lack of consideration of unproductiveness in the calculation of labor	Budget
66	Lack of consideration of social charges in the calculation of labor cost	Budget
67	Lack of consideration of the aggregate cost in the calculation of labor cost (meal, transportation, examinations, health plan, etc.)	Budget
68	Lack of consideration of price readjustment (labor, material, subcontractors, etc.)	Budget
69	Unit cost of budgeted resources lower than that practiced for lack of quotation or lagged database	Budget
70	The budget sector generally does not perform the work	Budget
71	Lack of productivity monitoring	Planning / Cost Control
72	Lack of planning in materials purchases and contracting services	Planning / Cost Control
73	Initial planning inefficient or impracticable	Planning / Cost Control
74	Lack of planning monitoring	Planning / Cost Control
75	Lack of cost monitoring	Planning / Cost Control
76	Low labor productivity	Production / Quality
77	Waste materials	Production / Quality
78	Low equipment efficiency	Production / Quality
79	Errors during construction caused by subcontractors	Production / Quality
80	Rework due to errors during construction	Production / Quality
81	Lack of quality control	Production / Quality
82	Delay in mobilization and start of service	Production / Quality
83	Maintenance after delivery of the work	Production / Quality
84	Excess overtime	Production / Quality
85	Execution of services out of scope	Production / Quality

The interviewees of the three groups performed an assessment of 1 to 5 according to the Likert scale when frequency, severity, and importance. The 10 most frequent causes can be observed in Table 3.

Table 3: Frequency of cost overrun causes

No	Directors	Project manager	Area Managers
1	Lack of design detail during budgeting	Changes/additives in scope	Lack of design detail during budgeting
2	Changes/additives in scope	The budget sector generally does not perform the work	Changes/additives in scope
3	Delay in the preparation of design projects	Political pressures to meet deadlines	Waste materials
4	High indirect cost in periods of low productivity	Lack of design detail during budgeting	Unrealistic initial budget assumptions
5	Low labor productivity	Excess overtime	High indirect cost in periods of low productivity
6	Excess overtime	Undefined scope	Political pressures to meet deadlines
7	The budget sector generally does not perform the work	Restrictions such as expropriations and interference	Excessive bureaucracy on the part of public entities
8	Lack of productivity monitoring	Unrealistic initial budget assumptions	Low labor productivity
9	Late in reviewing design documents	Waste materials	Late in reviewing design documents
10	Waste materials	High indirect cost in periods of low productivity	Project design incompatibility

As can be seen at the tables above, the frequency-related causes, common to all groups are: changes/additives in the scope; lack of design detail during budgeting; waste of materials.

With regard to severity, the 10 causes that generate the greatest impact according to the interviewees can be observed in Table 4.

Table 4: Severity of cost overrun causes

No	Directors	Project manager	Area Managers
1	Lack of design detail during budgeting	Restrictions such as expropriations and interference	Lack of knowledge of the real productivity in the elaboration of the compositions
2	Low labor productivity	Lack of design detail during budgeting	High indirect cost in periods of low productivity
3	High indirect cost in periods of low productivity	Undefined scope	Undefined scope
4	Lack of knowledge of the real productivity in the elaboration of the compositions	Mistakes in design documents	Unrealistic initial budget assumptions
5	Lack/inefficiency of contract administration	Waste materials	Error in raising quantitative
6	Delay in the preparation of design projects	Unrealistic initial budget assumptions	Lack of design detail during budgeting

7	Error in raising quantitative	Lack of knowledge of the real productivity in the elaboration of the compositions	Low labor productivity
8	Lack of productivity monitoring	Lack of consideration of unproductiveness in the calculation of labor	Changes/additives in scope

No	Directors	Project manager	Area Managers
9	Initial planning inefficient or impracticable	Lack of cost monitoring	Unit cost of budgeted resources lower than that practiced for lack of quotation or lagged database
10	Changes/additives in scope	Excess overtime	Late in reviewing design documents

The common causes for the 3 groups are budget-related. They are: lack of knowledge of the real productivity in the elaboration of the compositions and lack of design detail during budgeting.

Finally, the 10 most important causes can be observed in Table 5.

Table 5: Importance of cost overrun causes

No	Directors	Project manager	Area Managers
1	Lack of design detail during budgeting	Changes/additives in scope	Lack of design detail during budgeting
2	Changes/additives in scope	Lack of design detail during budgeting	High indirect cost in periods of low productivity
3	Low labor productivity	Restrictions such as expropriations and interference	Changes/additives in scope
4	High indirect cost in periods of low productivity	Undefined scope	Unrealistic initial budget assumptions
5	Delay in the preparation of design projects	Excess overtime	Lack of knowledge of the real productivity in the elaboration of the compositions
6	Lack of productivity monitoring	Waste materials	Low labor productivity
7	Lack of knowledge of the real productivity in the elaboration of the compositions	Unrealistic initial budget assumptions	Late in reviewing design documents
8	Excess overtime	High indirect cost in periods of low productivity	Waste materials
9	Lack of planning in materials purchases and contracting services	Late in reviewing design documents	Undefined scope
10	Initial planning inefficient or impracticable	Political pressures to meet deadlines	Project design incompatibility

Finally, with regard to importance, the common causes for the three groups of interviewees are: lack of design detail during budgeting; changes/additives of scope; high indirect cost in periods of low productivity.

As mentioned, the causes of cost overrun were classified into 11 departments and from the compilation of all data, the tables 6 to 9 below present the frequency, severity and importance

indices by each department and by groups of respondents. It is possible to identify the main department in which to act to avoid the occurrence of these causes.

Table 6: Ranking of departments of cost overrun by directors

Departments of cost overrun	Frequency		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Planning / Cost Control	66,18	1	72,73	1	48,13	1
Budget	56,51	5	72,48	2	40,96	2
Production / Quality	63,27	2	64,18	6	40,61	3
External	56,36	6	68,36	3	38,53	4
Client	57,64	3	66,55	4	38,35	5
Engineering / Consulting	56,59	4	61,82	7	34,98	6
Contract Management	53,94	7	64,85	5	34,98	7
Directorship	49,87	8	58,16	8	29,00	8
Commercial / Contractual Administration	46,36	10	56,14	9	26,03	9
Political Factors	49,39	9	51,36	11	25,37	10
Environmental Factors	37,27	11	55,00	10	20,50	11

Table 7: Ranking of departments of cost overrun by project managers

Departments of cost overrun	Frequency		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Client	68,00	1	73,41	3	49,92	1
Production / Quality	64,50	2	71,95	4	46,41	2
Planning / Cost Control	62,35	3	74,35	2	46,36	3
Budget	59,76	4	74,71	1	44,65	4
Engineering / Consulting	58,22	5	68,97	6	40,16	5
Contract Management	56,83	6	67,13	8	38,15	6
External	54,82	7	66,82	9	36,64	7
Directorship	53,28	8	68,24	7	36,35	8
Political Factors	52,25	9	60,99	11	31,87	9
Commercial / Contractual Administration	50,88	10	62,50	10	31,80	10
Environmental Factors	40,59	11	69,85	5	28,35	11

Table 8: Ranking of departments of cost overrun by project managers

Departments of cost overrun	Frequency		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Production / Quality	65,89	1	72,32	4	47,65	1
Client	61,90	3	73,65	2	45,59	2
Engineering / Consulting	64,47	2	69,87	6	45,05	3
Budget	58,11	6	77,47	1	45,02	4
Planning / Cost Control	61,68	4	72,63	3	44,80	5
External	56,42	7	71,37	5	40,27	6
Contract Management	58,60	5	67,54	7	39,58	7
Directorship	55,73	8	63,91	10	35,61	8
Commercial / Contractual Administration	53,55	9	65,66	8	35,16	9
Political Factors	51,93	10	56,73	11	29,46	10
Environmental Factors	40,79	11	64,21	9	26,19	11

Table 9: Ranking of departments of cost overrun by all parties

Departments of cost overrun	Frequency		Severity		Importance	
	Index	Rank	Index	Rank	Index	Rank
Planning / Cost Control	62,98	3	73,28	2	46,15	1
Production / Quality	64,78	1	70,28	4	45,52	2
Client	63,11	2	71,90	3	45,38	3
Budget	58,34	5	75,31	1	43,93	4
Engineering / Consulting	60,37	4	67,66	6	40,85	5
External	55,83	7	69,02	5	38,53	6
Contract Management	56,67	6	66,76	7	37,83	7
Directorship	53,46	8	64,15	8	34,29	8
Commercial / Contractual Administration	50,90	10	62,29	10	31,71	9
Political Factors	51,45	9	57,00	11	29,33	10
Environmental Factors	39,89	11	64,06	9	25,56	11

The data show that the directors consider planning and cost control the most important department in cost overrun. The evaluation of project managers shows that the behavior of the client is the most relevant causes. In the view of area managers, the production and quality departments are related the most important causes.

With all the data collected, the Spearman correlation coefficient was calculated with the objective of assessing if the points of view of the 3 groups agree. As can be seen in Tables 10 to 13, the coefficients indicate that the responses of the groups present a high degree of agreement.

Table 10: Spearman correlation with analysis of the results of directors and project managers

Department	Director	Project manager	d = x - y	d ²	r _s
n = 11	x	y	0	38	0,83
Client	5	1	4	16	
Commercial / Contractual Administration	9	10	-1	1	
Directorship	8	8	0	0	
Engineering / Consulting	6	5	1	1	
Environmental Factors	11	11	0	0	
Political Factors	10	9	1	1	
External	4	7	-3	9	
Contract Management	7	6	1	1	
Budget	2	4	-2	4	
Planning / Cost Control	1	3	-2	4	
Production / Quality	3	2	1	1	

Table 11: Spearman correlation with analysis of the results of directors and area managers

Department	Director	Area Manager	d = x - y	d ²	r _s
n = 11	x	y	0	46	0,79
Client	5	2	3	9	
Commercial / Contractual Administration	9	9	0	0	
Directorship	8	8	0	0	
Engineering / Consulting	6	3	3	9	

Environmental Factors	11	11	0	0
Political Factors	10	10	0	0
External	4	6	-2	4
Contract Management	7	7	0	0
Budget	2	4	-2	4
Planning / Cost Control	1	5	-4	16
Production / Quality	3	1	2	4

Table 12: Spearman correlation with analysis of the results of project managers and area managers

n	Area Manager	Project manager	d = x - y	d ²	r _s
n = 11	x	y	0	14	0,94
Client	2	1	1	1	
Commercial / Contractual Administration	9	10	-1	1	
Directorship	8	8	0	0	
Engineering / Consulting	3	5	-2	4	
Environmental Factors	11	11	0	0	
Political Factors	10	9	1	1	
External	6	7	-1	1	
Contract Management	7	6	1	1	
Budget	4	4	0	0	
Planning / Cost Control	5	3	2	4	
Production / Quality	1	2	-1	1	

Table 13: Spearman rank correlation coefficient

Groups	Index
Director e Project manager	0,83
Director e Area Manager	0,79
Area Manager e Project manager	0,94

8.0 Conclusions

The present study show the point of view of 47 professionals in the construction area, with many years of experience (between 10 and 28 years) and experience in works of various sizes throughout 16 states of Brazil. These professionals belong to 3 major hierarchical groups within a company with 11 directors, 17 project managers and 19 area managers.

On average, respondents pointed out that 71% of contracts have their costs increased by the end of the project by 14%. The results present a very large correlation in the perception of the causes of the cost overrun in the works as presented in table 22. Project managers and area managers presented a coefficient of 94% Spearman correlation. The directors and project managers with 83% and the directors and area managers with 79%.

The result of project managers group shows that customer is the major causer in cost overrun of the work and secondly the production department. On the other hand, the group of area managers

understands that the production department are the main responsible for the increase of costs and secondly the client. The result of the directors is more related to internal factors of planning, control, and monitoring and therefore they understand that the department of planning and cost control is the main cause of the cost overrun in the works and secondly the department of budget, being in fifth place the client.

9.0 Recommendations for Future Studies

A recommendation for future study would be to deepen the profile of the client to better understand the impacts on the results of construction contracts related to customer types (public, private and mixed) and types of contract (unit price, global or mixed price). The study reported a very large customer impact on costs overrun and loss of profitability.

When talking with professionals in the field, many reported difficulties in the relationship with the client, especially in the public department, which presents delays in payment, constant changes in scope and sequencing to meet third party interests. Another problem reported to the public client is the constant changes in tax inspectors according to political interests, which often ends up blocking the process and losing the contract's history. For these reasons, a customer-facing study would be interesting.

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